



RESEARCH ARTICLE

ANAPLASMA SPP IN BLOOD SMEARS FROM DWARF GOATS OF BÉOUMI (CÔTE D'IVOIRE)

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ABSTRACT

Background: *Anaplasma* is bacteria that infect the blood cells of domestic and wild animals, leading to a reduction in productivity. This study aimed to identify certain species of *Anaplasma* in goat blood of Béoumi's locality (Côte d'Ivoire). **Methods:** In order to determine their prevalence in dwarf goats in Béoumi locality, blood samples were taken from them during the dry season and the rainy season. A total of 270 dwarf goats were mobilized from December 2015 to September 2016 in areas close to watercourses and areas far from watercourses. Samples were taken from auricular venules, then placed on object slides in order to be observed under an optical microscope. **Results:** Of all goats examined, 12 were positive for *Anaplasma*. The prevalence was 4.44%. All the infested animals came from area B (near the waterways) and were only females over two years old. Two *Anaplasma* species were isolated: *Anaplasma marginale* and *Anaplasma centrale*. *Anaplasma marginale* was the most present with an overall prevalence of 4.44% versus 0.74% for *Anaplasma centrale*. **Conclusion:** This study showed the presence of *Anaplasma* in goats bred in Béoumi locality, particularly near waterways. goat farmers will need to be informed about the methods to combat anaplasmosis.

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INTRODUCTION

Oat's breeding is a lever to fight against deficit of animal protein in rural communities. Since their domestication approximately 10000 years ago (Haenlein, 2007), goats play a significant role in African societies in particular in the sociocultural (Daramola and Adeloje, 2009), nutritional (Waelti et al., 2003; Belew et al., 2009) and economic plan (Rhissa, 2010). Unfortunately, they are very often prone to pathologies including parasitic affections and particularly, anaplasmosis (Suchet, 2012). Anaplasmosis is a noncontagious infectious disease due to *Anaplasma* genus. It is usually transmitted by infected ticks (Friedhoff, 1997, Iago et al., 2021) and characterized by hyperthermia. This hyperthermia is most often accompanied by intense anaemia, inrumination, anorexia, weakness, slimming and constipation (Camus and Gerrit, 2003). The locality of Béoumi is home to a large number of dwarf goat farms. These animals provide a source of protein for the population, as well as a source of income. Moreover, they are used for festive ceremonies and rituals (Oussou et al., 2017). However, there is very little information regarding their infestation by *Anaplasma*. This work therefore proposes to identify *Anaplasma* spp in blood samples of dwarf goats and to estimate prevalence of the species encountered.

MATERIAL AND METHODS

Study areas: This study was carried out from December 2015 to September 2016 in sub-prefecture of Béoumi in the center of Côte d'Ivoire. The relief of this locality is composed of plateau. The climate is characterized by precipitations ranging between 1200 and 1600 mm/an (FAO, 2005). Two rivers irrigate the sub-prefecture. They are the Bandama River and its affluent Kan River. This site was selected because of the presence of a significant number of goat breeders (MIPARH, 2007).

Animals: The study focused on 270 goats divided into two batches according to the sampling areas (Table 1). The first batch included 135 goats from all localities located more than 15 km from watercourses (Area A). The second batch, made up of 135 goats, came from areas close to watercourses, at distances varying between 0.5 and 1 km (Area B). The goats examined were also distributed according to the seasons. Indeed, 135 animals were sampled in the dry season and 135 in the rainy season (Table 1).

Blood collection and examination: Auricular sampling consisted of pricking any part of the auricular vein using a sterile needle. The blood that emerges was collected on a slide beforehand degreased with alcohol. Thin drop blood smears

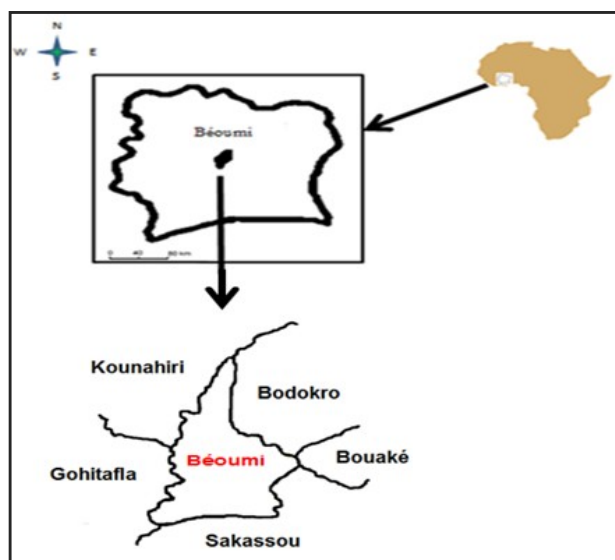


Figure 1. Geographical situation of Béoumi (Maphill, 2011)

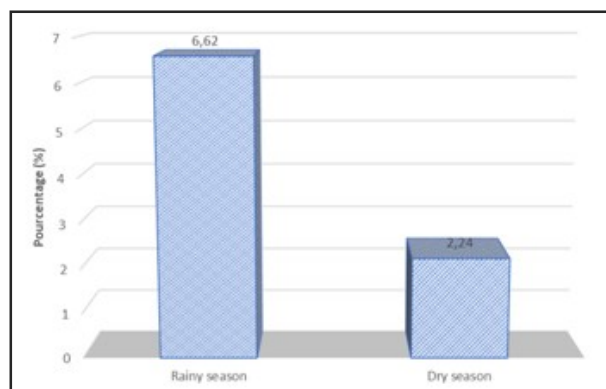


Figure 2. Prevalence of *Anaplasma* spp according to the season

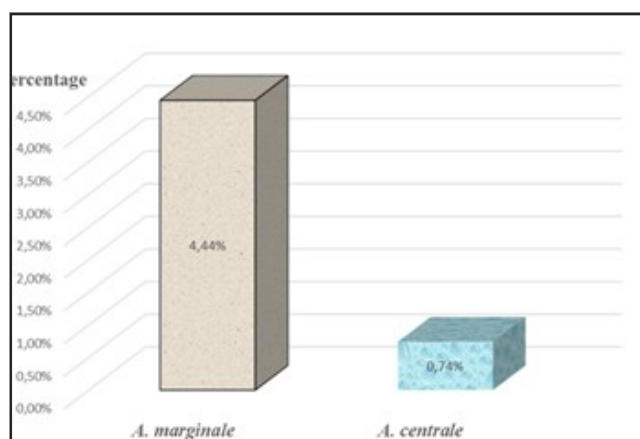


Figure 3. Prevalence of *Anaplasma* species

objective for the detection of *Anaplasma* spp. The identification keys used were those of Euzéby (1988), Radostits *et al.* (2007), and Kocan *et al.* (2010). According to these authors, these pathogens appear as intracellular dots, usually single, measuring 0.4 to 0.8 μm , generally located at the periphery of the cytoplasm (*Anaplasma marginale*) or in a central position (*Anaplasma centrale*).

Statistical analysis: The prevalence of *Anaplasma* species was given according to the zone, season, age and sex of animals according to the following formula:

$$\text{Prevalence of } Anaplasma \text{ sp } (\%) = \frac{\text{number of positive sample to } Anaplasma}{\text{Total number of samples}} \times 100$$

The obtained prevalences were subjected to the Chi-square test using Statistica 7.1 software to determine whether there is a significant difference between them at the 5% level.

RESULTS

- Global prevalence of *Anaplasma* During this study, *Anaplasma* spp was identified in 12 goats out of the 270 examined. This represents a prevalence of 8.89%. Depending on areas, it should be noted that only area B, characterized by localities near watercourses, had animals carrying *Anaplasma* spp. The prevalence in this area was therefore 8.89% (Table 2).
- Prevalence of *Anaplasma* according to the season This study showed that *Anaplasma* spp was more prevalent during the rainy season (Figure 2). Indeed, the prevalence of *Anaplasma* spp during the rainy season (6.62%) was higher than that observed during the dry season (2.24%) ($p < 0.05$).
- Prevalence of *Anaplasma* according to sex and age of animals Only female goats were affected by *Anaplasma* spp in this study. In fact, the twelve cases detected were only females. According to age of animals, only individuals over two years were affected by *Anaplasma* spp with a prevalence of 8.89%.
- *Anaplasma* species identified Two species of *Anaplasma* were identified during this study. They are *Anaplasma marginale* and *Anaplasma centrale*. The species *Anaplasma marginale* was the most prevalent. It was identified in all goats harboring *Anaplasma*. Its overall prevalence was 4.44% (12 goats infected out of 270), whereas that of *Anaplasma marginale* was only 0.74% (2 goats infected out of 270) (Figure 3). Additionally, two cases of co-infections were encountered. In fact, the two animals carrying *Anaplasma centrale* also carried *Anaplasma marginale*.

DISCUSSION

This study showed a low prevalence of *Anaplasma* spp in samples examined. This could be explained by the fact that animals were sampled in the subclinical phase where the bacteremia was weak and difficult to observe. This low prevalence could be due to poor observation of slides which have led to false negatives. *Anaplasma* on smears can only be detected if the bacteraemia is greater than 10^7 infected erythrocytes per milliliter. All 12 infested goats harbored *Anaplasma marginale*, while only two carried *Anaplasma*

were made by depositing a small drop of blood, approximately 3 to 4 μL on a slide. The blood was smeared with the perfectly clean and smooth edge of another slide. Slides were dried in the shade at room temperature and then stored in boxes to be transported to the Central Veterinary Laboratory of Bingerville (LCVB). Once at laboratory, the blood smears were fixed with alcohol (95% methanol) for 3 minutes. Then, they were covered with diluted GIESSA (3 drops per 1 mL of distilled water) for 20 minutes, then carefully washed under running water. The washed smear was dried and examined with immersion oil under a light microscope using the x100

Table 1. Distribution of the sampled goats

Sampling zone	Season	Male goats	Female goats	Young male goats	Young female goats	Total
Area A	Dry season	4	27	14	22	67
	Rainy season	4	28	14	22	68
Area B	Dry season	4	27	14	22	67
	Rainy season	4	28	14	22	68
Total		16	110	56	88	270

Table 2: Prevalence of *Anaplasma* spp according to the area

	Study area		p-value
	Area A	Area B	
Total samples	135	135	
Sample positive to <i>Anaplasma</i> spp	0	12	< 0.05
Prevalence (%)	0	8.89	< 0.05

centrale. This result could be explained by the high sensitivity of these animals to *Anaplasma marginale* which is the typical species of the genus *Anaplasma*. According to Futse et al. (2003), *Anaplasma marginale* is the species most encountered in breeding. *Anaplasma centrale* is closely related to *Anaplasma marginale* and causes similar but mild symptoms. This same observation was made by Yéo et al. (2017) in a similar study in northern Côte d'Ivoire. These authors founded prevalence of 76.94% for *Anaplasma marginale* against 42.22% for *Anaplasma centrale*.

This study also showed that only animals from areas near rivers were positive for *Anaplasma*. Indeed, the 12 smears positive for *Anaplasma* came from goats sampled along the waterways. The climate and vegetation around waterways would therefore be favorable for *Anaplasma* development. In their study, Madder et al. (2007) showed that the prevalence of *Anaplasma* spp was much higher in areas near watercourses where there is a thick vegetation cover. This is also what would explain the dominance of *Anaplasma* spp in the rainy season. In addition, the season would influence proliferation of *Anaplasma* spp. In fact, during drought periods, extreme temperatures and bush fires interfere with the mode of transmission of certain vectors. Vectors can disappear as a result of environmental changes, as predicted by Retolph (2007). Thus, the risk of infestation can decrease. This would explain the low prevalence observed during the dry season. In a study on sheep parasites in sheep farms in the central and southern Côte d'Ivoire, Kéita (2007) showed that areas with sufficient rainfall with the presence of undergrowth are areas with a high rate of pests. Morel (2000) pointed out that certain parasites were abundant in regions receiving 2000 to 3000 mm of rain per year. Vector biology and ecology are highly dependent on climatic conditions (temperature and humidity). This study also showed that only females were parasitized by *Anaplasma*. This result could be explained by the fact that female goats spend more time on farms than males. Under these conditions, the risk of infestation of females by *Anaplasma* is much higher than that of males who are heavily sacrificed during ceremonies and rituals (Missohou et al., 2016). However, these results are different from those of Hungerford and Smith (1997) who showed that males were more infested than females. The presence of this parasite only in animals over two (2) years old would make goats in this age group more susceptible to *Anaplasma*. Indeed, according to Kocan et al. (2003), animals show a natural resistance from an early age due to the numerous antibodies present in colostrum which provide a defense against certain bacteria. They are naturally resistant to diseases while adults, after three years

old, develop a severe form of disease that can lead to death (Pailley, 2007).

CONCLUSION

This study confirms the presence of the genus *Anaplasma* in goats from Béoumi, in the center of Côte d'Ivoire. Two species have been identified: *Anaplasma marginale* and *Anaplasma centrale*. These species have been found in females over two years old, during the rainy season and near the Bandama and Kan rivers. Further studies using more advanced methods (PCR) will need to be conducted to better identify these *Anaplasma* species. Also, goat farmers will need to be informed about the methods to combat anaplasmosis.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

- Belewu, MA., Adewole, AM. 2009. Goat milk: a feasible dietary based approach to improve the nutrition of orphan and vulnerable children. *Pakistan Journal of Nutrition*, 8 : 1711-1714.
- Camus, E., Gerrit, U. 2003. In Lefevre P. C. ; Blancou J., Chermette, R. 1996. Principales maladies infectieuses et parasitaires du bétail. Europe et régions chaudes. Maladies bactériennes. Mycoses. Maladies respiratoires (Major infectious and parasitic diseases of livestock. Europe and hot regions. Bacterial diseases. Mycoses. Respiratory diseases). Editions Tec & Doc, Paris, 2 : 1099-1108.
- Daramola JO., Adeloye, AA. 2009. Physiological adaptation to the humid tropics with special reference to the West African Dwarf (WAD) goat. *Tropical Animal Health Production*, 41: 1005-1016.
- Euzéby, J. 1988. Les hémoprotozooses des Ovins en France. (Hemoprotozoan diseases of sheep in France). *Revue de Médecine Vétérinaire*, 139 : 69-81.

- Friedhoff, KT. 1997. Tick-borne diseases of sheep and goats caused by *Babesia*, *Theileria* or *Anaplasma* spp. *Parasitologia*, 39: 99-109.
- Futse, JE., Ueti, MW., Knowles, DPJr., Palmer, GH. 2003. Transmission of *Anaplasma marginale* by *Boophilus microplus*: Retention of Vector Competence in the Absence of Vector-Pathogen Interaction. *Journal of Clinical Microbiology*, 41: 3829-3834.
- Haenlein, G. 2007. About the evolution of goat and sheep milk production. *Small Ruminant Research*, 68 : 3-6.
- Hungerford, LL., Smith RD. 1997. Variations in seroprevalence et host factors for bovine anaplasmosis in Illinois, *Veterinary Research Communications*, 21: 9-18.
- Iago CB., André, MR., Amaral, RBD., Valente, JDM., Vasconcelos, PC., Oliveira, CJB., Jusi, MMG., Machado, RZ., Vieira, TSWJ, Ueti, MW., Vieira, RFC. 2021. *Anaplasma marginale* in goats from a multispecies grazing system in northeastern Brazil. *Ticks and Tick-borne Diseases*, 12(1): 101592. <https://doi.org/10.1016/j.ttbdis.2020.101592>.
- Keita, K. 2007. Les tiques parasites des ovins dans les élevages des régions du centre et du sud de la Côte D'ivoire (Parasitic ticks of sheep in farms in the central and southern regions of Côte d'Ivoire). Veterinary medicine Thesis, Dakar, 110p.
- Kocan, KM., De la Fuente, J., Guglielmone, AA., Melendez, RD. 2003. Antigens and alternatives for control of *Anaplasma marginale* infection in cattle. *Clinical of Microbiology Reviews*, 16: 698-712.
- Kocan, KM., De la Fuente, J., Step, DL., Blouin, EF., Coetzee, JF., Simpson, KM., Genova, SG., Boileau, MJ. 2010. Current challenges of the management and epidemiology of bovine anaplasmosis. *The Bovine Practitioner*, 44: 93-102.
- Madder, M., Thys, E., Geysen, D., Baudoux, C., Horak, I. 2007. *Boophilus microplus* ticks found in West Africa. *Experimental and Applied Acarology*, 43, 233-234.
- Maphill, 2011. Cartographie de Béoumi. www.maphill.com/search/. Consulté le 15 janvier 2017 (Map of Béoumi. www.maphill.com/search/. Accessed January 15, 2017).
- MIPARH, 2007. (Ministère de la Production Animales et des Ressources Halieutiques) : Production et consommation nationales. Direction de la planification et des programmes (DDP) (Ministry of Animal Production and Fisheries Resources : National production and consumption. Directorate of Planning and Programs), Abidjan, Côte d'Ivoire, 4 p.
- Missohou, A., Nahimana, G., Ayssiwede, SB., Sembene, M. 2016. Goat breeding in West Africa: A review. *Revue d'Elevage de Médecine Vétérinaire des Pays Tropicaux*, 69 : 3-18.
- Morel, PC. 2000. Maladies à tiques du bétail en Afrique. In: Chartier, C.; Itard J.; Morel P.C.; Troncy P.M. (eds.). Précis de parasitologie vétérinaire tropicale. Universités francophones (Tick-borne diseases of livestock in Africa. In: Chartier, C.; Itard J.; Morel P.C.; Troncy P.M. (eds.). Handbook of Tropical Veterinary Parasitology. Francophone Universities). Editions Tec & Doc/EM Inter. Paris. 123p.
- Oussou, KA., Karamoko, Y., Zouh Bi, ZF. 2017. Rôle des éleveurs de caprins dans l'émergence des maladies caprines (*Capra hircus*, schaller, 1977) dans la localité de Béoumi (Côte d'Ivoire) (Role of goat farmers in the emergence of goat diseases (*Capra hircus*, Schaller, 1977) in Béoumi locality (Ivory Coast)). *Journal of Applied Biosciences*, 114 : 11317-11323
- Pailley, J. 2007. Les bactéries hémotropes des ruminants transmises par les arthropodes hématophages en France (Hemotropic bacteria of ruminants transmitted by blood-feeding arthropods in France). Veterinary Doctoral Thesis, National Veterinary School of Alfort, 128p.
- Radostits, OM., Gay, CC., Blood, DC., Hinchcliff, KW. 2007. *Veterinary Medicine: A textbook of the diseases of cattle, horses, sheep, pigs and goats*. (9th edition). W.B. Saunders Compagny Ltd (Ed), London, 1877p.
- Retolph, TF. 2007. Rôle de l'élevage dans la nutrition et la santé humaines pour la réduction de la pauvreté dans les pays en développement (Role of livestock in human nutrition and health for poverty reduction in developing countries). *Journal of Animal Science*, 85 : 2788-2800.
- Rhissa, Z. 2010. Ministère de l'Elevage, des Pêches et des Industries animales de Niamey (Ministry of Livestock, Fisheries, and Animal Industries of Niamey). *Review of the livestock sector in Niger*, 115p.
- Sharff, RL. 2010. Economic burden from health losses due to foodborne illness in the United States. *Journal of food protection*, 75 : 123-131.
- Suchet, A. 2012. Séroprévalence des maladies vectorielles transmises par les tiques chez le chien en France : importance du genre *Anaplasma* (Seroprevalence of tick-borne vector-borne diseases in dogs in France : importance of the genus *Anaplasma*). Doctoral thesis, Claude-Bernard University - Lyon I. 155p.
- Waelti, P., Koné, I., Barry, A., Diarra, M., Niangado O. 2003. Production laitière des petits ruminants. Lutte contre la malnutrition et diversification des revenus dans la commune de Cinzana (Mali). Etude pour les Recherches du Sahel (Dairy production of small ruminants. Combating malnutrition and diversifying income in the commune of Cinzana (Mali). Study for Sahel Research), 8-9 : 117-125.
- Yéo, N., Karamoko, Y., Soro, D., Zouh Bi, ZF., Okon, AJL., Gragnon, BG. 2017. Prevalence of *Trypanosoma*, *Babesia* and *Anaplasma* in cattle reared in the North of Côte d'Ivoire. *International Journal of Biosciences*. 10: 21-28.
