Influence of habitat and seasonal variation on wild mammal diversity and distribution with special reference to the *Trypanosoma brucei gambiense* host-reservoir in Bipindi (Cameroon)

Jacques Anselme Massussi, Champlain Djielo-Lordon, Flobert Njiokou, Claude Laveissière, Jan Douwe van der Ploeg

A R T I C L E   I N F O

Article history:
Received 30 July 2009
Accepted 11 August 2009
Available online 2 September 2009

Keywords:
Human African trypanosomiasis
Wild mammals
Animal density
*Trypanosoma brucei gambiense*
*Glossina palpalis palpalis*
Habitat types

A B S T R A C T

To evaluate the role of wildlife in the resurgence and perenisation of human African trypanosomiasis (HAT), we investigated the influence of habitat and seasonal variations on the diversity and spatial distribution of wild mammals, with special reference to those recognised as potential host-reservoirs of *Trypanosoma brucei gambiense* in Bipindi (southwestern Cameroon). To achieve this, we carried out transect surveys in four habitat types over two years. A total of 31 mammal species were recorded, of which 14 occurred in the undisturbed forest, 9 in cocoa plantations, 11 in farmlands and 11 in village-adjacent gallery forests. Among them, six species (*Cephalophus monticola*, *Cephalophus dorsalis*, *Atherurus africanus*, *Cricetomys emini*, *Nandinia binotata* and *Cercopithecus nictitans*) known as reservoir hosts of *T. b. gambiense*, occurred in all kinds of habitats suitable or unsuited to *Glossina palpalis palpalis* and in all seasons. These species are the most involved in the transmission cycle (human being/tsetse flies/wild animals). *Cercopithecus cephus*, *Miopithecus talapoin* and *Heliosciurus rufobrachium* host *Trypanosoma brucei* spp.; however, only *C. cephus* does not occur permanently in the suitable habitat of *G. palpalis palpalis*. In general, some species (*C. monticola*, *Tragelaphus spekei* and *C. emini*) showed a slight density increase from the long dry to the rainy season within the undisturbed and farmland habitats, and a slight decrease within cocoa plantations and village-adjacent forests in the same period. The density of *A. africanus* increased greatly from the long dry season to the heavy rainy season in the undisturbed forest while, the density of primates in this habitat decreased slightly from the long dry season to the heavy rainy season. These variations indicate a permanent movement of wild mammal reservoir or feeding hosts from one biotope to another over the seasons. *Thryonomys swinderianus* needs to be investigated because it occurs permanently in the suitable habitat of *G. palpalis palpalis* and *Potamochoerus porcus* for its genetic similarities to domestic pigs, favourable feeding hosts of *G. palpalis palpalis*.

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In Cameroon, parasitological methods used until the early 1990s failed to reveal the role of domestic and/or wild animals as reservoir hosts of *T. b. gambiense* (Asonganyi et al., 1986, 1990; Dukes et al., 1990; Berl et al., 1992). Since 1994, studies using molecular techniques revealed the reservoir role (8 species) and feeding role (18 species) of wild mammals (including primates, rodents, ungulates, small carnivores) (Herder et al., 2002; Njiokou et al., 2004) and consequently their implication in the resurgence of HAT. This discovery indicated the existence of a triangular transmission scheme of *T. b. gambiense* involving the vector (tsetse flies), the terminal host (human), and the reservoir hosts (livestock and wild animals). However, the importance of wild animals in this scheme remained unknown. Therefore, a multidisciplinary project aimed at collecting data for a better understanding of HAT resurgence in Bipindi was implemented. In this framework, the objective of the present work was to study the spatial distribution of wild mammals, hosts of *G. palpalis palpalis* in the Bipindi area with particular reference to habitat preference and seasonal cycles.

2. Methodology

2.1. Study site

The study was carried out in Bipindi (3°06′–3°68′N, 10°70′–11°E) (Fig. 1) located in the main active focus of HAT in Cameroon (Grébaut et al., 2001). The climate is equatorial with four seasons: a heavy rainy season from September to mid-November, a small rainy season from mid-March to mid-June, a long dry season (mid-November to mid-March) and a short dry season from July to August. The annual average rainfall is about 2000 mm (Van Dijk, 1999) and the mean annual temperature is about 25 ± 3 °C.

The study area belongs to the Atlantic Biafran district of the humid evergreen forest. Because of human pressure (extensive logging and agriculture) the local vegetation can be subdivided into village-adjacent forest, farmlands and fallows (rich in *Macaranga-Chromolaena*), cocoa plantations and the undisturbed forest. The area is surrounded by hills and several streams run along vegetation types and villages.

The population density is low, about 7 inhabitants/km² (Van Dijk, 1999), consisting of a majority of Bantu groups (Ngumba, Bassa, Fang and Bulu tribes) and a pygmy minority (Bagyeli). Most of the Bagyeli people live in small settlements in the forest at about 7–10 km from roads and Bantu villages, but also in some permanent project settlements where medical care and schooling are available. The main activities are hunting–gathering (mostly by pygmies), shifting cultivation and cocoa cropping (mainly by the Bantu).

2.2. Data collection

Seven line transects were established in two villages, of which two (1 km each) were installed in the undisturbed forest (about 7 km from the village), two (1 km each) in the farmlands and fallows, two (0.5 km each) in cocoa plantations and one (0.5 km) in the village-adjacent forest.

Four surveys (2 diurnal and 2 nocturnal) were completed on each transect line per season by a team of four persons (two researchers and two local specialised hunters) in 2003. In 2004 only diurnal surveys were completed on the same transect per season. Therefore, twenty-four surveys were completed in two
years (2003–2004). Standardised sheets were used to record direct observations and indirect evidence (dung, tracks, vocalisation, feeding signs and animal carcasses). For each direct observation, the data recorded included (1) the species observed, (2) its location along the transect, (3) the perpendicular distance from the animal to the transect, (4) the activity of the animal, (5) the estimated number of animals seen in case of groups. Daily surveys started between 06h30 and 08h00 AM and night surveys between 07h00 and 08h00 PM. Daily survey on each transect lasted about 0.607 km and the data recorded included (1) the species observed, (2) its location along the transect at a speed of 0.3–0.4 km/h. Small breaks of 5–15 min were taken each 100 m to hear the vocalisations of animals.

2.3. Data analysis

Data recorded were pooled according to the seasons and the biotopes and the animal densities computed for each biotope per season. All sightings (live animal observed, tracks, dung, feeding signs and animal carcasses) were pooled for the determination of animal densities (White and Edwards, 2001). Therefore, the density of species \( i \) in biotope \( j \) and seasonal survey occasion \( k \) in the season \( t \) is given by the formula:

\[
D_{ijkt} = \frac{N_{ijkt}}{w_{ijkt}L_{jk}}
\]

where \( N \) is the total number of sightings for species \( i \) in biotope \( j \) and seasonal survey occasion \( k \), \( w \) the effective strip width obtained on each side of the transect in biotope \( j \) at season \( t \) and at seasonal survey occasion \( k \), \( L \) the transect length in biotope \( j \) at season \( t \) and \( P \) (0.607) is the probability of detection (White and Edwards, 2001).

To test the spatio-temporal patterns of the distribution of each animal species, estimated densities were analysed. At each level (biotope), ANOVA was used with time (seasonal occasion) (Mayaka Bileng, 2002). Finally, the Student–Newman–Keuls procedure was used to separate significantly different means (Steel and Torries, 1981). All these analyses were carried out on SPSS 12.0.

3. Results

3.1. Species richness of the Bipindi area and diversity of species potential host–reservoirs of T. b. gambiense

A total of 31 mammal species belonging to six orders namely Artiodactyla, Rodentia, Carnivora, Primata, Pholidota and Hyraxes (Table 1) were recorded. In the statistical analysis, the species considered as rare or less common in the area, or not observed or seen during the survey but known to exist and captured by hunters were excluded. These species consisted of the Royal antelope (Neotragus pygmaeus), the Ogilby’s duikers (Cephalophus ogilbyi), Peter’s duiker (Cephalophus callipygus), Red-backed flying squirrel (Anomalous erythronotus), Large-spotted Genet (Genetta tigrina) and the small-spotted genet (Genetta servalina), the Golden potto (Arctocebus calabarensis), the galago (Perodicticus potto), the gorilla (Gorilla gorilla), the chimpanzees (Pan troglodytes), the mandrills (Mandrillus sphinx), the Pholodiota (Manis gigantea, M. tricuspis and M. tetradactyla), and Tree dassie (Dendrohyrax arboreus).

Among the species considered in the analysis, 14 occurred in the undisturbed forest, 10 in cocoa plantations, 10 in fallows/farmlands and 10 in village-adjacent forests (Fig. 2). Six of these species have been recognised as reservoir hosts of T. b. gambiense and ten host T. brucei spp. Reservoir host species consisted of ungulates (Cephalophus monticola and Cephalophus dorsalis), rodents (Cricetomyina emini and Atherurus africanus), small carnivores (Nandinia binotata) and primates (Cercopithecus nictitans) (Table 2). Ungulates

### Table 1

<table>
<thead>
<tr>
<th>Biotopes</th>
<th>Und. Forest*</th>
<th>Cocoa Pl.</th>
<th>Farm/Fall.</th>
<th>Vil-Adj Fo†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seasons</td>
<td>SRs</td>
<td>SDs</td>
<td>HRs</td>
<td>LDs</td>
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<tr>
<td>Primata</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Rodentia</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Carnivora</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Artiodactyla</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>T. Nb. of species</td>
<td>9</td>
<td>13</td>
<td>13</td>
<td>11</td>
</tr>
</tbody>
</table>

SRs: small rainy season; SDs: short dry season; HRs: heavy rainy season; LDs: long dry season; T. Nb. of species: total number of species.

* Undisturbed forest.

† Cocoa plantation.

‡ Food plantation.

### Table 2

<table>
<thead>
<tr>
<th>Species</th>
<th>Und. Forest*</th>
<th>Cocoa Pl.</th>
<th>Farmland Pl.</th>
<th>Vil-Adj Fo†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ungulates</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Cephalophus monticola</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Cephalophus dorsalis</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Cephalophus silviculor</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Trogelaphus sleepi</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Potamochoerus porcus</td>
<td>C</td>
<td>D</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Rodentia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cricetomyina emini</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Heliosciurus rufobrachium</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Atherurus africanus</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Thryonomyx swinderianus</td>
<td>D</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Carnivora</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nandinia binotata</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Vivera civetta</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Crossarchus obscurus</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Primates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miopithecus talapoin</td>
<td>D</td>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>Cercopithecus cephus</td>
<td>B</td>
<td>D</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Cercopithecus mona</td>
<td>D</td>
<td>B</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Cercopithecus nictitans</td>
<td>A</td>
<td>D</td>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>

A: reservoir host of T. b. gambiense; B: reservoir host of T. brucei spp.; C: not investigated for T. b. gambiense and T.brucel spp.; D: not occurring; E: reservoir host of T. brucei spp.

* Undisturbed forest.

† Cocoa plantation.

‡ Food plantation.

§ Village-adjacent forest.
Fig. 2. Seasonal variation of mammal species density in four biotope types. LDs: long dry season, SRs: small rainy season, SDs: short dry season, HRs: heavy rainy season.
Rodents occurred in all kinds of habitat types and in all seasons but their densities varied. Accordingly, *N. binotata*, the only carnivore reservoir host of *T. b. gambiense* recorded occurred only in the undisturbed forest and farmland. Finally, in the primate group, *C. nictitans* was sighted in the undisturbed forest and farmland habitat.

### 3.2. Densities and distribution in different habitat types of mammal species according to seasons

The mean animal densities of each species were computed according to seasons and biotopes. The results are given in *Tables 3, 4, 5 and 6*.

Among ungulates (*Table 4*), only the Blue duiker (*C. monticola*), the Black striped duiker (*C. dorsalis*) and the Sitatunga (*Tragelaphus spekei*) occurred in all kind of habitats. *C. monticola* was significantly abundant in the undisturbed forest and its density increased gradually from the long dry season to the heavy rainy season. During the long dry season, no ungulate species was sighted in the farmland habitat and the village-adjacent forest. Furthermore, the densities of *C. monticola* showed very highly significant biotope effect (*p* ≤ 0.001) but no significant season variation (*p* ≥ 0.05). The yellow-backed duiker (*Cephalophus silvicola*), rare in all kinds of habitats, was recorded only in the undisturbed forest and the farmland habitats. The densities of this species were very low and showed no significant biotope and seasonal differences (*p* ≥ 0.05). The Bush pig (*P. porcus*) was encountered only in the undisturbed forest during the small rainy season, the short dry season and the heavy rainy season.

Rodents were relatively common in all habitats but their densities varied according to biotopes and seasons (*Table 5*). In fact, the Cane rat (*Thryonomys swinderianus*) occurred only in cocoa plantations, the farmland habitats and the village-adjacent forest with densities varying significantly (*p* ≤ 0.05) according to biotopes and seasons. The African brush-tailed porcupine (*A. africana*), the most abundant species of this group occurred in all biotopes. However, its density showed a significant biotope effect (*p* ≤ 0.05) but no significant seasonal variation (*p* ≥ 0.05). The Giant rat (*C. emini*) occurred also in all kinds of habitats but no significant difference (*p* ≥ 0.05) of its densities was observed among biotopes; however, a significant density variation was recorded according to seasons (*p* ≤ 0.05). The Sun squirrel (*H. rufobrachium*) occurred in all kind of habitat types; its densities showed no significant biotope and seasonal effects (*p* ≥ 0.05).

Small carnivores were encountered in all four habitat types (*Table 6*). The Dark mongoose (*Crossarchus obscurus*) occurred in the undisturbed forest and the farmland habitats in all seasons. In the village-adjacent forest, this species was sighted only during the rainy seasons; while in cocoa plantations, they occurred all the year except in the small rainy season. The densities of mongoose showed highly significant biotope effects (*p* ≤ 0.01) and significant seasonal variation (*p* ≤ 0.05). In fact, this species moves in large groups from one biotope to another feeding by scratching the ground for eggs, insects, worms and lizards. The African civet (*Viverra civetta*) and the palm civet (*N. binotata*) were sighted in all biotopes during the small rainy season and were not observed in the long dry season. However, no significant biotope and season effects (*p* ≥ 0.05) of *V. civetta* densities were recorded; while *N. binotata* showed highly significant season effects (*p* ≤ 0.01) but no significant biotope effects (*p* ≥ 0.05).

Primates in general occurred mainly in the undisturbed forest and cocoa plantation (*Fig. 2*) where the food and hiding habitats were available. However, one species, *Miopithicus talapoin* was observed only along Mougue River in the village-adjacent forest. In cocoa plantations and fallows/farmlands, *M. talapoin* moved all the day from place to place looking for food. The primate densities are given in *Table 4*. In general, they decreased from the small rainy season to the long dry season. During this last season, only *M. talapoin* was sighted in the village-adjacent forest. *Cercopithecus cephus*, *Cercopithecus mona* and *C. nictitans* showed highly significant variation of densities among biotopes (*p* ≤ 0.001) (see *Table 7*) and no significant variation between seasons (*p* ≥ 0.05).
### Table 4
Mean density per square kilometre of ungulates found in Bipindi area. Data obtained from 14 surveys conducted in four seasons (2003–2004) over two years.

<table>
<thead>
<tr>
<th>Species</th>
<th>Biotope</th>
<th>Und. Forest</th>
<th>Cocoa Pl.</th>
<th>Farm/Fall.</th>
<th>Vil-Adj Fo.</th>
<th>Probab.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SRs</td>
<td>SDs</td>
<td>HRs</td>
<td>LDs</td>
<td>SRs</td>
</tr>
<tr>
<td>C. monticola</td>
<td></td>
<td>0.94</td>
<td>1.33</td>
<td>2.29</td>
<td>2.11</td>
<td>0.26</td>
</tr>
<tr>
<td>C. dorsalis</td>
<td></td>
<td>0.08</td>
<td>0.26</td>
<td>0.09</td>
<td>0.35</td>
<td>0</td>
</tr>
<tr>
<td>C. silvicultor</td>
<td></td>
<td>0</td>
<td>0.03</td>
<td>0</td>
<td>0.23</td>
<td>0</td>
</tr>
<tr>
<td>T. spekei</td>
<td></td>
<td>0.09</td>
<td>0.32</td>
<td>0.28</td>
<td>0</td>
<td>0.56</td>
</tr>
<tr>
<td>P. porcus</td>
<td></td>
<td>0</td>
<td>0.39</td>
<td>0.02</td>
<td>0.25</td>
<td>0</td>
</tr>
</tbody>
</table>

SRs: small rainy season; SDs: short dry season; HRs: heavy rainy season; LDs: long dry season. Fa: F-test according to biotopes; Fb: F-test according to seasons; Probab.: probability; ns: not significant.

a Undisturbed forest.
b Cocoa plantation.
c Food plantation.
d Village-adjacent forest.

### Table 5
Mean density per square kilometre of rodents found in the Bipindi area. Data obtained from 14 surveys conducted in four seasons (2003–2004) over two years.

<table>
<thead>
<tr>
<th>Species</th>
<th>Biotope</th>
<th>Und. Forest</th>
<th>Cocoa Pl.</th>
<th>Farm/Fall.</th>
<th>Vil-Adj Fo.</th>
<th>Probab.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SRs</td>
<td>SDs</td>
<td>HRs</td>
<td>LDs</td>
<td>SRs</td>
</tr>
<tr>
<td>C. emini</td>
<td></td>
<td>0.31</td>
<td>0.67</td>
<td>0.33</td>
<td>0.61</td>
<td>0.27</td>
</tr>
<tr>
<td>H. rufobrachium</td>
<td></td>
<td>0</td>
<td>0.12</td>
<td>0.14</td>
<td>0.05</td>
<td>0.11</td>
</tr>
<tr>
<td>A. africanus</td>
<td></td>
<td>3.95</td>
<td>5.62</td>
<td>11.23</td>
<td>8.34</td>
<td>1.22</td>
</tr>
<tr>
<td>T. swinderianus</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

SRs: small rainy season; SDs: short dry season; HRs: heavy rainy season; LDs: long dry season. Fa: F-test according to biotopes; Fb: F-test according to seasons; Probab.: probability; ns: not significant.
a Undisturbed forest.
b Cocoa plantation.
c Food plantation.
d Village-adjacent forest.

### 4. Discussion

#### 4.1. Dispersal and potential migration of potential host-reservoir of T. b. gambiense

Some of the species sighted in the present study are known to host *T. brucei* spp., namely the blue duiker, the black striped duiker, sitatunga (ungulates), the giant rat, the sun squirrel, the African bush-tailed porcupine (rodents), the palm civet (carnivore), the dwarf guenon, the moustached monkey and the greater white-nosed monkey (primates) (Herder et al., 2002). In general, the distribution of these species depended on their habitat requirements including food, water, resting and hiding places and their adaptability to environmental variations.

Many streams and rivers run through the study area, and around the village, making the water available. In the vicinity of farmland habitats and cocoa plantation, some streams dried up during the long dry season so that water holes were mainly localised in the undisturbed forest. During the long dry seasons, animal densities decreased in the village-adjacent forest, the farmland habitats and cocoa plantations and increased in the undisturbed forest during the same period. These water holes are also suitable habitats for tsetse flies because the offer favourable reproductive and resting conditions (Laveissière et al., 2000).
The densities of wildlife hosts of *T. b. gambiense* differed with habitat type, being higher generally in the undisturbed forest than in other biotopes, but also with seasons. The densities of these mammals were low in the dry season than in wet season. This variation was due to the availability of food and water randomly distributed during the wet season whereas in the dry seasons, the distribution was clumped around water holes and remaining forage areas. Therefore, during the dry season, the water holes constitute favourable contact zones between the vectors and hosts.

Within the group of ungulates the density of the blue duiker which was high in all biotopes during the heavy rainy season, declined significantly in the long dry season. The density of the black striped duiker declined in the undisturbed forest from the small rainy season to the short dry season, and slightly increased during the same period in the farmland habitats. Sitatunga is very well adapted to swampy areas; however, the highest densities of this species observed in cocoa plantations during the wet seasons, of which distribution among biotopes is mostly dependent on food availability (Redolfi et al., 2000).

The transmission, resurgence and perpetuation of sleeping sickness depend on many factors, some of the most important being host–vector contact, host susceptibility and trypanosome distribution in the vector population (Allsopp, 1972). Many species of wild mammals found in the Bipindi area host *T. brucei* spp. (Herder et al., 2002). According to Allsopp (1972), wild animals are able to support the infection. The period that a parasite could survive during laboratory experiments may not exist in nature (Allsopp, 1972). During the infection time, wild animals constitute a reservoir of sleeping sickness. The link is established between different host–reservoirs by the vectors (*G. palpalis* spp., *G. morsitans*) occurring from the village-adjacent forest to the undisturbed forest (Mbida Mbida, 2005). Some species such as the giant rats, the African brush-tailed porcupine, the sun squirrel, the blue duiker, sitatunga, the black striped duiker, the two-spotted palm civet, the dwarf guenon occur permanently in the suitable habitats of *C. monticola*, *C. cephus*, *M. talapoin*, *M. rburna*, and *M. t. gambiense*.

Among the rodents, the giant rat and the African brush-tailed porcupine were the most common species observed in the farmland and village-adjacent gallery forest. The densities of these rodent species were higher in the cocoa plantations where they feed on different fruits such as *Elaeis guineensis*, *Poga oleosa*, *Irvingia gabonensis*, *Musa sapientum*, *S. kamerunensis*, *C. mona*, *C. cephus*, *M. talapoin*, *M. acuminata*, and *Pogona* species. Among the rodents, the giant rat and the African brush-tailed porcupine are the most important hosts of *T. brucei* spp., and therefore the most important reservoirs of the sleeping sickness in Bipindi.

The permanent movements of wild mammals from one biotope to another according to seasons increase the contacts between the hosts and the vectors occurring in all biotopes (Mbida Mbida, 2005), and whose distribution among biotopes is mostly dependent on feeding host availability (Laveissière et al., 2000).

### 4.2. Potential role of wild mammals in the resurgence and maintenance of sleeping sickness

The transmission, resurgence and perpetuation of sleeping sickness depend on many factors, some of the most important being host–vector contact, host susceptibility and trypanosome distribution in the vector population (Allsopp, 1972). Many species of wild mammals found in the Bipindi area host *T. brucei* spp. (Herder et al., 2002). According to Allsopp (1972), wild animals are able to support the infection. The period that a parasite could survive in a host is significant and the long-lasting infections observed during laboratory experiments may not exist in nature (Allsopp, 1972). During the infection time, wild animals constitute a reservoir of sleeping sickness. The link is established between different host–reservoirs by the vectors (*G. palpalis* spp.) occurring from the village-adjacent forest to the undisturbed forest (Mbida Mbida, 2005). Some species such as the giant rats, the African brush-tailed porcupine, the sun squirrel, the black duiker, sitatunga, the black striped duiker, the two-spotted palm civet, the dwarf guenon occur permanently in the suitable habitats of *C. monticola*. This permanent presence of wild mammals in the *G. palpalis* habitat increases the contact between wild animals and the population of tsetse flies (Njokou et al., 2004) causing repeated infestation of wild animals, and therefore resulting in the maintenance of the disease.
The contact between the flies and hosts depends on various factors such as the diurnal activity behaviour of the animal species, the activity of the flies influenced by the temperature and humidity, the luminosity, the wind and rainfall. Therefore, species like the greater white-nosed monkey and the moustached monkey, occurring periodically in the suitable habitat of *G. palpalis palpalis*, could host the parasite for a period of time and favour the infestation of other mammals.

The fundamental objective of this study was to survey wild mammal species, hosts of *T. b. gambiense* and to investigate their probable role in the resurgence of sleeping sickness. Sixteen most frequently encountered species of wild mammals were surveyed in the region of Bipindi. Among them, 43.75% were reservoir hosts of *T. b. gambiense* while 31.25% of these species host *T. brucei* spp.; 12.5% were not investigated so far, while 12.5% did not host *T. brucei* spp. Therefore, wild animal species occurring in Bipindi can be classified in four groups:

1. **Wild animals** (giant rats, African brush-tailed porcupine, sun squirrel, cane rats, blue duiker, sitatunga, black striped duiker, two-spotted palm civet, dark mongoose and dwarf guenon) that occur permanently in the suitable habitat of *G. palpalis palpalis* (the village–adjacent forest, farmland habitats and cocoa plantations). They ensure frequent contact with the tsetse fly population and therefore the perenisation of sleeping sickness.

2. **Wild animals** (greater white-nosed monkey, mona monkey and moustached monkey) that occur periodically in the suitable habitat of *G. palpalis palpalis*, moving from the unsuited to suitable habitats of flies and which ensure the spread of trypanosomes among wild animals.

3. The third group includes wild animals that occur permanently in the suitable habitat (cane rats and bush pigs) of *G. palpalis palpalis* but not yet investigated. This group is more important due to the high reproduction rate of cane rats and the genetic similarities between bush pigs and domestic pigs, the preferential host of *G. palpalis palpalis*.

4. The last group consists of wild animals (*C. silvicoltor*, *V. civetta*) not hosting *T. brucei* spp.

This study shows that some animals come very close to human settlements to look for food and shelter. These animals interfere in the domestic transmission cycle of trypanosomiasis (human/tsetse flies/domestic mammals).

**Acknowledgements**

We thank the General Secretariat of OCEAC for permission to conduct this research within OCEAC study sites and to use OCEAC technicians and offices; especially Dr. Bilongo Manene (the formal secretary general of OCEAC). We thank the Research Institute for Development (IRD) that provided direct funding and indirect funding through “Jeune Equipe Associée” to support the fieldwork and a research allowance to Massussi J.A. for the rest of the material. We finally thank the population of Bipindi for their participation, contribution to this study and their hospitality.

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