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Full Length Research Paper

Tsetse fly species diversity in Kainji Lake National Park, Nigeria

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A survey of tsetse flies was carried out at the two sectors of Kainji Lake National Park. Gouteax fly traps, the drum shaped and biconical-shaped, were used. The traps were set adjacently at the same location. Four traps were set in each vegetation zone. At Borgu Sector, 20 traps were set, while 24 were set at Zurguma sector. Cattle and Pig urine (Mixture) were used as attractant. The traps were set in the mornings and harvested in the evenings. Harvests were reserved in 4% formalin and identified later in the laboratory under microscope. Three species of tsetse flies were identified. These include; Glosina *morsitans, Glosina palpalis and Glosina tachnoides*. They belong to the family Glosidae, the class insecta (hexapoda) and order Diptera and genus Glosina. *G. morsitans* were found all over the wooded vegetation zones while *G. palpalis* and *G. tachnoides* were restricted to the Oli complex and the riverine vegetation zones at Borgu sector. At Zugurma sector; *G. tachnoides* was restricted to the riverine forests of River Nuwanzurugi. The reason for these findings is that morsitans group mostly live in open savanna while *G. palpalis* and *G. tachnoides* inhabit the riverine area. The two types of traps were equally efficient in catching the three species of flies (P≤0.05) using one tailed t-test.

Key words: Tsetseflies, tsetse traps, attractant, *G. morsitans, G. palpalis, G. tachnoides*.

INTRODUCTION

The world all over has throughout ages mostly used wild animals for food, health protection, and their physical well being, especially in African societies (Afolayan, 1987; Ajayi, 1986). In many developing countries animal protein production from domestic livestock is insufficient to meet the demand of the growing population (Asibey, 1974; Alonge, 1999). Often associated with bush meat is the trade in animals' skins, hides, and trophies. This trade has become very lucrative to the point of creating new activities which can be fulltime for those involved (Ndiaye, 1999; Owusu – Nsiah, 1999).

However, it has been reported that some species of tsetse fly have been associated with the presence of certain species of wildlife. Davies (1977) observed that the important wildlife hosts for most Nigerian tsetse are Bush buck (*Tragelaphus scriptus*), Warthog (*Pharcochoerus aethiopicus*) and Red River Hog (*Potamocherus porcus*) with reptiles most important for riverine tsetse. While some wild animals such as Zebra (*Equus* spp.), Wilderbeast (*Connochaetes taurinus*), Duiker (*Cephalophus rufilatus*) and Waterbuck (*Kobus defassa*) are rarely fed upon by tsetse flies.

Tsetse flies are important because they transmit Nagana between the domestic animals and sleeping sickness between humans. The most important vector of bovine trypanosomiasis is the *Glossina morsitans* group. It transmits *Trypanosoma vivax*, *Englerophytum congo-lense, Trypanosomes brucei,* which cause Nagana, *Trypanosomes brucei gambiense* and *Trypanosomes brucei rhodesiense*, which causes sleeping sickness, are mostly transmitted by flies of G. palpalis group, but also by the *Glossina fusca* group (Seifert, 1996; Davies, 1977).

Kainji Lake National Park (Figure 1) was established by Decree 46 of 1979 (Marguba, 2002). The Park is located in the tsetse belt and hence the occurrence of tsetse flies is not a misnormal (Figure 2).

The two traps that have been used and described for catching these flies are the Gouteax traps, which one of two types, the biconical-shaped and the drum-shaped (Davies, 1977; Seifert, 1996). However, the previous workers and authors did not discuss the efficiency of the two traps in the catching of the different species of tsetse fly. The objectives of this study include;

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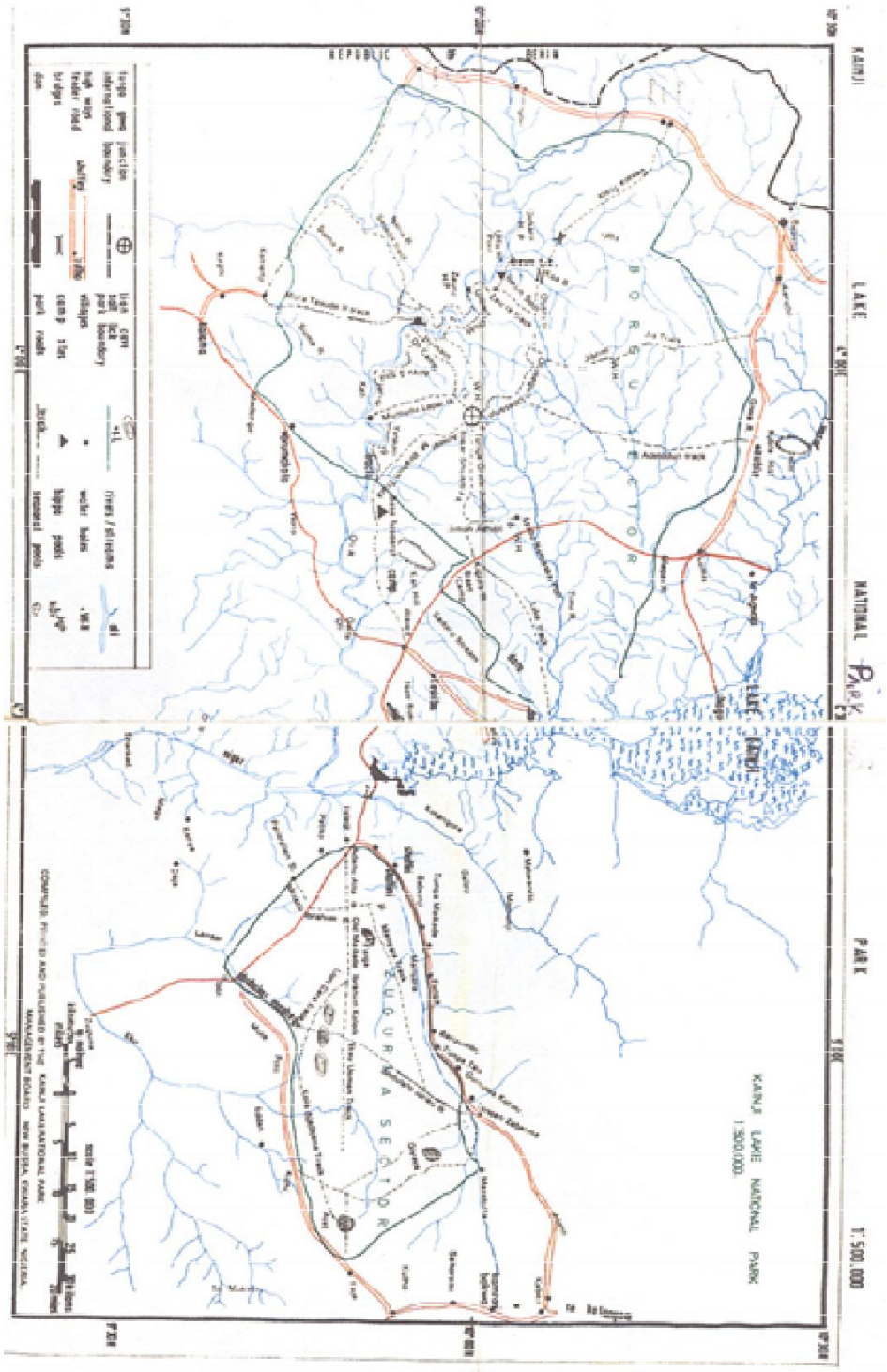

Figure 1. Map of Kainji Lake National Park. Source: Kainji Lake National Park Management Plan (2006).

i). To confirm the occurrence of tsetse flies and identify the particular species.
(ii) To compare the efficiency of the traps.
(iii) To determine the species vegetation preference.
The knowledge will be useful to the wildlife ecologists and epidemiologists that are concerned with the control and prevention of outbreak of diseases among the wildlife species, the public that visit the park as tourists and the domestic animals that are illegally grazing in the park and also for control of disease.

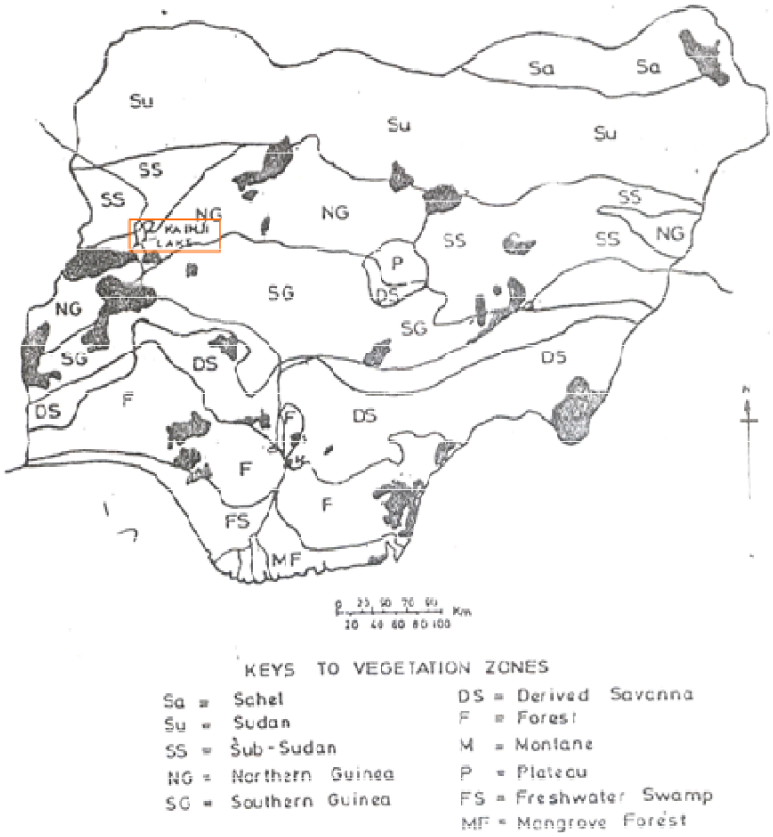

Figure 2. Map of Nigeria showing the approximate location of Kainji Lake National Park and game reserves in relation to the vegetation zones in Nigeria. Source: Kainji Lake National Park Management Plan (2006).

METHODS

Tsetse flies have light sensory and smelling organs, which assist them to recognize their hosts from distance. They have a special preference for dark and blue objects. This knowledge has been used for the designing and construction of their traps.

The flies traps are usually referred to as Gouteux traps and were described by Seifert (1996) . The construction is also based on the knowledge that tsetse flies are attracted by the contrast between light and shade and seek shade and dark spots. The traps have two parts. The undersides are made of blue cloths with the inner lined with dark cloths. The upper side is made of white synthetic nylon material with an open pointed end where a net is attached for harvesting.

Two types of tsetse traps were constructed. One is of the shape of the pyramid or double pyramid while the other is of a drum shape (Figure 3). The flies are attracted to the traps by the blue colour of the under-side of the traps and the attractant. The attractant is made of cattle and pig urine (mixture) . They enter through the openings on the blue cloths into the dark region created by the dark cloths. As the flies are trying to get back to light at the upper sides of the traps, they will be trapped at the top pointed end by the net and be harvested.

Study area: The study area is Kainji Lake National Park, Nigeria. The Park covers an area of 5830 km^2 (Figure 2).

Identification: Glossines are yellow brownish insects. The position of their wings while resting is characteristics: one covers the other like a pair of scissors. The typical proboscis with lateral palpae protrudes over the head looking like protruding tongue. The different species can be recognized by their leg markings, size and shape of their abdominal segments. (Appendixes I and II) (Seifert, 1996; Davies, 1977).

Statistical analysis: One-tailed t-test was used to compare the mean catches of the two types of traps, the biconical-shaped and the drum shaped.

RESULTS

Table 1 shows the Tsetse fly catches in the different vegetations in the two sectors of the Park. Results show that G. morsitans were caught by the two traps all over the Wooded savanna, vegetation which include *Diospyrus mespliformis* forest, Isoberlinia woodland and Burkea/Detarium woodland. *Glossina palpalis* and *Glossina tachnoides* were caught respectively both in the Riparian and Oli complex at Borgu sector. At Zugurma sector only *G. tachnoides* (163) were caught in the Riparian vegetation. At Borgu sector *G. morsitans* were caught in the Burkea/Detarioum woodland, 80 were caught, while 68 and 50 were caught in iroberlinia woodland and *Diospyrus mespliformis* forest respectively.

Table 1. Tsetse fly catches in the different vegetations in Kainji Lake National Park**.**

	Borgu Sector		
S/N	**Vegetation Type**	**Species of Tsetse Fly**	**Total Catches**
1.	Diospyrus mesplifornis Forest	*G. morsitans*	50
2.	Isoberlinia Woodland	*G. morsitans*	68
3.	Riparian forest	*G. tachnoides*	78
		G. Palpalis	80
4.	Bunkea/Detanium woodland	*G. morsitans*	80
5.	Oli complex	*G. tachnoides*	92
		G. palpalis	126
	ZUGURMA SECTOR		
1.	Terminalia/monotes	-	
2.	Ptericarpus/Detarium woodland	-	
3.	Isober linia woodland	-	
4.	Afzelia/Danielia woodland	-	
5.	Acacia Savanna woodland	-	
6.	Riparian forests	*G. tachnoides.*	

Table 2. Summary of tsetse-fly catches by the traps in Borgu sector of Kainji Lake National Park

Species	***Glossina morsitans***			***Glossina palpalis***			***Glossina tachnoides***		
Trap	**Biconical shaped**	**Drum shaped**	**Total**	**Biconical shaped**	**Drum shaped**	**Total**	**Biconical shaped**	**Drum shaped**	**Total**
1st-31st July	28	20	48	26	18	44	24	21	45
1st-31st Aug	50	54	104	60	64	124	45	40	85
1st-8th Sept.	24	22	46	27	21	48	18	22	40
TOTAL	102	96	198	113	103	216	87	83	170

Table 3. Summary of tsetse-fly catches by the traps in Zugurma sector of Kainji Lake National Park.

Species	***Glossina morsitans***			***Glossina palpalis***			***Glossina tachnoides***		
Type of trap	**Biconical shaped**	**Drum shaped**	**Total**	**Biconical shaped**	**Drum shaped**	**Total**	**Biconical shaped**	**Drum shaped**	**Total**
1st-31st July	…	…	…	…	…	…	18	26	44
1st-31st Aug	…	…	…	…	…	…	41	27	68
1st-8th Sept.	…	…	…	…	…	…	26	25	51
TOTAL	…	…	…	…	…	…	85	78	163

It appears as if the number of catches in each vegetation is affected by the level of the opening or denseness. Higher catches of G. palpalis were recorded in the Oli complex than in the Ripanrian vegetation. The Oli complex is closer to the river and this support the observation that these species of tsetse fly are lovers of riverine vegetation (Davies 1977).

Tables 2 and 3 show the summary of catches by the two traps in the different vegetations and for the three months. For the three months a total of 198 *G. monsitans* were caught by the two traps at Borgu sector. The biconical – shaped caught 102, while the drum – shaped caught 96. The total catches of *G. palpalis* was 216. The biconical scaped caught 113 while the Drum – shaped caught 103. The total catches of *G. tachnoides* was 170. The biconical – sloyed caught 87 while the Drum – shaped caught 83. At Zugurma sector, a total of 326 G. tachnoides were caught. The Biconical shaped traps caught 170, while the drum-shaped traps caught 156. Other species were not found in all the vegetations in this sector.

Although, the biconical shaped traps recorded higher catches of the tsetse fly in each of the vegetations, statistical analysis shows that there were no significant differ-

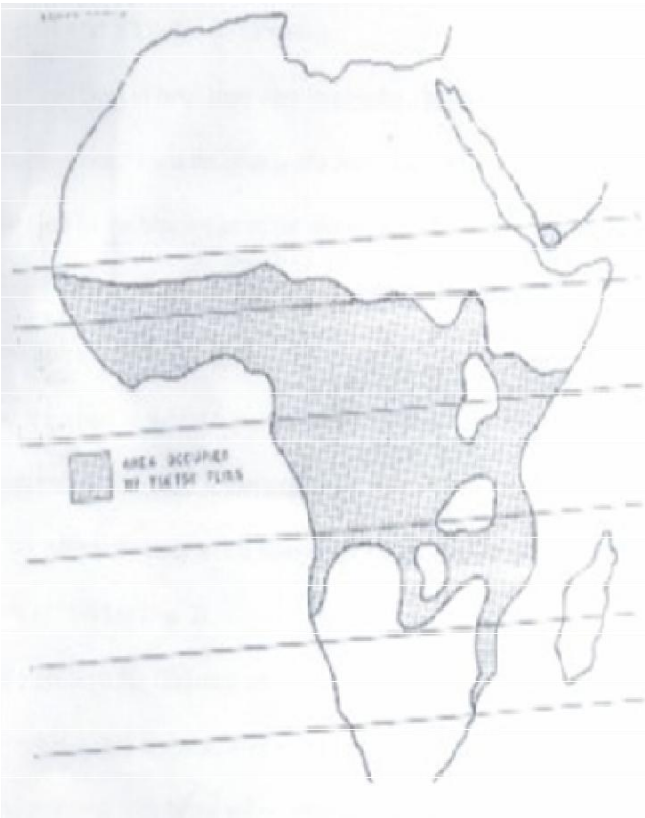

Figure 1. Distribution of tsetse flies in Africa. Source: Davies 1977.

Figure 4. Drum-shaped and biconical-shaped traps for tsetse flies (Seifert, 1996).

rences between the mean catches of the two traps using one-tailed t-test for the three species and the different vegetation zones ($P \leq 0.05$).

DISCUSSION

Tsetse flies belong to the family Glosidae, the class Insecta, the order Diptera and genus Glossina. The family is divided into 22 species and 33 sub-species. They can be summarized into 3 groups; *G. mortisan* group, the palpalis and the fusca group. The larger species are of G. morsitans and mostly live within the open savanna. The palpalis group is limited to living along the rivers or riverine areas. The third group *Glossina fusca* inhabit tropical forest (Seifert, 1996).

Tsetse flies are found only in Africa, south of Sahara and north of Republic of South Africa (Figure 1) although there were flies in the north east corner of the Republic until they were eradicated. Tsetse also live in North America millions of years ago and southern Arabian to 70 years ago, but there are none there now (Davies, 1977). Glosines are not distributed evenly since there are also areas which do not have an environment which is suitable for their physiological requirement within the tsetse belt.

Optimum temperatures are between 20 and 28^{O}C with relative humidity between 50 and 80% and an annual rainfall of between 635 and 1524 mm, (Seifert, 1996). The lower limits is 16 – 18^{O}C, because at lower temperatures the fat reserved are used up; at higher temperature they metabolized too quickly.

Habitats of *G. morsitans* were spread all over the wooded vegetation zones, while G. tachnoides and *G. palpalis* have been restricted to the River Oli complex and Riparian vegetation at Borgu Sector. At the Zugurma Sector, G. tachnoides is restricted to the riverine forest of river Nuwanzurugi. This finding is in line with the report of the Nigerian Institute for Trypanosomiasis Research (1999) . Seifert (1996) reported that each species restricted to a specific ecology. Temperature and humidity as well as vegetation are limited factors, which are especially important for the pupa period of the vector. Also the size of area of distribution (Figure 4) of the fly population depend on the season of the year. During the late dry season when most part of savanna are defoliated and the climatic factors are drastically altered, the Glossines retreat into the area which do provide the shade during the season, and guarantee the environment required.

Although, no dissection was carried out, the probability for some of the tsetse being infected cannot be ruled out. Davies (1977) reported that the rate of infection of G. morsitans is 20%, while that of G. palpalis is 5% and G. Tachnoides 6%. Since these infections are very harmful to livestock, with these rate of infections, it is advisable that livestock (Cattle, Sheep and Goat) be kept away from the Park. Pastoralists that are keeping or grazing their animals in the Park are at high risk of their cattle contacting and dying of trypanosomiasis.

As regards the efficiency of the two types of the traps the total catches of each specie by bi-conical traps were higher than those of the drum-shaped traps. However statistical analysis shows that there was no significant dif-

difference between the mean catches of the two types of traps ($P \leq 0.05$) in all the vegetations where these species occurred.

Conclusion

The presence of G. palpalis and G. tachnoides should be of concern to the Management of the Park as it provides the risk of tourists and workers contacting sleeping sickness since these two species can transmit human trypanosome *T. gambiense* (Davies, 1977; Seifert, 1996). The presence of *G. morsitans* also implies that the domestic animals that are grazing illegally in the Park can contact the diseases trypanosomiasis (Institute for Tripanosomiasis Research, 1999).

Recommendation

There is need to control and prevent the spread of the flies in the Park for the safety of the Park workers, tourist and the domestic animals that graze the Park illegally. As a result, biological control is highly recommended for the tsetse flies since the habitats cannot be destroyed that is, a protected area.

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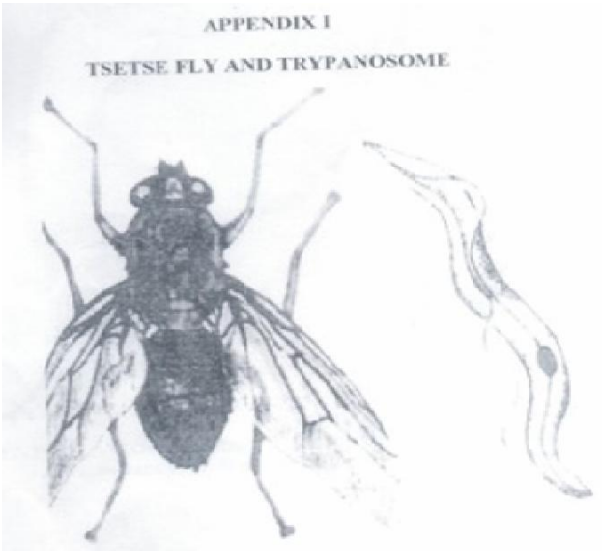
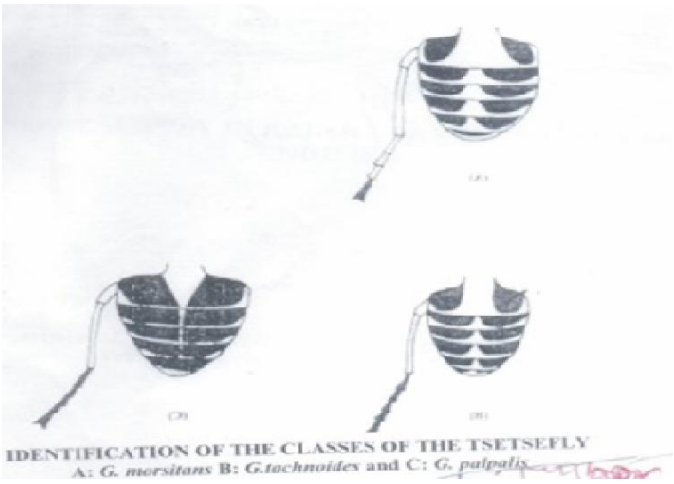
APPENDIX 1.



Appendix 1. Source:Davies (1977)



Appendix 2. Tsetse Fly Identification (A) G Morsitant (B) G. Tachinoides (C) G. Palpalis Source: Davies (1977).
Distinguishing Features:
a). *G. morsitans* – Black Socks
b).Gitachnoides – Black Stockings
c). *G. palpalis* – A grey or yellow patch in the form of triangle is present on the middle of the dorsal surface of the first (large) abdominal segment.