Seasonal Differences in the Abundance of Tsetse Flies (*Glossina Species*) in Pantaki, Kaduna State

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Abstract

Seasonal-differences in the abundance of tsetse flies in Pantaki was investigated between July and August, 2016 and January and February, 2017 in Kagarko. Standard bioconical trapping method was used to collect the insects. A total of 208 tsetse flies were caught of which 139 (66.8%) were *Glossina palpalis palpalis* while 69 (33.2%) were *Glossina tachinoides* revealing an overall apparent density of 3.7T/T/D. The results indicate a significant difference ($p < 0.05$) in abundance of tsetse flies in the wet compared to the dry seasons. Also, both species were relatively more abundant during wet (*G. palpalis palpalis* 75.5%, *G. tachinoides* 84.1%) than dry (*G. palpalis palpalis* 24%, *G. tachinoides* 15.9%) seasons. The differences in abundance observed could be due to the favourable climatic condition. This call for deployment of tsetse fly control measures (during the wet season) in the area.

Keywords: *G. palpalis palpalis*, *G. tachinoides*, Season, Biconical Traps, Trypanosomiasis.

INTRODUCTION

Tsetse flies (*Glossina spp.*) are the primary vector of animal and human trypanosomiasis in tropical Africa; and are a continuing threat to public health, livestock production and agricultural development in which tsetse fly infestation constitute a major source of

economic loss (Desta *et al.*, 2013). Eleven of the twenty-three known species of tsetse flies are found in Nigeria (Solano *et al.*, 2010) infesting approximately 74% (686,488 km²) of the country's landmass from Latitude 4°N to Latitude 12°N covering all the agro-ecological zones of the country (Jawonisi, 1988). Transmission of trypanosomes occurs largely among rural populations where activities such as agriculture and fishing

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expose people to the bite of tsetse fly (Muturi *et al.*, 2011; Okoh *et al.*, 2012).

Trypanosomiasis is a major constraint for ruminant production in Africa, Asia and South America (Gutierrez *et al.*, 2006; Taylor *et al.*, 2008; Fernandez *et al.*, 2009). Outbreak of the disease has been reported in some Northern and Southern parts of Kaduna State (Maikaje *et al.*, 1991; Ahmed, 2007; Fajinmi *et al.*, 2007; Okoh *et al.*, 2012) resulting in constraint to livestock production. Although, studies have been carried out in many areas especially in the North and Central part of Nigeria (Onyiah *et al.*, 1983; Isaac *et al.*, 2016), adequate information on the true prevalence of the disease and density of fly population in these areas is still scanty to enable proper disease surveillance. These among other factors have prevented effective control of the disease (Kalu *et al.*, 2001; Samdi *et al.*, 2008; 2010; 2011). Although, there are reports of African Animal Trypanosomiasis prevalence however, those on tsetse infestation are old. This study assesses current infestation levels of

Glossina species in order to consolidate Tsetse and Trypanosomiasis control programmes in the area.

MATERIALS AND METHODS:

Study Area

Kagarko Local Government Area is geographically within Latitude $9^{\circ} 30'N$ and Longitude $7^{\circ} 43'E$ covering an area of 1,864 km² with a human a population of 240,943 (NPC, 2006). It is located in the Northern Guinea Savannah characterized by woodland vegetation. The area has distinct wet and dry seasons from May to October and November to April, respectively. The mean annual rainfall is reported to be 1536 mm with an average of 28.6 °C | 83.5 °F, April is the warmest month at 23.3 °C | 73.9 °F on average, August is the coldest month of the year (climate-data.org). Human activities in the area include: herding of cattle and crop farming with breeding of sheep, goat and chicken.

Map of Kagarko with sampling sites in the Pantaki Area

Tsetse Survey

Tsetse flies were trapped for a period of two months during dry and rainy season using biconical traps (Okoh *et al.*, 2012). Trapping of flies was carried out between the months of July and August, 2016 and January to February, 2017 for the rainy and dry seasons, respectively. For each month, seven traps were deployed and set at intervals of 100m in suitable tsetse habitats. The temperature and relative humidity of each trapping point was recorded using a whirling hygrometer (Dede *et al.*, 2005). Flies caught were harvested, counted, sexed and identified to specie level according to the markings on the abdomen, hind leg and colour of the thecal bulb of the proboscis (Davies, 1977). For *Glossina palpalis* species, the thecal bulb is dark brown, all tarsal segments of the hind leg are black and the first segment of the abdomen is square shaped while in *Glossina tachinoides* first segment of the abdomen is triangular.

Apparent Density Determination

The apparent density of fly was determined by dividing the total number of flies caught by the product obtained from the multiplication of the number of traps used by the trapping days. (Okoh *et al.*, 2012).

Seasonal trapping rate of tsetse flies was calculated as the number of tsetse flies caught per season divided by the product of the number of traps deployed and the number of days multiplied by 100 (Molaleane *et al.*, 2011).

$$\text{Seasonal trapping (\%)} = \frac{\text{No. of flies caught per season}}{\text{Number of traps} \times \text{number of days}} \times 100$$

The data was calculated using analysis of variance (ANOVA).

RESULTS

Distribution of Tsetse Flies in Pantaki

Two hundred and eight (208) tsetse flies were collected during the period of study. Of these, One hundred and thirty nine (66.8%) were morphologically identified as *Glossina palpalis* while the remaining sixty nine (33.2%) were *Glossina tachinoides*. Student t-test analysis shows a significant ($P < 0.001$) difference in the distribution of the two species in Pantaki area during the study period (Table 1).

Seasonal Abundance of Tsetse Flies

A total of one hundred and sixty three (163) glossina species were caught during the rainy months while forty five (45) tsetse flies were caught in the dry season months. These correspond to 78.4% and 21.6% of the total tsetse flies caught for wet and dry season months respectively, and also 66.8% *G. palpalis* and 33.2% *G. tachinoides*. The seasonal trapping rates for the wet and dry seasons were 11.6 and 3.2 tsetse flies/trap/day respectively. Data analysis shows a significant ($P < 0.001$) variation in tsetse fly abundance between the 2 seasons (Table 2).

Relative Seasonal Abundance of Glossina species

The relative seasonal abundance of the two *Glossina* species identified in Pantaki is presented in Table 3. Both *G. palpalis* and *G. tachinoides* were relatively more abundant during wet season (*G. palpalis*: 75.5%; *G. tachinoides*: 84.1%; than during the dry season (*G. palpalis*: Dry 24.5%; *G. tachinoides*: Dry 15.9%).

Table 1: Diversity of Tsetse Flies Species caught in the Pantaki Area of Kagarko

Tsetse species	No. collected	Relative proportion (%)	<i>p</i> value
<i>G. palpalis</i>	139	66.8	0.001
<i>G. tachinoides</i>	69	33.2	
Total	208	100.0	

Table 2: Seasonal variation of Tsetse Flies

Seasons	No. collected	Trapping rate F/T/D	Relative proportion (%)	<i>p</i> value (χ^2)
Wet	163	11.6	78.4	< 0.001
Dry	45	3.2	21.6	
Total	208	3.7	100.0	

F/T/D: Flies per trap per day.

Table 3: Relative Seasonal Abundance of Glossina species

Species of flies	Seasons		Relative seasonal proportion (%)		Total and Relative proportion (%)
	Dry	Wet	Dry	Wet	
<i>G. palpalis</i>	34	105	24.5	75.5	139(66.8)
<i>G. tachinoides</i>	11	58	15.9	84.1	69(33.2)
Total	45(21.6)	163(78.4)			208(100.0)

Relative Abundance of Tsetse Flies in relation to temperature and relative humidity

The mean seasonal temperature values recorded were 28.0°C (dry season) and 25.8°C (rainy season), with mean seasonal relative humidity values of 33.5% (dry season) and 59.8% (rainy season) respectively. There was a significant variation ($p \leq 0.05$) in the mean relative humidity over the two seasons.

Scatter plots of the number of tsetse flies caught per day and the daily variation in

temperature and relative humidity indicated a positive relationship between relative humidity and the number of tsetse flies abundance. A significantly ($p \leq 0.05$) strong positive correlation was also found between relative humidity. However, scatter plot of temperature and number of trapped tsetse flies showed that temperature inversely varies with tsetse fly abundance. Furthermore, a significantly ($p \leq 0.05$) negative correlation was found between temperature and abundance of the flies.

The Temperature and Relative Humidity of Tsetse Flies at Pantaki in dry and rainy season

A scatter plot of the relative humidity and number of tsetse flies caught between July and August, 2016 and January and February, 2017

A scatter plot of the temperature and number of tsetse flies caught during the sampling period

DISCUSSION

Glossina tachinoides and *G. p. palpalis*, the two species of tsetse fly found in Pantaki have earlier been reported by Okoh *et al.* (2012) in Kamuku Park of Birnin Gwari; Ahmad (2005; 2007) in Kaura Local Government Area of Kaduna State; and Kalu (1991) in Barkin-Ladi Local Government Area of Jos Plateau. The two species have been reported to coexist in many areas (FAO, 1996). Vegetation types, climate, altitude and presence of suitable animal host determine the distribution and abundance of tsetse flies (Stephen, 1999). The observed differences in abundance of *Glossina tachinoides* and *G. p. palpalis* in Pantaki, the study area; could be due to differences in microhabitat and host preference of the two species. *Glossina tachinoides* although, typically a riverine species, were found in the area due to the presence of savannah woodlands in the area.

The higher number of *G. p. palpalis* to *G. tachinoides* in the area could be due to reduced vegetation and dried streams which destroy the habitat of *G. tachinoides* resulting in reduced fly abundance according to FAO, 1996, although Davies, 1997 reported that *G. tachinoides* displays strong adaptation to peridomestic habitat. The presence of *G. tachinoides* and *G. palpalis* is of significance; these species are important vectors of both human and animal trypanosomiasis (Fajinmi *et al.*, 2007; Hendrickx *et al.*, 2000). Although, both species are less suited to dry conditions, they tend to survive in vegetations with enough shelter from wind (Mellanby, 1936; Okoh *et al.*, 2012).

The relative abundance of 139 (66.8%) *G. p. palpalis* and 69 (33.2%) *G. tachinoides* agree with the findings of Kalu, 1991 while for Okoh *et al.*, 2012; it shows that *G. tachinoides* are more abundant than *G. palpalis*. According to the study, *Glossina*

palpalis and *Glossina tachinoides* recorded relative abundance of 76% and 84% for wet season and, 24% and 16% for dry season respectively.

A lot has been done to the control of trypanosomiasis but only 10% of the infected areas final onslaught on the vector is being planned under the aegis of the Pan African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC) (Ahmed, 2007), this could be as a result of active surveillance that makes the exact present situation of the disease in many parts of Africa and has led to a breakdown of control strategies.

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