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# Preliminary study on vectors of bovine trypanosomosis in the central African republic one decade after the socio-military crisis

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## 1 ABSTRACT

**A cross-sectional entomological survey using Vavoua traps (n=30) was carried out in three main cattle rearing regions (Center, West and East) of the Central African Republic (C.A.R), ten years after the socio-military crisis to establish the abundance and diversity of vectors of bovine trypanosomosis. The haematophagous flies caught consisted of members of the genus *Glossina* with their apparent densities: *G. morsitans submorsitans* [Bossembele (0.9 f/t/d), Yaloke (0.7f/t/d), Bouar (1.2f/t/d), Bossangoa (0.9f/t/d), Bambari (1.6f/t/d)], *G. fusca congolensis* [Bossembele (0.5f/t/d), Yaloke (0.5f/t/d), Bouar (0.4f/t/d), Bossangoa (0.5f/t/d), Bambari (2.6 f/t/d)]and *G. fuscipes fuscipes* [Bossembele (0.6 f/t/d), Yaloke (0.3 f/t/d), Bouar (0.6 f/t/d), Bossangoa (0.7f/t/d), Bambari (0.7f/t/d)]. Other haematophagous flies including species that belong to the family Tabanidae and Stomoxyidae were also caught. The presence of these vectors in the prospected sites of the C.A.R may suggest a potential mechanical transmission of animal trypanosomosis and *loa loa* filariasis. A more in-depth study of these insects is underway to clarify on their seasonal dynamics and epidemiological importance.**

## 2 INTRODUCTION

The livestock sector immensely contributes to the economic development of the C.A.R as it sums up to 15% of its gross domestic product (GDP). The sector remains a source for job creation and wealth in the national socio-economic policy. The C.A.R is one of the three major livestock producing countries in the CEMAC zone with its vast pastoral land (16 million hectares). The country cattle herd is currently estimated at 3,950,000 head i.e. 13% of cattle head of the CEMAC region. This is also true for transboundary transhumance cattle that reaches hundreds of thousands of cattle. The number of small ruminants is estimated at six million with 5.9 million goats and 400,000 sheep. The production of large and small ruminant farms faces the recrudescence of health constraints, especially African Animal

Trypanosomosis (AAT). AAT is a vector-borne parasitic disease biologically transmitted by the bite of tsetse flies (Van Den Abbeele *et al.*, 2010; Wamwiri and Changasi, 2016) and mechanically by the bite of mechanical vectors like tabanids (Baldacchino *et al.*, 2014) and *Stomoxys* (Baldacchino *et al.*, 2013). In Africa, tsetse flies hinder animal production in about 7 to 8 million km$^2$. The first study on the distribution of *Glossina* of C.A.R was made by Martin *et al.* (1909) and they reported *G. fuscipes fuscipes*, *G. tachinoides*, *G. fusca* and *G. morsitans*. An update of the list of tsetse of C.A.R was made by Maillot (1953) who reported 11 species. Thirteen species were later reported by Finelle *et al.* (1963) in the district of Bambari and Bouar with four of them (*G. morsitans submorsitans*, *G. tachinoides*, *G. fuscipes fuscipes* and *G. fuscipleuris*) being the most important vectors of AAT. Finelle in 1961reported on a brief history of the tsetse eradication campaign of C.A.R where he mentioned that the first (1961) tsetse eradication campaign aimed at relieving the forested areas from *G. fusca congolensis* and *G. fuscipleuris* and the second (1962-1963) concerned *G. fuscipes fuscipes*. According to Gouteux *et al.* (1994) there was a drift of *G. morsitans submorsitans* from the main livestock areas in the west (Bouar, Bozoum, Bocaranga, Batangafo, Bossangoa and Paoua), Center (Bossembele, Bouca and Dekoa) and East (Bambari, Grimari and Ippy). This drift was suggested to occur from the South to the North-West, inducing a shift of about 400Km and this important retreat created huge pasture land for the Mbororo pastoralists in the tsetse free rangelands. Access to such tsetse free pasture lands was still restricted in the Center-North and in the East by wild game reserves where *G. morsitans submorsitans* occurred. Trypanosomosis is considered by most experts to be a primary factor causing serious threat to the development of livestock production in tropical Africa (Dicko *et al.*, 2015). Improving animal health status is a prerequisite to ensuring the productivity of herds and food security of the C.A.R population. It is therefore important to tackle the major health constraints that persist, particularly bovine trypanosomosis, which is currently experiencing an increase in the C.A.R savanna areas, due to its socio-military crisis. In the C.A.R, very little research has focused on hematophagous vectors of trypanosomosis. Tsetse flies pose a great threat to the health of livestock with transboundary movements between Chad, Cameroon and Sudan leading to the exposure of over 3 million cattle to the bite of tsetse flies in the different infested foci. Because of the insecurity and shortage of pasture land during the dry season in the C.A.R, some Fulani cattle herdsmen together with their cattle, spend most of their time in the North region of Cameroon in some areas that have been reported as tsetse infested (Sevidzem *et al.*, 2016), tabanids infested (Lendzele *et al.*, 2017) and *Stomoxys* infested (Sevidzem *et al.*, 2016) foci. The report of the entomological prospection phase of the ZAGROP de Yeremo by Cuissance *et al.* (1994) showed three species notably *G. fuscipes fuscipes*, *G. fusca congolense* and *G. morsitans submorsitans* with *G. fuscipes fuscipes* considered as an omnipresent and dominant species as well as the most important vector of AAT especially for the mbororo zebu cattle breed that surges between the pasture land of Bouar plateau in the C.A.R, Adamawa plateau of Cameroon and Chad. The objective of this present study was to know the apparent density and the species composition of tsetse in C.A.R. For these purposes, entomological prospections were conducted in the main cattle rearing areas in the C.A.R one decade after the socio-military crisis.

## 3 MATERIALS AND METHODS

**3.1 Study area:** The study sites consisted of major cattle rearing sites of the C.A.R in the Center (Bossembélé in four localities (Bégoua, Yaloké, Bossangoa, Kaga Bandoro), in the West (Bouar in two localities (Koui and Niemyelowa) and in the East (Bambari in two localities (Maloum and Ippy). Considering the insecurity in the two localities of Bambari (Maloum and

Ippy), indigenes of these localities were trained on how to collect flies with the traps and brought the collections to Bangui for identification. The climate of the C.A.R. is generally tropical. The northern areas are subject to harmattan winds, which are hot, dry and carry dust. There are two seasons, dry (November to April) and rainy (May to October). Most of the country is occupied by a plateau, whose altitude ranges between 400 and 800 metres a.s.l; in the westernmost part where it reaches around 1000m, in the Nana-Mbamberé and Ouham-Pendé (Bouar and Bocaranga) divisionas and Mount Ngaoui as well as at the border with Cameroon where it reaches 1374 metres a.s.l. The south-central part of the country is covered with rainforest while the other regions are mostly savanna. The far north consists of a drier strip close to the Sahel. In the far north**,** nights are cool in winter or a bit cold sometimes, but hot during the day. Maximum temperatures hover around 33/34 °C but may rise even higher.

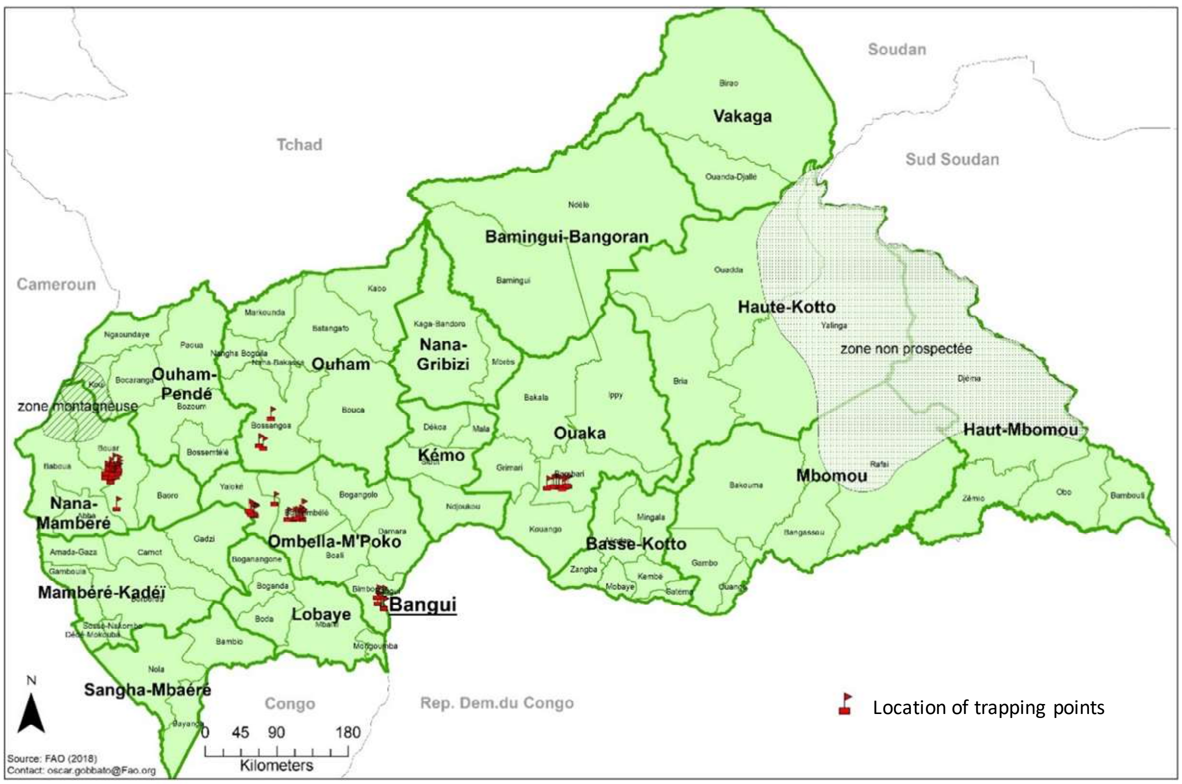


**Figure 1:** Location of the study sites

**3.2 Fly trapping:** An entomological prospection was carried out for 26 days in five sites. The prospection was carried out in the dry season from the 9th of July to the 3rd of August 2018 in major cattle rearing areas reporting frequent cases of trypanosomosis. Vavoua traps (Laveissiere and Grebaut, 1990) were used. Six traps were deployed in every site. In total, 30 Vavoua traps were activated in the study area and their positions noted using a GPS (Garmin®) portable device. Traps were deployed for three days in each site.

**3.3 Fly identification:** The identification of glossines was carried out up to species level in the laboratory. The morphological identification of the species of glossines was carried out using the identification key of Pollock (1982) and identification software (Brunhes *et al*., 1998). Tabanidae were morphologically identified using the published taxonomic key of Odroyd (1957). *Stomoxys* spp.

were identified using the identification key of Zumpt (1973).

**3.4 Data analysis:** The abundance of flies caught was defined by the apparent density (TAD) which can be translated as the number of specimens of each species caught per trap and day.

$$TAD = \frac{\text{Number of flies caught}}{\text{Number of traps} \times \text{Number of trapping days}}$$

Where TAD is the trap apparent density

## 4. RESULTS

The sites surveyed were infested with three species of tsetse flies (*G. fuscipes*, *G. fusca congolensis* and *G. morsitans submorsitans*) with *G. morsitans submorsitans* (156) being the most dorminant species. The overall trap apparent density for tsetse was 13.6 tsetse/trap (Table 1). The cartographic presentation of the main tsetse fly species in the prospected areas is shown (Figure 2 and Figure 3).

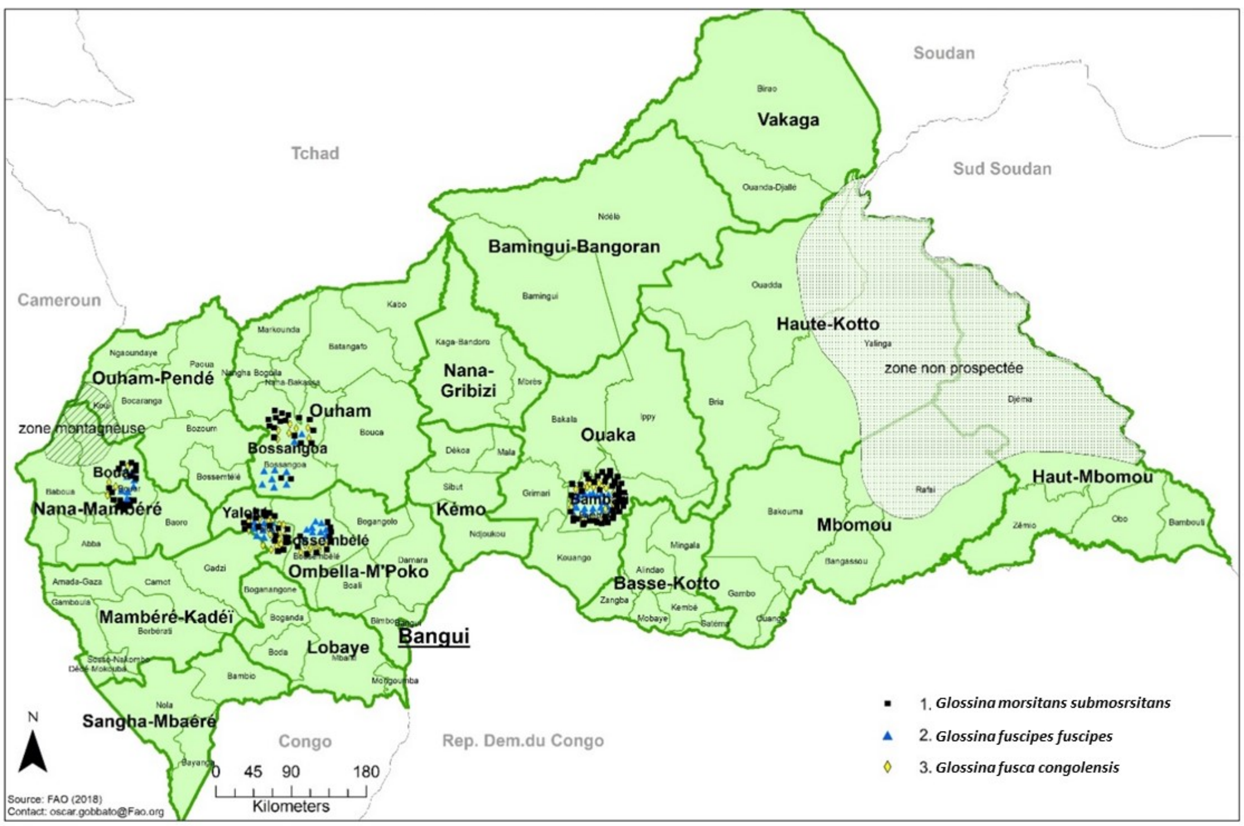


**Figure 2**: Tsetse distribution map in four major cattle rearing zones

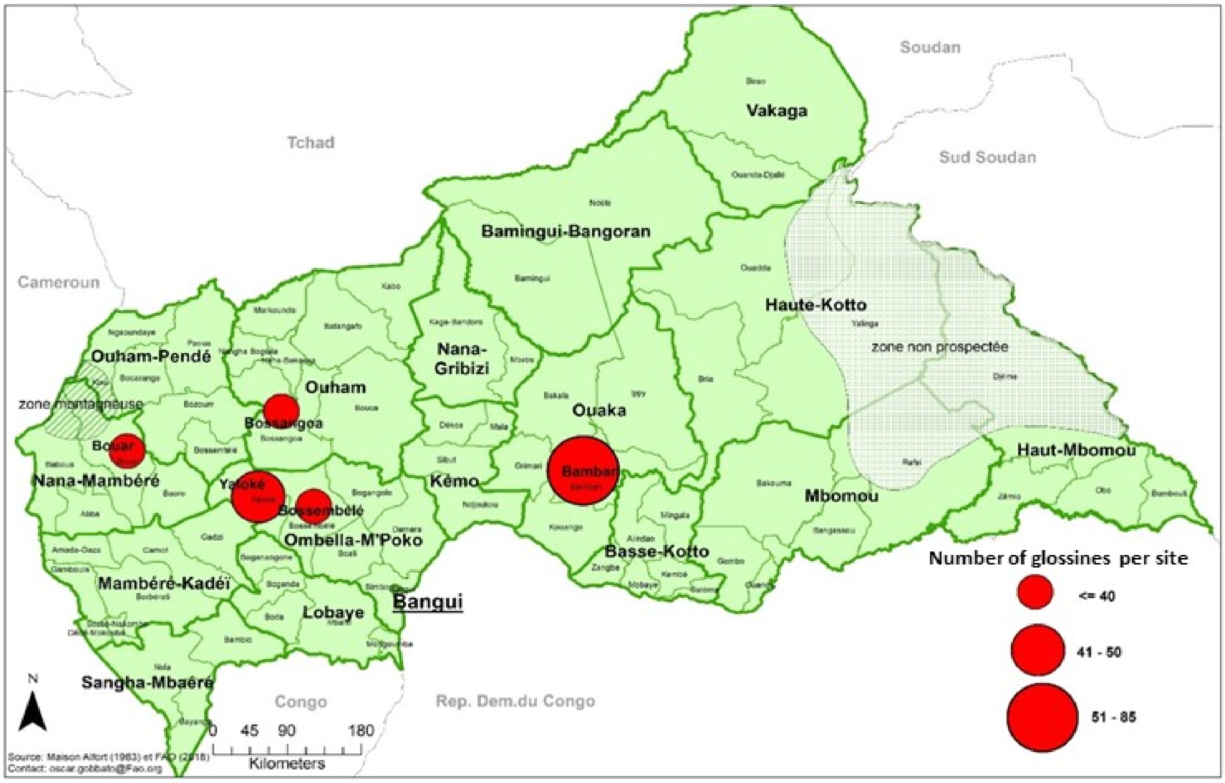


**Figure 3:** Map showing the density of tsetse flies in the prospected sites

**Table 1:** Trap apparent density of the main vectors of HAT and AAT with site

| Site | *G. fuscipes fuscipes* | | *G. fusca congolensis* | | *G. morsitans submorsitans* | |
|---|---|---|---|---|---|---|
| | Number | TAD | Number | TAD | Number | TAD |
| Bossembele | 19 | 0.6 | 15 | 0.5 | 27 | 0.9 |
| Yaloke | 9 | 0.3 | 15 | 0.5 | 21 | 0.7 |
| Bouar | 18 | 0.6 | 13 | 0.4 | 35 | 1.2 |
| Bossangoa | 20 | 0.7 | 16 | 0.5 | 28 | 0.9 |
| Bambari | 21 | 0.7 | 78 | 2.6 | 48 | 1.6 |
| Total | 87 | 2.9 | 137 | 4.6 | 159 | 5.3 |

The trap apparent density of *Stomoxys* (17.4 *Stomoxys*/trap/day) and tabanids (2.0 tabanids/trap/day) indicates high infestation of the prospected sites with mechanical vectors of AAT (Table 2). Highest TAD of *Stomoxys* was observed in Yaloke (9.3 *Stomoxys*/trap/day) and that of tabanids was seen in Bossangoa (0.6 tabanids/trap/day) and Bambari (0.6 tabanids/trap/day) (Table 2).

**Table 2**: Trap apparent density of tabanids and *Stomoxys* with prospected sites

| Locality | Tabanids | | *Stomoxys* | |
|---|---|---|---|---|
| | Number | TAD | Number | TAD |
| Bossembele | 6 | 0.2 | 54 | 1.8 |
| Yaloke | 9 | 0.3 | 279 | 9.3 |
| Bouar | 8 | 0.3 | 96 | 3.2 |
| Bossangoa | 17 | 0.6 | 27 | 1.0 |
| Bambari | 19 | 0.6 | 65 | 2.2 |
| Total | 59 | 2.0 | 521 | 17.4 |

## 5 DISCUSSION

The tsetse apparent density (2.20 tsetse/trap/day to 4.90 tsetse/trap/day) during the present survey was higher in Bambari and Bouar and indicates a high risk of trypanosomosis as compared to the surveys that were carried by Gouteux (1991) and Cuissance *et al.* (1992) who reported TADs of 2.64 and 2.82 respectively. It was interesting to know that the study of Gouteux *et al.* (1994) in the prospected sites did not report *G. morsitans submorsitans* which was the most abundant species recorded in the present survey. The three identified species in this present survey have already been described in ZAGROP de Yeremon (Bossembélé) by Cuissance *et al.* (1992); the same species were identified and mapped by Finelle *et al.* (1963) in the same divisions surveyed in this present study. One of the tsetse species (*G. morsitans submorsitans*) mentioned in this present survey have been reported to exist in the savanna of North region of Cameroon (Sevidzem *et al.*, 2016) where some transhumance cattle from C.A.R spend most of their time during the dry season. This shows the risk of trypanosomosis transmission for both cattle of North Cameroon and C.A.R because they share the same rangeland and are equally exposed to other dangerous transboundary diseases. Trypanosomosis and tsetse do not only prevail in C.A.R but extends across the borders of the national territory to other neighbouring countries like Sudan, Chad, Gabon and Congo. Tsetse fauna of Sudan consists of two species notably *G. fuscipes fuscipes* and *G. morsitans submorsitans* (Ahmed *et al.*, 2016). The review of Kabamba and Malekani (2017) revealed four *Glossina spp. (G. tabaniformis, G. fuscipes, G. fuscipes quazensis and G. palpalis palpalis*) that prevails in the Democratic republic of Congo. The report of Zinga *et al.* (2016) reveals seven species of glossines from Gabon namely *G. frezili*, *G. fusca congolense*, *G. nashi*, *G. palpalis*, *G. tabaniformis*, *G. tachinoides* and *G. fuscipes*. The existence of tsetse in south Gabon is related to the occurrence of trypanosomes in the area (Maganga *et al.*, 2018). The trypanosome foci of Mandoul in Chad harbours niches of *G. fuscipes fuscipes* as reported by Mahamat *et al.* (2017). About the mechanical vectors of AAT, the predominance of *Stomoxys* and tabanids was noticed in all the prospected areas. A similar finding was reported in Cameroon for tabanids (Lendzele *et al.*, 2017) and *Stomoxys* (Sevidzem *et al.*, 2016). Highest proportion of tabanids resided in Bombari (32%) and Bossangoa (29%) than the other sites possibly because of high tabanid breeding sites, unathropised nature of the site as well as high cattle numbers in the site during prospection The occurrence of tabanids in the C.A.R indicates the possibility of the mechanical transmission of infectious pathogens like AAT and loa loa filariasis (Baldacchino *et al.*, 2014; Desquesnes and Dia, 2003a, b; Desquesnes and Dia, 2004). The highest proportion of *Stomoxys* resided in Yaloke than the other sites possibly because their breeding sites were found in the site as well as high numbers of blood meal hosts during prospection. The occurrence of *Stomoxys* indicates the potential mechanical transmission of AAT and other infectious agents (Baldacchino *et al.*, 2013). Although the survey lasted for less than one month, it revealed vital information on the number of tsetse species present, their spatial distribution and the risk of AAT transmission.

## 6 CONCLUSION

All the biological vectors (*G. fusca congolensis*, *G. fuscipes fuscipes*, *G. morsitans submorsitans*) involved in the transmission of Human African Trypanosomosis and African Animal Trypanosomosis are present in the prospected sites of the Central African Republic. This preliminary result call for the development of strategies for the control of tsetse and trypanosomosis in the prospected regions.

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