PREVALENCE OF TSETSE FLIES (*GLOSSINA)* SPECIES AND TRYPANOSOMOSIS AMONG CATTLE IN NUKU, DOMI, KWAKWA AND GADA-BIU VILLAGES IN ABAJI AREA COUNCIL OF FEDERAL CAPITAL TERRITORY ABUJA NIGERIA.

H. U. Wintola[1]*, H. S. Idris[2]. and B. D. J. George[3]

[1]Federal Ministry of Agriculture, Federal Department of Livestock and Pest Control, Abuja, Nigeria.
[2]University of Abuja, Department of Biology, F.CT. Abuja, Nigeria.
[3]Department of Veterinary Parasitology, Ahmadu Bello University, Zaria, Nigeria.

*Corresponding Author's email address: hwintola@yahoo.com

Abstract

The entomological survey was undertaken between June 2006 and May 2007 in the agro- pastoral area of Domi, Nuku, Kwakwa and Gada-biu villages of Abaji Area Council of the Federal Capital Territory (FCT), Abuja, Nigeria. Detailed entomological studies on the vector (Glossina) were conducted in the riverine areas of relict forest of the four Villages. Acetone baited bi-conical traps were used as traps for Glossina. A mean total of 1819 flies (839 males and 980 females) were harvested and identified for species and sex composition, dissected and examined for trypanosome infection. G. p. palpalis was the most abundant (1583) compared with 76 of G. tachinodes and no other Glossina species in the areas surveyed, and the abundance was significantly different (T= 2, df=5 P< 0.05) from other species. The distribution of Glossina within the 4 villages were Domi had 484(26.61%), Nuku 386(22.22%), Kwakwa 550(30.26%) and Gada-biu 399(21.94%). A total of 600 non-teneral flies were examined for trypanosomes out of which 160 (26.00%) were found positive for trypanosome. Out of this 133(22.17.%) had T.vivax while T. congolense were seen in 27(4.50%). The difference was significant (T=3, df=3 P< 0.05).The infection rate was lower in the dry season and higher in the early raining season/mid-wet season and the difference was significant (T= 7, df=5 P< 0.05). Glossina spp. was consistently higher in the larger riverine habitats of Domi, Kwakwa and Nuku. Sex ratio of Glossina spp. was 1:1; however, more females were collected than the males. Out of 1819 flies collected, 980 (53.87%) were males and 839 (46.12%) females and the difference was significant (T=1.6, df=3 P< 0.05). Also detailed parasitological studies were conducted in the same areas to determine the infection rate of animal trypanosomosis in Zebu cattle. A total of 120 blood samples were collected from each village and screened using Enzyme-Linked Immunosorbent Assay (ELISA) Technique. The overall results of infection rate of Trypanosoma in Zebu breed recorded in the four villages were 20.00% (48). They were all positive for T. vivax (T=9.5,df=3,p<0.05). The infection rate in females 32 (13%) was higher than in the males 16 (7%) the difference was significant at (T= -5, df=3, p<0.05).

INTRODUCTION

Trypanosomosis is a serious parasitic disease of humans and domestic animals with prolonged effect when an infected host is not treated, and could lead to nervous disorder, abortion, loss of weight, progressive anaemia and subsequent death (W.H.O., 2009). Maudlin *et al*. (2004) has reported that tsetse flies transmit animal trypanosomosis (nagana) leading to half a million cases annually, and that the disease is responsible for the massive decline in agricultural development in Africa. For several decades, there have been concerted efforts aimed at controlling tsetse flies and the menace associated with little success (Marcella, 2012). Some of the areas that have been reported free of tsetse are becoming re-infested primarily due to lack of consolidated measures (Marcella, 2012).

Abaji Area Council was formerly in Kwara state and this area was sprayed in the 1960[s] when the infestation of tsetse-flies was high during the colonial era and Abaji fall within the northern area where cases of tsetse flies infestations have been reported. The areas have shown very promising agricultural potentials in crop and livestock resources. However, available information on the prevalence and distribution of tsetse flies has revealed that tsetse flies constitute serious constraints to effective utilization of the resources (Ilemobade, 1983). Consequent upon this, this research aimed at ascertaining the status of the distribution and vector

competence of tsetse flies in relation to animal trypanosomosis in Nuku, Domi, Kwakwa and Gada-Biu in Abaji Area Council of Federal Capital Territory; Abuja; while the specific objectives were to determine the following:

i. prevalence of trypanosomosis in Zebu cattle in Abaji Area Council

ii. species composition of tsetse flies present in the in the four villages of Abaji Area Council of the Federal Capital Territory

iii. Sex ratio of the flies and

iv. Vector Competance of *Glossina* spp.within the four villages of Abaji Area Council of the FCT Abuja.

MATERIALS AND METHODS

The Study Area: The study was carried out in the four villages of Abaji Area Council namely: Nuku, Domi,Kwakwa and Gada-biu in Abuja, of Federal Capital Territory (FCT) of Nigeria. It lies between latitudes 8^0 25/ and 9^0 20/ North of the equator and longitude 6^0 45/ East of Greenwich meridian. Geographically, Abaji Area Council is located at the south western part of Federal Capital Territory and FCT is at the centre of Nigeria and within the Guinea Savannah Zone (MFCT,1994), is one of those areas where there had been repeated outbreaks of trypanosomosis in livestock in 1950's to 1960's (Glover and Aitchison, 1966). The mean monthly relative humidity (rh) range between 80 % in the wet season and 40 % in the dry season

The four villages are characterized by hills and basement complex rocks which and at riverine area of the FCT. Most of the rivers here flow into River Niger as tributaries. Abaji Area is bordered with Kogi State in the south, Nasarawa State, Kwali and Kuje Area Councils in the east and Niger State in the west and North. There are several river systems in these areas that flow from North to South and East to West direction all into River Niger direction. The pastoralists, encouraged by the good pasture of this Area and settle here. The number of cattle within Abaji Area Council was estimated to be 11750 as at 1993 (MFCT, 1994). Average number of heads of cattle per house hold was estimated to be 83 in the hands of the 31 households. Fulanis are the major herdsmen here.

SAMPLE COLLECTION

Trapping and Collection of tsetse flies (Glossina species): Trapping of the *Glossina* species were conducted in 4 randomly selected locations of each of the 4 villages.A total of 16 bi-conical traps (white and blue) see (Plate 1) were set in the 4 villages (Challier and Larvessier, 1990). The traps were set and baited with acetone (Ahmed et al; 1993) to enhance trapping of *G. palpalis* and other *Glossina* species. The traps were set in the fringes forest by the river plains, stream and ponds where the villagers fetch water, and cattle graze and drink water. The 4 traps in each village were set at approximately 1-2 km apart and labeled. The harvests in each trap were emptied after every 5 days (Ahmed *et al*., 2000) into small insect boxes. At the point of removal from the trap, each fly was pressed on the thorax to kill them so that they will not fly away and the flies contained in the boxes were then taken to the laboratory for identification and other analyses.

***Identification of fly species*:** All the catch from the 4 traps in each village were sorted out and counted. The sex of the flies were equally identified and counted to determine the sex ratio. Details on the identification and determination of the sexes of the *Glossina* collected were based on description by Davies (1977), Pollock (1982) and were

equally identified by N.T.R.I. Suleja in Niger State. Non-tenerals (gorged flies, those that have taken blood meal) were selected for dissection (Itard, 1989).

Plate 1

Dissection of *Glossina* and identification of *trypanosome* sp: The teneral fly by definition could not be infected because they are flies that have not taken any blood meal, and could therefore have no infection, they were not dissected. Thus only the non-teneral tsetse (those that have taken blood) which can easily be identified with their gorged abdomen were dissected. The wings were carefully detached from the thorax, after which the body of the tsetse was placed on slide under a dissecting microscope. A piercing needle was used to separate the head from the body gently. The hypopharynx was

removed onto a clean microscopic slide with a drop of saline added; and the slide observed under microscope using X 320 magnification. The same procedure was applied to the gut and salivary gland; they were separated on 2 different slides followed by addition of saline (Moloo *et al*., 1973; Mulligan *et al*., 1979; and Penchenier and ITARD, 1981) technique for the location of trypanosomes. The mouth parts (labrum and hypopharynx), mid-gut, and salivary glands were squashed on slide and examined. The trypanosomes were identified and differentiated into species by their location within the insect, presences of flagellum, position of kinetoplast, size and mobility (Oniyah., 1997).

Collection and analysis of Blood Samples: A total of 480 samples were collected from each bovine (zebu cattle) in the 4 villages, blood samples were collected from each village; that is, 120 (60 males and 60 females) in each of the four villages in Abaji Area Council. The samples were collected between 7.00am and 9.10am before the animals were released for grazing. Samples were collected from Zebu breed which were randomly selected from open ranches under the prevailing average temperature of 30^0C and 65% relative humidity.

Five millitres of blood was collected from the Zebu via the jugular vein (Molyneux, 2004). The blood samples were immediately emptied into 20ml bottles containing EDTA as anticoagulant; which were then packed in a potable cooler containing ice blocks and transported to the parasitological laboratory in National Veterinary Research Institute Vom, Jos for analysis. Direct ELISA test was conducted to diagnose blood samples (Nantulaya and Lindquist, 1989).

DATA ANALYSIS

- Data was analyzed using T=Test pair's method in comparing the following:
- The species composition of tsetse flies present in the Abaji Area Council.
- Vectorial capacity of the vectors within each village.
- The sexes of the flies.
- The prevalence of trypanosomosis in Zebu cattle, using blood samples in Nuku, Domi, Kwakwa and Gada-biu villages in Abaji Area Council

RESULTS

***Distribution of Glossina*:** A total of 1819 *Glossina* spp. were trapped during 132 trap-days within the riverine relict forest of the four villages between June 2006 and May 2007.The highest number of *Glossina* (488) were observed in the month of May in Abaji Area Council, while the lowest (8) were observed in the month of December and no flies were encountered in the month of January and February. There were flies throughout the year except in the 2 months. (Table 1).

Table 1: Monthly Distribution of Glossina *in the Domi, Nuku, Kwakwa and Gada-biu*

Village	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
Domi	109	90	60	70	70	32	9	0	0	9	19	80	484
Nuku	113	78	56	35	17	10	0	0	0	10	21	29	386
Kwakwa	90	121	82	46	53	21	55	0	0	5	76	20	550
Gada-biu	373	162	115	33	44	28	0	0	0	0	125	9	399
Total													1819

Table 2: Distribution and Species Composition of *Glossina* sp in the four villages of Abaji Area Council of F. C.T, Abuja

Village	Non-Teneral *Glossina*	Male *Glossina*	Female *Glossina*	*G. palpalis*	*G. tachinodes*	Total Flies Collected
Domi	161	210	274	413	71	484
Nuku						
Kwakwa	127	182^{ns}	204^{ns}	341	45	386
Gada-biu						
	159	238^{ns}	312^{ns}	466	84	550
Total						
	153	209^{ns}	190^{ns}	363	36	399
	600	839	980	1583	236	1819
Average			245			
	150	209		396	59	455

*F=Female=245, M= Male=209, LSD Value at (P<0.05) T=4.2 significant.
**G.P.Palpalis* = 1583, *G.tachinodes*=236, LSD= (P<0.05) T=1.6 significant
*No of flies=455, No of non –teneral=150. LSD =(P<0.05) T=3.5 significant.
ns=not significant.

***Species Composition of Gossina**:* With respect to species composition, its relative abundance in the four villages, *G. p. palpalis* (Robineau-Desvoidy 1830) and *G. tachinodes* (Westwood, 1850) were the only tsetse species trapped within the riverine of relict forest, Abaji, Abuja, Nigeria in this study (Table 2). Generally, *G. p. palpalis* had the higher number of 1583 while *G. tachinodes* was 236. Their numbers were

significantly different (T=1.6 df=5, P<0.05) from each other, with a ratio of 10:1. Kwakwa had the highest number of *G. p. palpalis* (466), while the lowest number (341) for this species was recorded in Nuku. Kwakwa also had the highest number of *G. tachinodes* (84) while Gada-biu had the lowest number of 36 *G. tachinodes* and 363 *G. palpalis palpalis*. Domi recorded 413 G.p. palpalis and 71 *G. tachinodes* the second highest, *G .p. palpalis* was significantly (T=3.5 df=3 p<0.05) more abundant than *G. tachinodes*, with ratio 7:1.

***Sex ratio of Glossina*:** On the whole there was no significant difference between the number of male and female *Glossina* spp. encountered in the study area that were trapped (T= 4.2, df=5, p< 0.05); being almost 1:1 that is 839 males and 980 females (Table 2). Gada-biu had 209 males and 190 females, there was no significant difference in the sex ratio (T= 7, df =3 and p<0.05). Nuku had 182 males and 204 males, the number of male and female did not differ significantly from each other (T= 4, df= 3, P>0.05), with a ratio of 1:1. In Domi had 210 males and 274 females, females was significantly (T=8 df=3 p<0.05) there was no significant difference in the sex ratio (T= 2, df =3 and p<0.05) more abundant than male, with ratio 1:1.In Kwakwa 238 males were recorded and 312 females.

Infection rate of trypanosoma.: Of 600 non-teneral flies dissected and examined for trypanosomes infection between June 2006 and May 2007; 160 (27.00%) were positive. More females 101(17.00%) and 59(10.00%) males were infected; there was significant difference (T= -6. df=5 p< 0.05) between the two rates. A total of 121(22.00%) were positive for *T. vivax,* 38 (4.50%) for *T. congolense*. and 1 *T. brucei.* Of the 153 non-teneral flies examined in Gada-biu, 37(6.00%) were positive. More females 23(4.00%) were infected than males 14(2.00%); and there was a significant difference (T=7, df=3, p<0.05) between the rates. A total of 29(5.00%) were positive for *T. vivax;* and 8(2.00%) for *T. congolense.* In Nuku out of 127 flies examined 42(7.00%) were positive. More females 26(4.00%) were infected than males 16(3.00%); and there was a significant difference (T=5, df=3, p<0.05) between the rates. A total of 35(6.00.00%) were positive for *T. vivax;* and 6(1.00%) for *T. congolense.* Of 161 tsetse examined in Domi 40(7.00%) were positive of *T. vivax* and *T. congolense.* More females 28(5.00%) were infected than males 12(2.00%); and there was a significant difference (T=-4, df=3, p<0.05) between the rates. A total of 31(5.00%) were positive for *T. vivax;* and 9(1.00%) for *T. congolense.* In Kwakwa a total of 41(7%) were positive of trypanosomes, out of these more males 66(11.00%) were more infected than females 24(4.00%); and there was a significant difference (T=4, df=3, p<0.05) between the rates, 38(5.00.00%) were positive for *T. vivax;* and 34(6.00%) for *T. congolense.* Kwakwa had the highest infection rate of *T. congolenses* to compare with other villages.

Table 4: Infection Rate with trypanosomes of Glossina in the four villages of Abaji Area Council of FCT

Village	Number examined	Number positive	Male Flies	Female Flies	*T. vivax*	*T. congolense*	*T. brucei*	% positve
Domi	161	40	28	12	31	9	0	7.00
Nuku	127	42	16	26	38	6	0	7.00
Kwakwa	159	41	366	26	19	4	0	7.00
Gada-biu	153	37	14	23	29	8	0	6.00
Total	600	160	66	94	121	38	1	27.00

*600 flies examined, 160 positive,. LSD value at (P< 0.05) T= 15 significant.
* 59 males and 101 females *Glossina* positive, LSD = (P< 0.05) T= -6 significant.
* 160 flies positive, *T. vivax* = 121 *T. congolensis* = 38, *T. brucei* 1, P< 0.05. LSD = (P< 0.05) T= 2.5 significant

BLOOD SAMPLES ANALYSIS

***Prevalence of bovine trypanosomiasis*:** Of 240 zebu cattle were examined in the four villages between June 2006 and May 2007, 48(20.00%) were positive of *T. vivax*. More females 32(13.00%) were positive than males, 16(7.00%); there was significant difference (T=9.50, df=3 P<0.05) between the two rates, Domi recorded the highest infection rate 17 (7.00%) and Gada-biu with the lowest 9(4.00%) the difference was significant (T= 2, df = 5, P < 0.05). Nuku and Kwakwa recorded 11(5.00 %) (40) each

Table 5: Prevalence of Bovine Trypanosomiasis in Zebu Cattle in the four villages of Abaji Area Council of FCT, Abuja

Village	Total No. Exam	M	+VE	F	+VE	Total No +VE	*T. vivax*	*T. congolensis*	Total +VE	%
Domi	60	30	3	30	14	17	17	0	7.00	
Nuku	60	30	5	30	6	11	11	0	5.00	
Kwakwa	60	30	3	30	8	11	11	0	5.00	
Gada-biu	60	30	16	30	32	9		0	4.00	
Total	240	120	16	120	32	48	9 48	0	20.00	

*240 zebu screened, 48 positive for *T.vivax*,. LSD value at (P< 0.05) T= 15 significant.
* 16 males and 32 females positive, LSD = (P< 0.05) T= 9.5 significant.

DISCUSSION

Species composition and relative abundance of *Glossina* in Nuku, Domi, Kwakwa and Gada-Biu in Abaji Area Council of the FCT, Abuja

Glossina p. palpalis and *G. tachinoides* were the only species encountered in the relict of the riverine forest of the Abaji Area Councils of the FCT, Abuja, Nigeria. The presence of these species in the area is consistent with the earlier report of Davies (1977), which indicated the presence of the two species in the Guinea Savanna Zone of Nigeria. The observed high catches of *Glossina* in the four villages of Abaji Area Council might have also been influenced by baited acetone trap used in this studies (Groenendijk (1996). More also, Abaji Area Council still retains forest of Guinea Savanah with less deforestion activities and this trees serve as cover for tsetse to prevent desiccation.

In a related study, Torr (1994) observed that high catches of tenerals could be boosted in ox-baited odour, similar to the high population of *Glossina* observed in Abaji Area Council which might be as a result of more stable climatic conditions in the guinea savannah forest and perennial rivers at these sites. The mean monthly humidity at these areas never fell below 60% due to the insulating. Also temperature has a profound effect on flies in many ways .High temperature causes mortality on *Glossina* and cold temperature makes flies inactive and reduces reproduction .Mean temperature between 28^0_C and 30^0_C in these forest of the riverine is favourable to *Glossina* reproduction (Davies, 1982).

Sex Ratio

Although the sex ratio of testse at emergence is 1:1 (Paynter *et al*., 1992), the monthly catches in the four villages of Abaji Area Councils of the FCT was predominantly females. Sex composition of tsetse population is often influenced by the catching method (Mizell *et al*., 2002). Challier *et al*. (1990) had noted that traps generally caught a higher percentage of females due to reproductive state of the females because they are out searching for food than the males, and this confirm to Packer *et al*. (1991) that high abundance of females may also indicates, a hungry population in the sexes and nutritional deficiency was more acute in females than males and could have been associated with viviparity (Maudlin, 2006).

Non-Teneral

The high numbers of non-teneral (gorged) females collected in this study in the four villages of Abaji Area Council of the FCT might have been influenced by the catching methods because flies of these categories are less active due to indigestion and pregnancy making them more available for trapping as they are always in need and searching for food (Schofield *et al*., 2002). At this stage, the female non-teneral tsetse only find a place to rest, and are more attracted to the baited traps than the male (Hagrove, 2004). Since flies are more susceptible to infection because their first blood meal is derived from infected source (Baylis, 1997). Which is also an indication that breeding was in progress, an important aspect in habitats where breeding sites were difficult (Ahmed *et al.*, 2000**).**

Infection Rates of Trypanosomes in Glossina

Tsetse-flies are *haematophagous* insects that feed mainly on vertebrate animal. Both sexes neither feed on water nor plant juice, during feeding process they transmit the protozoan *trypanosome* parasite that causes Human African Trypanosomiasis (HAT) or sleeping sickness in man and Animal Trypanosomiasis (Nagana) in Livestock. The accurate understanding of the *trypanosome* infection rates in both vectors and hosts; this could be used to predict the epidemic and duration of trypanosomiasis risk in an area (Opiyo *et al*., 1982; Hagrove, 2004). In the current result, the trypanosome infection rates of tsetse in the Abaji showed that large populations of the flies found in the Area Council were infected with trypanosomes mainly *T. vivax* only, the total infection rate of 20.00% in the area which is high. Though, less than the 29% rate reported by MFCT Abuja (1994).

The mean prevalence rate of 834 tsetse flies recorded in this Area Council between June 2006 and May 2007 were closely correlated to the mean infection rate of the diseases in the flies 1819(29.00%); indicating that the distribution of the vector had a significant effect on the distribution of the disease. The results showed a

significantly higher proportion of females harbouring infections than the males. These were similar to the data obtained in other studies in Nigeria (Oniyah *et al*., 1985), Kenya (Tarimo *et al.*, 1984). The lower infection rates observed in males could be attributed to the fact that the males take a blood meal every 3-4 days (Davies, 1977) while females feed more regularly because of the demand of their role in reproduction (Moloo, 1976). The increased feeding frequency of the females increases the probability of feeding on an infected host.

There reasons that may be accounted for the high infection rate of *T. vivax and* few cases of *T. Congolese* and few *T. brucei* infections in the animals, the infections due to *T. congolese* type were probably scanty in the animal hosts and therefore very rarely picked up by the flies during feeding. Schofield *et al*. (2002) observed that naturally, infection rate with *T. congolense* are generally low, while *T.vivax* type infection fluctuate within wide limits. Pino (2004) observed that natural infection rate with *T. congolese* type infection was never above 5% regardless of the sources of blood. A third factor is that *G. p. palpalis* is probably a more efficient vector of *T. vivax* (Baldry, 1964). It was observed by Wint *et al*. (2004) that *T. vivax* was dominant when there was a breakdown in the natural immunity conferred by repeated tsetse challenge many of these reasons may be applicable in the complex epizootiology of the disease in the Abaji.

The *G. palpalis* group, to which *G.P. palpalis* belongs has been considered an inefficient vector of animal trypanosomiasis with an average infection rate of only 5% of the Savanna Zone (Machenman, 1970) compared to the morsitan group that exhibits infection rates to a maximum of 25% (Davies, 1977). The absence of the *G. morsitan* in the area studied and the high trypanosome infection of 20.00% recorded in *G. p. palplis* trapped in the relict forest of the riverine locations of the Abaji Area Council of the FCT, and paralleled with high infection rates as (20.00%) in the livestock examined, portray the major vector responsible for the cyclical transmission of trypanosomiasis in the area and this is consistent with the finding of Groenendijk (1996). The level of the vector challenge to an animal host is ann important component of the risk factor in disease transmission (Swallow, 2000; Schofield *et al*., 2002).

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