



## Prevalence of *Trypanosoma*, *Babesia* and *Anaplasma* in cattle reared in the North of Côte d'Ivoire

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### Abstract

A study was performed in the north of the Côte d'Ivoire with the aim of determining the prevalence of *Trypanosoma*, *Babesia* and the *Anaplasma* in the cattle. The peripheral veins blood was taken at the ear base on 360 cattle of the two sexes and various age groups during the seasons dry and rainy. The blood sample collected from the breeding of three departments (Korhogo, M'Bengue and Ferkessedougou) in the northern Côte d'Ivoire. The prevalence of blood parasites were determined examining Giemsa-stained smears. Several species of blood parasites were observed under the optical microscope: *Trypanosoma vivax* (6.94%), *Trypanosoma brucei* (2.50%), *Babesia bovis* (45.83%), *Babesia bigemina* (13.61%), *Anaplasma marginale* (76.94%) and *Anaplasma centrale* (42.22%). The analysis of the results showed that in general, the cattle from 1 to 2 years old were more likely to be infected than younger and adult ones. Age and geographical situation of the breeding did not have any influence on the parasites distribution except *Anaplasma marginale*. Parasites were more detected in rainy season than in dry season excluding *Anaplasma marginale*. Moreover, the season had an influence on the distribution of the *Trypanosoma* and the *Babesia*.

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## Introduction

Vectors born diseases prevented livestock productivity in West Africa. Considered as the second group of vectors of human disease after mosquitoes (Goodman *et al.*, 2005), ticks transmit pathogens with high economic impact over cattle farmers. These they cause abortions, weight falls and the decline in milk production (Minjauw *et al.*, 2003; Teglas *et al.*, 2005). Another constraint to livestock is animal trypanosomiasis. This disease is alone responsible for one quarter of economic losses due to animal pathologies (De hann *et al.*, 1991).

They cause an annual deficit of productivity estimated at 1.03 million tonnes of meat and 1.6 million tonnes of milk. It is estimated that, in subsaharian Africa, approximately 18% of all cattle mortalities are due to tick-borne diseases including babesiosis, anaplasmosis and heart water (De Waal, 2000). Consequently it is important to pay more attention to diseases transmitted by ticks and tsetse. In addition to the damage caused by pitting and anemia, they are able to convey and to inoculate a large number of

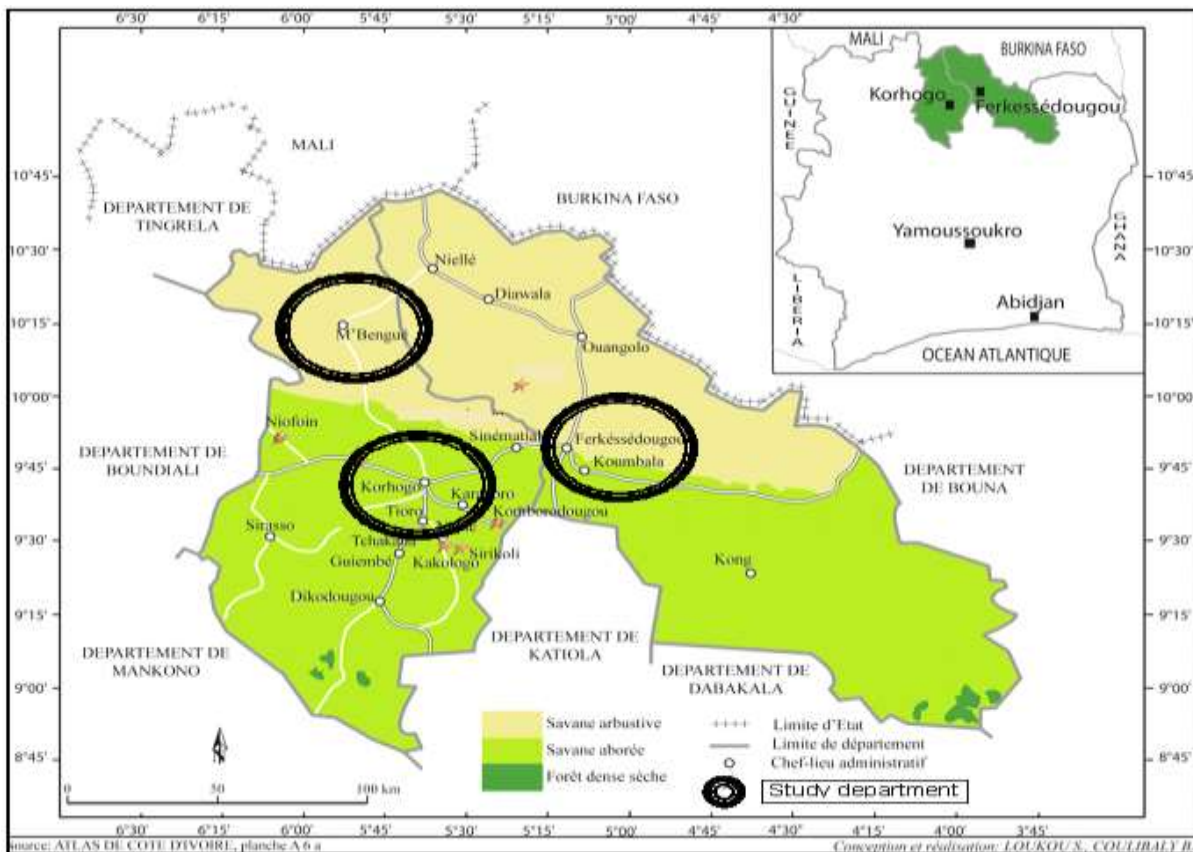
pathogens including parasites. The health status of domestic ruminants related to tick born pathogens in northern region of Côte d'Ivoire is not yet well known. Indeed, this part of the country, that represents the largest livestock cattle production zone, is also affected.

There is an interest continue research on pathogens transmitted by tsetse flies and ticks is necessary. This study aimed to determine the prevalence of *Trypanosoma*, *Babesia* and *Anaplasma* encountered in breeding cattle from the northern part of Côte d'Ivoire. To achieve this goal, smears have been made with blood from peripheral veins of the ear of dairy and beef cattle at different age groups during the dry and rainy seasons..

## Material and methods

### Study environment

The study was carried out on cattle farms of three (3) departments in the northern area of the Côte d'Ivoire: Korhogo, Ferkessedougou and M'Bengue (Fig. 1).



**Fig. 1.** District of Savannah within the study departments.

This border area of Mali and Burkina Faso are mainly characterized by a sudanese climate, with a rainy season from April to October and a dry season from November to March and under the influence of a dry and hot wind from the Sahara. They are irrigated by many rivers such as the Bagoue in south of Boundiali, the Bou and Solomougou in south of Korhogo, the Bandama at east of Korhogo, the Badenou in south of M'Bengue, and Babani and Lopkoho respectively to the north and west of Ferkessedougou.

#### Data collection

The surveys were carried out in three cattle breedings of each department of Korhogo, Ferkessedougou and M'Bengue. Peripheral blood was taken on the base of the ear of old cattle from 0 to 3 years and more. In each of the three breedings of each department, 20 smears were done by season (one smear by animal), overall 60 blood smears by season and department. At the end of this study, 180 smears were carried out by season in the north of the Côte d'Ivoire. After two seasons (dry and rainy) 360 blood smears were obtained. The blood smears were protected from dust, sun and flies. At the regional laboratory of Korhogo, the smears were fixed with methanol 95% for 3 to 5

minutes 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 by light microscopy.

#### Data analysis

The prevalences were calculated as follows:

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

The proportions of the various studied parameters were subjected to a Chi2 test to evaluate their significant level. The prevalences were significant at 5%.

### Results

#### Overall prevalence of cattle's *Trypanosoma*, *Babesia* and *Anaplasma* in the District of Savannah

Blood smears were positive for *Trypanosoma* (*Trypanosoma vivax* and *Trypanosoma brucei*), for *Babesia* (*Babesia bovis* and *Babesia bigemina*) and *Anaplasma* (*Anaplasma marginale* and *Anaplasma centrale*). Among *Trypanosoma*, *T. vivax* prevalence was the most met with 6.94%, nearly the triple the rate of infection for *T. brucei* (2.50%) (Table 1).

**Table 1.** Prevalence of trypanosomiasis, babesiosis and anaplasmosis of breeding cattle in north of the Côte d'Ivoire.

Pathogenic	Prevalence (%)	
<i>T. vivax</i>	6.94 <sup>a</sup>	(25/360)
<i>T. brucei</i>	2.50 <sup>a</sup>	(9/360)
<i>B. bovis</i>	45.83 <sup>b</sup>	(165/360)
<i>B. bigemina</i>	13.61 <sup>a</sup>	(49/360)
<i>A. marginale</i>	76.94 <sup>c</sup>	(277/360)
<i>A. centrale</i>	42.22 <sup>b</sup>	(152/360)

The values of the same column carrying the same letter while exposing do not differ significantly with the threshold from 0.05% for each pathogenic.

The  $\chi^2$  test has not shown significant difference ( $P = 0.1404$ ) between *T. vivax* and *T. brucei*. It was the similar for *B. bovis* and *B. bigemina*, although *B. bovis* was the most encountered parasite in the study area with 45.83% infection rate more than triple that recorded for *B. bigemina* (13.61%).

Furthermore, *Anaplasma* were the most observed in the entire study area. Its prevalence was 76.94% versus 42.22% for *Anaplasma centrale*. The difference was significant for anaplasma ( $P = 0.0014$ ) between *Anaplasma marginale* and *Anaplasma centrale* and *Babesia* ( $P = 0.0001$ ) between *B. bovis* and *B. bigemina* in the study area.

*Seasonal prevalence of Trypanosoma, Babesia and Anaplasma of breeding cattle in the northern of Côte d'Ivoire*

Cattle parasitic infection (*Trypanosoma*, *Babesia* and *A. centrale*) rate was higher in rainy season than in dry season for 180 blood smears samples collected by season.

The difference was significant ( $P < 0.05$ ) for *Trypanosoma* and *Babesia* in both dry and rainy seasons. In contrary *A. marginale* was more encountered in the dry season (83.33%) than in rainy season (70.56%). The difference was not significant ( $P < 0.05$ ) for *A. marginale* ( $P = 0.303$ ) and *A. centrale* ( $P = 0.146$ ) in both dry and rainy seasons (Table 2).

**Table 2.** Number of positive animals and seasonal prevalence (%) infection of trypanosomiasis, Babesiosis and anaplasmosis.

Pathogenic	Dry	Rainy	Effect	$\chi^2$	P
	Prevalence (%)	Prevalence (%)			
<i>T. vivax</i>	3.33 <sup>a</sup> (6/180)	10.56 <sup>b</sup> (19/180)	**	3.9549	0.046
<i>T. brucei</i>	0 <sup>a</sup> (0/180)	5 <sup>b</sup> (9/180)	***	6.9315	0.008
<i>B. bovis</i>	35.56 <sup>a</sup> (64/180)	56.11 <sup>b</sup> (101/180)	**	4.6462	0.031
<i>B. bigemina</i>	8.33 <sup>a</sup> (15/180)	18.89 <sup>b</sup> (34/180)	**	4.2063	0.04
<i>A. marginale</i>	83.33 (150/180)	70.56 (127/180)	NS	1.0609	0.303
<i>A. centrale</i>	35.56 (64/180)	48.89 (88/180)	NS	2.1129	0.146

The values of the same line not carrying the same letter while exposing differ significantly with the threshold from 5% for each pathogenic

\*\* Significant  $0.03 < P < 0.04$  \*\*\* Significant  $P = 0.008$  NS No significant.

*Prevalence of Trypanosoma, Babesia and Anaplasma of cattle in relation to the localization of farms in northern Côte d'Ivoire*

We have noticed an important occurrence of these parasites in the department of Ferkessedougou except

for *T. brucei* and *B. bovis* more observed respectively in the cattle farms of M'Bengue Department (3.33%) and Korhogo (65.83%) (Table 3).

**Table 3.** Number of positive animals and prevalence (%) of infection by Trypanosomiasis, Babesiosis and Anaplasmosis following the localization of breeding cattle in the northern part of Côte d'Ivoire.

Pathogenic	Departments			Effect	$\chi^2$	P (%)
	Korhogo Prevalence (%)	M'Bengue Prevalence (%)	Ferkessedougou Prevalence (%)			
<i>T. vivax</i>	5.83 (7/120)	5.83 (7/120)	9.17 (11/120)	NS	1.445	0.48
<i>T. brucei</i>	1.67 (2/120)	3.33 (4/120)	2.5 (3/120)	NS	0.713	0.7
<i>B. bovis</i>	65.83 (79/120)	16.67 (20/120)	55 (66/120)	NS	36.769	1.03
<i>B. bigemina</i>	8.33 (10/120)	5.83 (7/120)	26.67 (32/120)	NS	18.503	9.59
<i>A. marginale</i>	85.83 <sup>a</sup> (103/120)	51.67 <sup>b</sup> (62/120)	93.33 <sup>c</sup> (112/120)	****	18.292	0.0001
<i>A. centrale</i>	47.5 (57/120)	20 (24/120)	59.17 (71/120)	NS	23.776	6.87

The values of the same line not carrying the same letter while exposing differ significantly with the threshold from 5% for each pathogenic

\*\*\*\* High Significant  $P = 0.0001$  between departments for *A. marginale*

NS No significant.

In addition, the difference was highly significant ( $P = 0.0001$ ) for *A. marginale* in the three department. This difference was highly significant for *A. marginale*, in the departments of Korhogo and M'Bengue ( $\chi^2 = 8.5761$ ,  $P = 0.003$ ) and highly significant in the departments of M'Bengue and Ferkessedougou ( $\chi^2 = 12.139$ ;  $P = 0.0004$ ).

#### Prevalence of *Trypanosoma*, *Babesia* and *Anaplasma*

Young cattle of one to two years olds were more infected with *Trypanosoma*, *Babesia* and *Anaplasma*. The prevalence was 8.33% for *T. vivax*, 2.22% (*T. brucei*), 39.44% (*B. bovis*), 13.33% (*B. bigemina*), 68.33% (*A. marginale*) and 36.11% for *A. centrale* (Table 4).

**Table 4.** Number of positive animals and prevalence (%) of trypanosomiasis, Babesiosis and Anaplasmosis for infection by the age of Savannah District cattles.

Pathogenic	AGE			Effect	$\chi^2$	P(%)
	Cattle (0 - 1 year)	Young (1 - 2 years)	Adults (> 2 years)			
	Prevalence (%)	Prevalence (%)	Prevalence (%)			
<i>T. vivax</i>	2.78 (5/180)	8.33 (15/180)	2.78 (5/180)	NS	4.391	0.111
<i>T. brucei</i>	1.11 (2/180)	2.22 (4/180)	1.67 (3/180)	NS	0.477	0.787
<i>B. bovis</i>	27.22 (49/180)	39.44 (71/180)	25 (45/180)	NS	5.662	0.058
<i>B. bigemina</i>	7.78 (14/180)	13.33 (24/180)	6.11 (11/180)	NS	3.577	0.167
<i>A. marginale</i>	46.11 <sup>a</sup> (83/180)	68.33 <sup>b</sup> (123/180)	39.44 <sup>a</sup> (71/180)	***	11.733	0.002
<i>A. centrale</i>	26.67 (48/180)	36.11 (65/180)	21.67 (39/180)	NS	5.463	0.065

The values of the same line not carrying the same letter while exposing differ significantly with the threshold from 5% for each pathogenic.

\*\*\* Significant  $P = 0.002$  for *A. marginale* between different age groups

NS No significant.

The difference was significant ( $P = 0.002$ ) for *A. marginale* in different age groups. Also, a significant difference in parasite ( $\chi^2 = 7.840$ ,  $P = 0.005$ ) among young adults and then a very low significance for this same parasite ( $\chi^2 = 4.3418$ ,  $P = 0.037$ ) in calves and young cattle.

#### Discussion

The study has revealed the presence of *Trypanosoma*, *Babesia* and *Anaplasma* in cattle farms of the north of Côte d'Ivoire. Among 360 blood smears collected, 25 were positive for *Trypanosoma vivax* (6.94%) and

nine (9) for *Trypanosoma brucei* (2.50%). These parasites have been also isolated by Djakaridja *et al.*, (2014) in northern Côte d'Ivoire with similar prevalence rates. Mamoudou *et al.*, (2016) has obtained the same rate in healthy cattle of northern Cameroon within a higher prevalence for *Trypanosoma* (9.00%). Zemedkun *et al.*, (2016) founded in the districts of Wolaita Zone, Southern Ethiopia 6.67% for *Trypanosoma*, 5% for *T. congolense* and 1.67% for *T. Vivax*. The usual occurrence of these *Trypanosoma* could be explained



by the presence of an ecosystem (sacred groves, meadows and streams) favorable to the survival and development of tse-tse flies. Moreover, abundance of *Trypanosoma vivax* was observed in a further work because the ecosystem of the study area was more favorable to the development of tse-tse. Regarding the effect of the season, *Trypanosoma* are more observed in the rainy season than in dry season.

The cattle infection rate for *Trypanosoma vivax* was 10.56% in the rainy season and 3.33% in season dry. Mamoudou *et al.*, (2016), report that 67 cattle were infected during the dry season and 11 during the rainy season, corresponding to a prevalence of 12.20% and 3.47 % for the dry and rainy seasons, respectively. The department of Ferkessedougou was the most infected by *Trypanosoma vivax* (9.17%), while *Trypanosoma brucei* (3.33 %) was the most encountered in the department of M'Bengue. The observed parasite prevalence in these two departments is favored by an important hydrography including rivers such as Lokpoho and Babanie at Ferkessedougou and Badenou and the classified forest of Badenou in M'Bengue.

Out of 360, 165 blood smears were positive for *Babesia bovis* (45.83%) and 49 positive for *Babesia bigemina* (13.61%). *Babesia bigemina* has been isolated by Achi *et al.*, (2012) in northern Côte d'Ivoire (0.04%). In a study conducted in Sargodha District, (Pakistan) Farhan *et al.*, (2012) a lower prevalence for *B. bigemina* (6.57%) was observed. Ahmad and Hashmi (2007) have also reported a lower prevalence of *B. bigemina* (6.6%) in cattle from Malakand Agency.

Out of 360, 277 blood smears were positive for *Anaplasma marginale* (76.94%) and 152 positive for *Anaplasma centrale* (42.22%). *Anaplasma* is the tick-borne rikettsial pathogen of cattle which is observed worldwide (Futse, 2003). Among the isolated pathogens in this study, *Anaplasma marginale* was the most common. *Anaplasma* were isolated by Farhan *et al.*, (2012) with an occurrence of 9.71% for *Anaplasma marginale*. Komoin-Oka *et al.*, (2004) has noticed the same prevalence for *Anaplasma* in the central area of the humid savanna of the Côte d'Ivoire.

The elevated presence of *Anaplasma marginale* in this study may be explained by the presence of the vector tick *Rhipicephalus (Boophilus)*. This tick was identified by Achi *et al.*, (2012) in the northern cattle farms in Côte d'Ivoire. Madder *et al.*, (2007) has identified *Rhipicephalus (Boophilus) microplus* for the first time in the south of the Côte d'Ivoire. *Anaplasma marginale* was observed in dry season with high infection rate of 83.33%. As other parasites encountered, *Anaplasma marginale* and *Anaplasma centrale* are more common in young cattle with 1 or 2 years of age. This result is contrasting those obtained by Muhammad *et al.*, (2014) in Khanewal District, Punjab, Pakistan. *Anaplasma* spp. can cause infections in cattle population of all age categories where severity mortality rate increases with increase of animal age. Khan *et al.*, (2004) and Atif *et al.*, (2012) found adult population exposed to bovine anaplasmosis.

### Conclusion

This study has confirmed the presence *Trypanosoma vivax* and *Trypanosoma brucei* in the north of Côte d'Ivoire. *Babesia bovis* and *Babesia bigemina* responsible for babesiosis and *Anaplasma marginale* and *Anaplasma centrale* etiologiological agent of anaplasmosis . *Anaplasma marginale* is by far the most encountered in the north of Côte d'Ivoire. The department Ferkessédougou seemed most infected with anaplasmosis. Moreover, young cattle aged from 1 to 2 years were the most infected with *Trypanosoma Babesia* and *Anaplasma*. It is important to undertake anti-tsetse control measures and improve rearing to reduce parasitic loads. This should be associated with preventive and curative actions.

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