

Preliminary survey on tsetse flies and trypanosomosis at grazing fields and villages in and around the Nech Sar National Park, Southern Ethiopia

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Abstract

Preliminary survey on tsetse flies and trypanosomosis were conducted between July and August 2007 at grazing fields and villages in and around the Nech Sar national park, with the ultimate intention of forwarding baseline information on the extent of the problem and possible control strategies. Entomological (Tsetse flies) survey was conducted by deploying a total of 16 geo referenced NGU traps on the grazing fields of cattle. Parasitological (Trypanosomosis) survey and PCV (Packed Cell Volume) measurement were done on randomly selected 202 cattle, of the park neighboring villagers. *Glossina pallidipes* with mean apparent density of 11.46 ftd (flies per trap per day) were found to be the only prevailing tsetse fly species in the study area. However, the mean apparent density of biting flies was found to be 4.54 ftd. Trypanosomosis with population mean estimated 17.33±5.30 were seen to be a serious problem of cattle in the area. *Trypanosoma congolense* and *T. vivax* were the two dominant species encountered in the area. However statistically significant proportion of the cattle ($P < 0.005$) were found infected with *T. congolense*. The overall mean PCV was 17.65±5.30%. The mean PCV of the aparsitemic and parasitemic animals were found to be statistically significantly different ($P < 0.05$). On the contrary, the number of cattle aparsitemic but anemic was also significant. These could be possibly due to infection by other recurrent parasites (such as haemonchosis, babesiosis and anaplasmosis), and nutritional deficiencies,. The present study disclosed that *G. pallidipes* to be the principal vector of trypanosomosis in the area. Thus, an urgent intervention on control mechanisms need to be adopted before the devastating impact of tsetse flies and trypanosomosis is aggravated to the extent of unbearable economic loss.

Keywords: Cattle, Trypanosomosis, *Glossina pallidipes*, PCV

Introduction

Tsetse flies are the cyclic vectors of trypanosomosis, a disease occurring mostly in rural areas affecting agro-pastoral activities in rural communities.

The situation results in inadequate production of local food due to preventing optimal productive livestock –keeping and mixed farming (Feldmann *et al.*, 2005). About 10 million km² area of the 37 sub Saharan African countries are infested with tsetse flies (PATTEC, 2001). In Ethiopia about 200,000 km² area in the western and south western parts of the countries infested with tsetse flies and thus African Animal Trypanosomosis (AAT) remains a serious problem (Temesgen Alemu *et al.*, 2007)

In tsetse and trypanosomosis affected countries about 40-50 million animals are at risk of contracting the disease (Kamuanga, 2003; Shaw, 2004; Feldmann *et al.*, 2005). Trypanosomosis is a chronic debilitating condition that reduces fertility (calving rate), weight gain, milk and meat off take by at least 50% (USD 2750 million per year) (Budd, 1999; Swallow, 1999; DFID, 2001; Shaw, 2004; Feldmann, 2005). It can also result in death of affected animals (especially calves) if left untreated (Hursey and Slingenbergh, 1995; Feldmann, 2005). Moreover, trypanosomosis reduces the potential opportunities for livestock and crop production (mixed farming) through less drought animal power to cultivate land and less manure to fertile soils for enhanced crop production and also affects human settlement as people tend to avoid areas with tsetse flies (Shaw, 2004; Feldmann, 2005).

Ethiopia has the highest total livestock unit and cattle population in Africa (AU/IBAR, 2003; Abayneh Dagne, 2005) and the livestock sub sector provides 30% of agricultural GDP, 14% of the foreign exchange and alone provides 16% of the total GDP (Abayneh Dagne, 2005). Meanwhile, the presence of tsetse flies and trypanosomosis, prevents optimal productive livestock keeping and mixed farming (Feldmann *et al.*, 2005) resulting in inadequate exploitation of the sub sector. The current preliminary study was initiated and designed with the objective of offering baseline information on the prevalence of trypanosomosis, population density and species of tsetse flies and other mechanical vectors, to come up with alternative control options in alleviating the problem of tsetse and trypanosomosis.

Materials and Methods

Study area

The study was conducted at the grazing fields surrounding the Nech Sar National Park and five villages neighboring the National Park namely: Chcha, Harroropie, Shekeresha, Sulula and Tselkie. It is one of the National Parks,

found in SNNPRS of Gamo Goffa Zone. The park is also known of its unique features of having forty (40) springs “Arba Minch” (BoFED, 2006).

Study population

Cattle of indigenous east African Zebu breed, grazing communally in and around the grassland zone of Nech Sar National Park were randomly selected.

Tsetse survey

The tsetse survey was conducted through deployment of geo referenced (using hand held Garmin 48xGPS) NGU traps at wood grass land and grass land vegetation coverage. The traps were deployed at altitudinal range of 1150-1228 meters above sea level. Traps were baited with acetone and cow urine, remained deployed for about 72 hours. After 72 hours trapped flies were identified, sexed, counted and recorded (IAEA, 2006).

Trypanosome survey

Parasitological and hematological techniques were employed. Accordingly, blood samples were obtained by bleeding marginal ear veins of cattle using a sterile lancet and drawing the blood into the heparinized capillary tube up to 3/4th of the length and sealed with crystal seal. The collected blood was centrifuged for about 5 minutes with 12,000 rpm (revolutions per minute). After centrifugation the Packed Cell Volume (PCV) level was measured using hematocrit capillary reader .PCV below 25% was designated as anemic (Murry *et al.*, 1977).

Blood smear was done via cutting the centrifuged blood containing capillary tube 1mm above and below the buffy coat layer using a diamond tipped pencil. So as to include plasma and red cells in the blood smear. The blood then expressed on to the clean glass slide, mixed well and covered with a clean cover glass. Examination was done under 40x objective and 10x eye pierce magnification, using dark ground buffy coat technique (Murray *et al.*, 1977)

Statistical analysis

One sample t-test was used to identify the marginal error of the means of trypanosomosis prevalence and means of PCV values for 95% CI. The significance of the difference in the mean PCV values of parasitemic and aparsitemic cattle were compared using two sample t-tests. *Trypanosoma congolense* and *T. vivax*

difference in prevalence was analyzed using two proportion test for 95% CI. Minitab version 13.1 statistical package was employed.

Results

Tsetse survey

The mean apparent density of tsetse flies in this preliminary survey was investigated as 11.46f/t/d (flies per trap per day). While the mean apparent density of mechanical vectors, tabanids was recorded to be 4.54f/t/d. Species wise all of the 550 tsetse flies caught were *Glossina pallidipes*. Male and female *G. pallidipes* represented 37.81% and 62.18% of the total tsetse catch respectively.

Table 1: *Glossina pallidipes* and tabanids catch results, during the survey period at various altitudinal and vegetation ranges in and around the Nech Sar national Park

Trap Id	Altitude (masl)	Vegetation	<i>G. pallidipes</i> catch				Tabanids Catch	Tabanids Apparent Density (f/t/d)
			Male	Female	Total	Apparent Density (f/t/d)		
NSP/M1/T01	1150	WGL	40	80	120	40.0	11	3.67
NSP/M1/T02	1154	WGL	1	2	3	1.0	3	1.0
NSP/M1/T03	1282	WGL	35	69	104	34.6	4	1.33
NSP/M1/T04	1298	WGL	3	14	17	5.66	2	0.66
NSP/M1/T05	1206	WGL	16	25	41	13.66	1	0.33
NSP/M1/T06	1164	WGL	61	70	131	43.66	2	0.66
NSP/M1/T07	1207	WGL	5	8	13	4.33	10	3.33
NSP/M1/T08	1199	WGL	7	11	18	6.0	9	3.0
NSP/M1/T09	1170	WGL	3	6	9	3.0	9	3.0
NSP/M1/T10	1174	WGL	9	19	28	9.33	14	4.67
NSP/M1/T11	1204	GL	11	7	18	6.0	38	12.67
NSP/M1/T12	1207	WGL	10	16	26	8.66	41	13.67
NSP/M1/T13	1222	WGL	3	7	10	3.33	25	8.33
NSP/M1/T14	1203	WGL	0	3	3	1.0	25	8.33
NSP/M1/T15	1244	WGL	3	4	7	2.33	20	6.67
NSP/M1/T16	1228	WGL	1	1	2	0.66	4	1.33
Total/Mean			208	342	550	11.46	218	4.54

NB; f/t/d-Flies per Day per Trap

WGL-Wood Grass Land, Type of vegetation coverage

GL-Grass Land, Type of vegetation coverage

masl-meter above sea level

Trypanosoma survey

Parasitemia was detected in 35/202 cattle, which was 17.33% prevalence rate. (*T. congolense*) was the prominent *trypanosoma* species encountered, that induced 94.29% of the total *trypanosoma* infection, where as 5.71% of the *trypanosoma* infection was caused by *T. vivax*. Highest *trypanosoma* infection rate was seen at the village by the name Shekeresha (29.17%) and the least was seen at Sulula (11.63%).

Table 2; Prevalence of cattle trypanosomosis in the four villages, in around the Nech Sar national park

No	Sampling Villages	Sample size	<i>Trypanosoma</i> Encountered			Prevalence (%)
			<i>T. congolense</i>	<i>T. vivax</i>	Total No Positive Cattle	
1	Chacha	49	6	0	6	12.24
2	Shekeresha	48	13	1	14	29.17
3	Sulula	43	4	1	5	11.63
4	Tselkie	62	10	0	10	16.13
Total/ Mean		202	33	2	35	17.33

PCV Measures

The overall mean PCV value was found to be 17.65% with a range of maximum PCV 32% and minimum PCV 5.5 %. Significant proportion of parasitemic animals were anemic (97.14%) indicating that anemia was being the important clinical indication of trypanosomes infection. Hundred and eighty eight (188) cattle had a PCV below 25%, fourteen animals had $\geq 25\%$. Out of cattle with the parasitemic status 97.14% found to be anemic and 92.22% of parasitemic were anemic.

Table 3: Packed Cell Volume of cattle examined for *trypanosoma* infection, at the four villages, in and around the Nech Sar National park

No	Sampling village	Sample size	Mean PCV(%)	No. Cattle PCV $\geq 25\%$	No. Cattle PCV $< 25\%$
1	Chacha	49	18.8	5	44
2	Shekeresha	48	16.1	0	48
3	Sulula	43	18.6	7	36
4	Tselkie	62	16.7	2	60
Total/Mean	4	202	17.65	14	188

Discussion

The present preliminary survey of tsetse flies depicted that *G. pallidipes* as the only species responsible for the cyclical transmission of trypanosomosis in the area. Baseline survey analysis report of block -1 STEP area made by Marck Vreysen (2000) has substantiated the presence of *G. pallidipes* as the only *Glossina* species in western and eastern parts of lake Abaya. Although *G. f. fuscipes* occurs in the deme basin a smaller valley in the north western part of the southern rift valley (Vreysen et al., 2000; Temesgen Alemu et al., 2007). This could possibly contribute for focusing on the eradication of *G. pallidipes*, through learning the past experience of other tsetse infested and cleared countries with similar species or one species of *Glossina*. For instance the successful eradication of *G. austeni* in Zanzibar, applying SIT (Sterile Insect Technique) was advantageous of a particular species and discrete zones or "island" infestation scenario (PATTEC, 2001). Since SIT involves mass production of target insect pest species (for the current case, *G. pallidipes*), sterilization and releasing into the field on a sustained basis and in sufficient numbers to achieve appropriate over flooding ratios (IAEA, 2006). The overall mean apparent density of *G. pallidipes* was found to be 11.46 ftd. The mean apparent density of mechanical vectors, tabanids was 4.54 ftd. Trypanosomosis with point prevalence of 17.33% and population mean estimated 17.33±5.30 were seen to be a serious problem of cattle in the area. *Trypanosoma congolense* and *T. vivax* were the two *trypanosoma* spp encountered. However very significant proportion of the cattle ($P<0.05$) are infected of *T. congolense*. Thus, *G. pallidipes* remains the important cyclical vector of *T. congolense* in Arba Minch area. *T. vivax* can be seen in Africa where the tsetse belt is located hundreds of kilometers away. The parasite was also found to establish itself in western hemisphere, Bolivia, El Salvador, Central America, Cuba, Islands of Mauritius, where tsetse flies aren't present. *T. vivax* is reported to commonly exist in highlands of Ethiopia that is too cold for the tsetse survival (Uilenberg, 1998). Which is in accordance with the findings of this study, higher prevalence of *T. congolense* than *T. vivax* in tsetse free zones is considered as a result of mechanical transmitters (Roeder et al., 1984; Getachew Abebe and Yilma Jobre, 1996). These all evidences suggested the notion that, if any animal health problem posed on cattle due to trypanosomes is mainly of *G. pallidipes* as a vector. Significant proportion of parasitemic cattle (97.14%) were seen to have anemia indicating that trypanosomosis is a wasting disease characterized by slow progressive loss of condition accompanied by increasing anemia (Uilenberg, 1998). The mean PCV of the aparsitemic (18.108±0.70) and

parasitemic (15.457±1.37) animals were significantly different (P<0.05). In the contrary the number of cattle aparasitemic but anemic was also considerable. Infection by other recurrent diseases, some gastro intestinal parasites such as *Haemonchus spp.*, hemoparasites like babesiosis and anaplasmosis and nutritional problems,(Radostits *et al.*, 2006) ,might be the contributory factors for the paradoxical match of anemia with aparasitaemia. Thus, anemia is not the only and unequivocal indication of trypanosomosis. Tsetse flies in particular of *G. pallidipes* was found to be the sole vector of trypanosomosis and which in turn resulted in ill health and decreased production and productivity of cattle of the area. Control tactics against the flies (deployment of insecticide impregnated and odor baited cloth-panels, topical treatment of cattle, therapeutic and prophylactic administration of trypanocidal drugs and improvement of animal management and nutrition should be practiced. Investigation of all possible causes of anemia, trypanocidal efficacy test, fly infection rate and employment of molecular diagnostic techniques could be more helpful.

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