

DETERMINATION OF SEX AND SPECIES COMPOSITION OF TSETSE FLIES FROM SELECTED COMMUNITIES OF KAGARKO L.G.A. KADUNA STATE

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ABSTRACT

Tsetse flies are the exclusive biological vectors of African trypanosomes in Africa, which are estimated to cover about 80% of the country's total area, hindering rearing of livestock and creating health risk to humans as well. This study was performed to determine the sex and species composition of tsetse flies from selected communities of Kagarko Local Government Area, Kaduna State, Nigeria. Sampling of flies was done using standard biconical traps according to the method of Challier and Larvessiere and were sorted into sex and species using morphological distinctions as described by Leak. The study was carried out for four (4) months, during which forty seven (47) tsetse flies were caught, 16 (34.04%) were male and 31(65.96%) were female and all forty seven (47) flies were members of the *Glossina palpalis palpalis*. The abundance of more female flies supports the fact that they live longer, go out more frequently in search of blood meal due to reproductive requirements and the presence of only *Glossina palpalis palpalis* implies that it is the dominant species, hence, transmission of trypanosomiasis as *Glossina palpalis palpalis* are the major vectors of trypanosomiasis in Nigeria.

Keywords: Tsetse flies; *Glossina palpalis palpalis*; Sex; Species; Trypanosomiasis; Kagarko L.G.A. Kaduna State.

INTRODUCTION

Tsetse flies are the exclusive biological vectors of African trypanosomes in Africa (Ngonyoka *et al.*, 2017) which are estimated to cover about 80% of the country's total area, hindering rearing of livestock and creating health risk to humans as well (Isaac *et al.*, 2016). Tsetse flies are unique among insects in that they reproduce through adenotrophic viviparity (Attardo, 2006; Attardo, 2014) and are important due to the part they play in transmission of trypanosomiasis caused by protozoan parasites, *Trypanosoma spp* (Musa *et al.*, 2019) that kills humans as well as animals (Muhanguzi *et al.*, 2015). Other effects of tsetse flies on humans include increased mal-nutrition to the immediate community and state at large due to shortage of meat, milk and related products (Odeniran *et al.*, 2018). Tsetse flies are also responsible for the death of over three (3) million cattle per year and 1.5 million daily adjusted life years (FAO, 2008; WHO, 2011). Seventy (70) million people and about fifty (50) million cattle are infected thus slowing down agricultural based activities (Maikaje *et al.*, 2009) leading to hunger and poverty in infected areas (Maikaje *et al.*, 1991; Maikaje, 2002). Nigeria has 19.5 million cattle, 725 million goats, 41.3 million sheep, 7.1 million pigs, 28,000 camels

and 974, 499 donkeys (National Agriculture Sample Survey, Nigeria, 2010) with a reasonable number of all these animals at risk because of their presence in tsetse and trypanosomiasis endemic areas (WHO, 2010). In Sub – Sahara Africa, twenty-three (23) species of the vector are found that solely satisfy their nutritional need on blood (Junquera, 2014) sucked from various wild animals from which they acquire and transmit the African trypanosomes to both domestic animals and humans (Bakele and Desta, 2019). These species of tsetse flies are dispersed around thirty-six (36) African countries, covering about ten million (10m) Km² of land (Odeniran *et al.*, 2018) which includes; Angola, Uganda, Democratic republic of Congo (DRC), Cote d'Voire, Central African Republic, Tanzania, Mali, Zambia, Kenya, Gabon and Nigeria among others (WHO, 2020). The tsetse infestation in Nigeria has moved to re-attack areas such as Plateau, Obudu, Mambilla and Kano that were previously thought to be free of tsetse fly (Fajinmi *et al.*, 2011; Majekodunmi *et al.*, 2013) with eleven species found all over the country (Dede *et al.*, 2005; Dede *et al.*, 2013). In Kaduna state, species of tsetse found include; *G. p. p Robineudesnoidy* 1830 (Ahmed, 2007), *G. palpalis* and *G. tachnoides* (Okoh *et al.*, 2012) and (Dadah *et al.*, 2017) *G. palpalis* (Abudllahi *et al.*, 2017; Dauda *et al.*, 2017). Both tsetse and the disease it causes are regarded as a hitch to the ongoing poverty eradication in Africa (WHO, 2014).

This study was performed to determine the sex and species composition of tsetse flies from selected communities of Kagarko Local Government Area, Kaduna State, Nigeria.

MATERIALS AND METHODS

Study Area

The study was conducted in Kagarko Local Government Area of Kaduna State, with a tropical dry and- wet type of climate (Abaje and Giwa, 2010), wet season lasting from April through mid-October with the highest in August, while the dry season covers from mid-October of one year to April of the next year (Abaje *et al.*, 2010; Abaje *et al.*, 2016) and the following co-ordinates 9°27'0" North, 7°41'0"East which has an area of 1,864 km² and a population of 240,943 (Anon, 2006). Residents are engaged in farming and rearing of livestock, with the presence of Koro, Fulani and Gbagyi among other tribes. Selection of the study area was as a result of trypanosomiasis outbreak in some part of the area (Machina *et al.*, 2017).

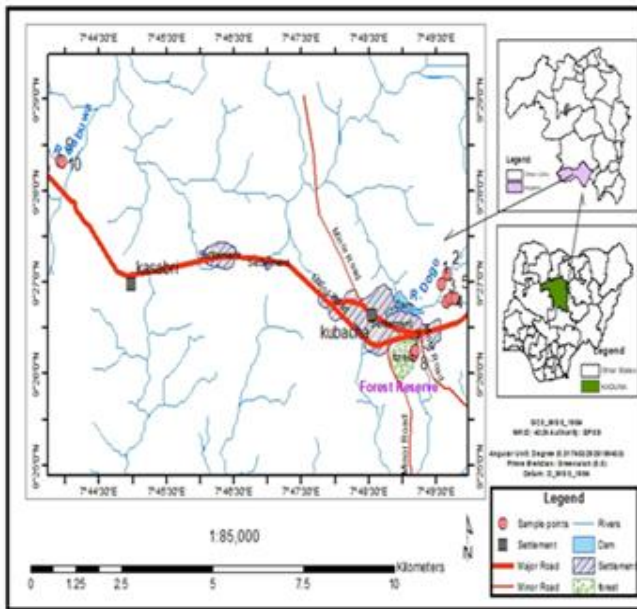


Figure 1. Map of Kagarko LGA displaying the sampling locations. Source: Google Earth

Trapping of Tsetse Flies

Tsetse flies were captured by the use of trapping technique (Challier and Laveissiere, 1973) cited by (Weber *et al.*, 2019) and was done for four (4) months. Ten (10) standard biconical traps were set 100m apart across the three (3) sampling sites (River Dogo, Kubacha Forest Reserve and River Babuwa) along grazing passages of animals and river paths where animals pause to drink water. Traps were baited with cow urine and acetone (Esterhuizen, 2007) to improve fly catch, metal poles were greased with oil to stop insects from bugging the traps, location of each trap was recorded using a GPS (Etrex 10 Garmin) and traps were allowed to stay at sampling sites for a day before harvesting.

Determination of Sex and Species

The sex and species of trapped flies were determined by observation of morphological distinctions with the aid of identification kit described by (Leak *et al.*, 2008) as reported by (Wama *et al.*, 2018).

Distinguishing features were looked for on the mouth parts (Proboscis), wings, antenna and eyes with the aid of a hand lens and forceps for tsetse identification. Thus the sharp pointing proboscis consisting of (3) parts (The upper lip/Labium, hypopharynx and the lower lip/labrum) all encompassed by a couple of maxillar palps, folding of wings one over another in resting position like a pair of scissors, presence of a hatchet shaped cell in the venation of the wings, feathered arista with hairs on the third (3rd) part of the antenna and possession of a pair of compound eyes that are distantly apart separated by frons were looked for.

Differentiation based on species was done by observing the sizes, colours found on tsetse abdomen and nature of clasper found on male genital armature. The *morsitans* are of 7.5 – 11mm in size usually having dark spots on a yellow background as colour of abdomen and the male has on its genital armature, a convergent claspers having attached membrane and last two (2) section of the back tarsi are darker than the front section, the *Palpalis* are of 6.5

– 11mm in size with the abdomen been evenly brown or grey with some dark spots with a more advanced and divergent armature claspers on the male genital and the tarsi of the back leg are evenly dark and the *Fusca* are about 10.5 to 15.5mm in size, generally having a dark abdomen with an even colour, possessing a divergent clasper on the male genital armature, but differ from the *palpalis* by having a free clasper not linked by an intercalated membrane and the back tarsi having two (2) last section or all of its section dark coloured.

Male flies were differentiated from the female on the basis of their abdomen, the male fly possesses on its abdomen the hypogoeum which is missing on the abdomen of a female tsetse.

RESULTS

During the study, a total number of forty seven (47) *Glossina spp* were collected at the sampling sites over a number of five (5) visits, thirteen (13) of the flies were captured during the first visit, 16 during the second, 11 in the fourth, 7 during the fifth and no tsetse was captured during the third visit as the traps were unmounted, destroyed and some stolen, other problems encountered were those of security challenges and inaccessibility to some roads. Sixteen out of the forty-seven captured flies were male 16(34.04%), while thirty-one were females 31(65.96%) with a mean number of 4.0 ± 0.82 and 8.25 ± 0.75 for male and female respectively as depicted in table (1.) below. The results of a student t test showed that mean number of catches of female tsetse flies was significantly higher ($t(6) = 3.83, P = 0.0083$) than the mean number of male tsetse captured.

Table 1. Abundance of tsetse flies in relation to sex, captured from selected communities of Kagarko L.G.A. Kaduna State

| Number of visits | Sex of flies captured | | Total |
|------------------|-----------------------|------------|------------|
| | Male | Female | |
| 1 | 4(30.77%) | 9(69.23%) | 13(27.66%) |
| 2 | 6(37.50%) | 10(62.50%) | 16(34.04%) |
| 3 | - | - | - |
| 4 | 4(36.36%) | 7(63.63%) | 11(23.40%) |
| 5 | 2(28.57%) | 5(71.43%) | 7(14.89%) |
| Total | 16(34.04%) | 31(65.96%) | 47 |

Over a number of five visits, the first having 13 flies captured, 16 during the second, with 11 and 7 for the fourth and fifth visits respectively, and all forty seven (47) flies captured were members of the *Glossina palpalis palpalis* as shown in table (2.0) below.

Table 2. Abundance of tsetse flies in relation to species, captured from selected communities of Kagarko L.G.A. Kaduna State

| Number of visits | Number of flies captured | Species of flies found |
|------------------|--------------------------|-----------------------------------|
| 1 | 13(27.66%) | <i>Glossina palpalis palpalis</i> |
| 2 | 16(34.04%) | <i>Glossina palpalis palpalis</i> |
| 3 | - | - |
| 4 | 11(23.40%) | <i>Glossina palpalis palpalis</i> |
| 5 | 7(14.89%) | <i>Glossina palpalis palpalis</i> |
| Total | 47 | <i>Glossina palpalis palpalis</i> |

DISCUSSION

A total number of (47) tsetse flies were obtained, with the ratio of the female flies being higher than that of the male. This is due to the variations in their life span, the female tsetse survives up to a period of (2-3) months compared to the male flies Attardo *et al.* (2010). Secondly, tsetse flies are unique among insects in that they reproduce through adenotrophic viviparity (Attardo, 2006; Attardo, 2014). The intra uterine retention of the egg that is nourished by the female requires it to feed more, therefore moves frequently to locate hosts causing their abundance more than the male tsetse. This study corresponds to the researches carried out in Rwanda, Uganda and Kaduna State by (Gashururu *et al.*, 2021, Egeru *et al.*, 2020 and Abdullahi *et al.*, 2017). It also concurs with the findings of (Dadah *et al.*, 2017, and Manun, 2016) in studies conducted in Kaduna State and Scotland respectively. On the other hand, the result of this study disagrees with the work of (Samuel *et al.*, 2019 and Olaniyan, 2016) who had higher ratio of male tsetse flies.

Glossina palpalis palpalis were the only species of tsetse flies captured from Kagarko L.G.A. of Kaduna State. The nature of the traps location is partly responsible for such result; traps were mounted close to rivers which is the habitat of choice for members of this group. Also, their ability to bear and acclimate to anthropogenic activities Bouyer *et al.* (2010), have also contributed to having only their presence in this study. This agree with the results of (Musa *et al.*, 2019, Dauda *et al.*, 2017, Ajunwa *et al.*, 2017 and Onyekwelu *et al.*, 2017) who carried out their studies in Kaduna state, FCT Abuja and Delta state Nigeria.

Conclusions

The abundance of more female flies supports the fact that they live longer, go out more frequently in search of blood meal due to reproductive requirements and the presence of only *Glossina palpalis palpalis* in the study area implies that it is the dominant species, hence, transmission of trypanosomiasis as *palpalis* are the major vectors of trypanosomiasis in Nigeria.

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