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Trypanosome Infection Rate in G*lossina pallidipes* and G*lossina fuscipes fuscipes* in Gojeb Valley, Southwest Ethiopia

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Abstract: A study was carried out to determine the infection rates of trypanosomes in *Glossina pallidipes* and *Glossina fuscipes fuscipes* fly species in Gojeb valley of Ghibe - Omo river system at Shebe Sombo woreda, Southwest of Ethiopia. Tsetse flies were traped, dissected and their organs (proboscis, salivary glands and mid-gut) were microscopically examined. A total of 384 tsetse flies were randomly selected and dissected. 200(52%) of them were *G. pallidipes* and 184(48%) were *G. fuscipes fuscipes*. Out of the dissected flies, 49 (24.5%) *G. pallidipes* and 42 (22.8%) *G. fuscipes fuscipes* were positive for trypanosomes. However, the difference is not statistically significant (P > 0.05). Out of 200 dissected *G. pallidipes* flies 33(16.5%), 15 (7.5%) and 1(0.5%) were infected by *T. vivax*, *T. congolense* and *T. brucei* respectively. On the other hand, out of 184 dissected *G. fuscipes fuscipes* flies 27(14.7%) were infected by *T. vivax* and 15 (8.2%) were infected by *T. congolense*. The study showed that, infection rate of *T. vivax* is higher in both species of tsetse flies than with *T.congolense*. There was a statistically significant difference (P<0.05) in trypanosome infection rates between male and female *G. pallidipes* fly species. Infection rates in male and female *G. pallidipes* and male and female *G. fuscipes fuscipes* were18.35%, 31.87%, 21.43% and 24% respectively. Finally a few points of recommendations were forwarded to alleviate the problem.

Key words: Trypanosomes % Infection rate % *G. pallidipes* % *G. fuscipes fuscipes* and Gojeb Valley

INTRODUCTION

Trypanosomosis is a disease caused by several species of protozoan parasites (Trypanosomes) found in the blood and other tissues of vertebrates including livestock, wildlife and people [1, 2]. The disease is transmitted mainly by tsetse flies and by other biting flies. It is one of the most important diseases of livestock, which hampers agricultural production in sub-Saharan Africa including Ethiopia [3]. Currently, tsetse flies infest approximately 11.6 million km^2 of Africa, about 37% of the land area of the continent [4, 2]. A recent study has estimated the direct annual cost of Trypanosomosis to be about 1.34 billion dollars [5]. According to Budd [6], African farmers spend 35 million dollars per year on trypanocidal drugs to protect and cure their cattle. It is estimated that 7 million km^2 of tsetse infested area in Africa would be suitable for the livestock and mixed agriculture, if trypanosomosis could be controlled [7].

A total of 98.000 km^2 area of Ethiopia was infested by five species of tsetse flies until 1976 [8]. In more recent years, tsetse flies have progressively invaded productive agricultural areas in the west, south and southwest part of Ethiopia. Consequently, it is estimated that a total area of 220.000 km^2 is currently believed to be infested with different species of tsetse flies in which case livestock below 2000 meter contour are exposed to various levels of Trypanosomosis risk [9]. The overall economic loss due to the disease is estimated to be between 1.408 and 1.540 million dollars annually [9]. Tsetse flies are important because of their ability to spread disease among human and domestic animals. The tsetse flies feed only on blood and in the act of piercing the skin and drawing blood, the flies pass on the blood parasite trypanosome to previously uninfected animals or human, causing trypanosomosis [10]. Living tsetse flies are restricted to sub-Saharan Africa north of Kalahari and there are 22 described species [11].

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Tsetse flies in Ethiopia are confined to the southern, western and southwestern regions between longitude 33° and 38° E and latitude 5° and 12°N.Tsetse infested areas lie in the low lands and also in the river valleys of Baro, Akobo, Didessa, Abay (Blue Nile), Ghibe and Omo [8]. Five species of tsetse flies are believed to be found in Ethiopia. These are *Glossina marsitans submorsitans, G. pallidipes, G. fuscipes fuscipes, G. tachinoides* and *G. longipennis* [8, 12 and 13]. There are five economically important animal trypanosome species in Ethiopia. These are *T. congolense, T. vivax, T. brucei brucei, T. evansi* [8] and *T. equiperdum* [14].

Tsetse flies (Glossina species) are the primary vectors of animal and human trypanosomosis and hurt livestock production, human health and agricultural development. These flies, after feeding on an infected host, usually remain infective for the rest of their lives [10]. Studying of infection rate in tsetse flies is essential to obtain a reasonable indication about the risk of Trypanosomosis in domestic livestock and a useful parameter to design a strategy for disease control [15]. In Ethiopia, little studies were carried out regarding trypanosome infection rate in tsetse fly while no studies were performed in the current study area. Therefore the objective of the present study is to determine the infection rate of *Glossina pallidipes* and *G. fuscipes fuscipes* flies with trypanosomes in Gojeb valley of Ghibe Omo river system in the southwestern Ethiopia.

MATERIALS AND METHODS

Study Area: The study was carried out at Shebe Sombo woreda in the Gojeb valley of Ghibe Omo river system, Southwest of Ethiopia. The Shebe Sombo wereda is located at latitude of 7°.17N up to 7° 44N N and a longitude of 36°17N up to 36° 52NE with an altitude of 1580 meter above sea level. It is at about 50 kilometers distance from Jimma town and 396 kilometers distance from Addis Ababa along the main road to Bonga. The livestock population is estimated to about 187.221 cattle, 100.183 small ruminants (sheep and Goat) and 13.071 equines [16]. Gojeb valley has many tributaries. Some of them are Kishe, Gurate, Kole, Didibo, Doko (Bola), Gicho, Urgesa, Doyo and yeged. These rivers support the growth of vegetation that could harbors tsetse flies and its reservoir host animals [17]. The valley has a pronounced dry season from November to February with rainfall occurring between March and April and from late May to October. The mean maximum temperature ranges from 29.8°C to 44°C.

Study Design: A cross-sectional study was conducted to determine the infection rate of trypanosomes in *G. pallidipes* and in *G. fuscipes fuscipes* in the Gojeb valley of Ghibe Omo river system.

Sample Size and Sampling Method: The simple random sampling technique was used, for the study of tryponosomes infection rates in *G. pallidipes* and in *G. fuscipes fuscipes* in Gojeb valley of Ghibe Omo river system according to [18] with 95% confidence interval and at 5% desired absolute precision, assuming the expected prevalence of the trypanosomes in the study area to be 50%. Accordingly a total of 384 flies, 200 *G.pallidipes* (109 males and 91 females) and 184 *G. fuscipes fuscipes* (84 males and 100 females) were dissected to determine the infection rate with trypanosomes in the Gojeb valley.

Study Methodology

Collection of Tsetse Flies: Tsetse flies were trapped using monopyramidal traps which were deployed in the side of Gojeb valley and in the near by savannah vegetation. The traps were baited with 1- octen - 3-ol, acetone and cow urine filled in separate bottles to attract tsetse flies. To prevent the ascent of ants up on the poles towards the collecting cage, the underneath of each pole was smeared with grease.

Dissection of Tsetse Flies and Microscopic Examination: Before starting to dissect tsetse flies, the species and sexes of each fly was identified and recorded on data record sheet. In *Glossina pallidipes* the last two tarsal segments of the hind leg has dark color, all tarsal segments of the front leg had pale colour, while in *G. fuscipes fuscipes,* most of the tarsal segments of the hind leg had dark colour and the general color of the abdomen was very dark on the dorsal side. Tsetse flies were identified as male or female by examine the posterior end of the abdomen. The male fly has a lump on the ventral side of the abdomen (hypopygium) at the posterior end but not in the female flies [10, 19]. Wings were removed from the flies. Then the legs of the flies were removed. The dissection was carried out as described by the FAO [10] Training manual for tsetse control personnel. The freshly killed tsetse flies were dissected under a dissecting microscope by using 0.9% saline solution. The proboscis, mid-gut and salivary glands were examined [19].

Data Analysis: The data was entered into Microsoft excel and analyzed by SPSS V 16.0 software at 95% confidence interval. The overall infection rates of trypanosomes in *G. pallidipes* and in *G. fuscipes fuscipes* were calculated as the number of microscopically positive flies in each species divided by the total number of dissected flies and multiplied by 100. The significant difference of the trypanosomes infection rates in relation to the risk factors was tested by chi-square (P^2).

$$\text{Infection rate (IR)} = \frac{\text{Number of tsetse flies infected}}{\text{Total Number of tsetse flies dissected over a given period}} \times 100$$

RESULTS

A total of 384 tsetse flies (200 *G. Pallidipes* and 184 *G. fuscipes fuscipes*) were dissected to determine the infection rates by different trypanosomes species. Out of which 49 *G. pallidipes* and 42 *G. fuscipes fuscipes* were detected to be positive for trypanosome species. There was no significant difference in the infection rate with variation of Glossina species (P> 0.05) (Table 1).

A total of 109 male *G. pallidipes* were dissected and trypanosomes parasite were identified in the proboscis, salivary glands and mid-gut with an infection rate of 14.68% for *T. vivax*, 2.75% for *T.congolense* and 0.92% for *T. brucei* with an overall infection rate of 18.35%. A total of 91 female *G. pallidipes* fly species were dissected and the infection rates with trypanosomes were found to be 18.68% for *T. vivax*, 13.19% for *T. congolense* and 0% for *T. brucei* with an overall infection rate of 31.87%. The infection rate was significantly different with variation in sex (P< 0.05) (Table 2).

A total of 84 male *G. fuscipes fuscipes* fly species were dissected and trypanosomes parasites were identified in the proboscis, mid-gut and salivary glands with an infection rate of 14.29% *T.vivax*, 7.14% *T. congolense* and 0% *T. brucei* with an overall infection rate of 21.43%. Again a total of 100 female *G. fuscipes fuscipes* fly species were dissected and the infection rate of trypanosome parasites were found to be 15% for *T. vivax*, 9% for *T. congolense* and 0% for *T. brucei* with an overall infection rate of 24%. However the difference in trypanosome infection rates was not statistically significant (P>0.05) between male and female *Glossina fuscipes fuscipes* fly species.

Table 1: Infection of Glossina species in Gojeb Valley with different trypanosomes

		No of flies infected by trypanosome species			
Tsetse fly species	No. of dissected flies	*T. congolense*	*T. vivax*	*T. brucei*	Overall infection rates (%)
G. pallidipes	200	15 (7.5%)	33 (16.5%)	1 (0.5%)	49 (24.5%)
G. fuscipes fuscipes	184	15 (8.2%)	27 (14.7%)	0 (0%)	42 (22.8%)
Total	384	30 (?%)	60 (?%)	1 (?%)	91 (?%)

$P^2 = 3.56$, P = 0.62

Table 2: Infection rates of male and female *Glossina pallidipes* flies species

		No of infected flies with trypanosome species			
Sex	No of dissected flies	*T. congolense*	*T. vivax*	*T. brucei*	Over all infection rates (%)
Male	109	3 (2.75%)	16 (14.68%)	1 (0.92%)	20 (18.35%)
Female	91	12 (13.19%)	17 (18.68%)	0 (0%)	29 (31.87%)
Total	200	15 (7.5%)	33 (16.5%)	1 (0.5%)	49 (24.5%)

$P^2 = 2.782$, P = 0.045

Table 3: Infection rates of male and female *Glossina fuscipes fuscipes* flies species

		No of infected flies with trypanosome species			
Sex	No of dissected flies	*T. congolense*	*T. vivax*	*T. Brucei*	Overall infection rates (%)
Male	84	6 (7.14%)	12 (14.29%)	0 (0%)	18 (21.43%)
Female	100	9 (9%)	15 (15%)	0 (0%)	24 (24%)
Total	184	15 (8.2%)	27 (14.7%)	0 (0%)	42 (22.8%)

$P^2 = 4.34$, P = 0.287

DISCUSSION

The study determined the overall trypanosomes infection rates to be 24.5% and 22.8% in *Glossina pallidipes* and *Glossina fuscipes fuscipes* respectively. The infection rate in *G. pallidipes* is higher than in *G. fuscipes fuscipes*, however statistical analysis of the results showed that there is no significant difference (p> 0.05). These rates are higher than the results obtained from previous study at Mettu Sor hydroelectric power station in *G. pallidipes* and *in G. fuscipes fuscipes* which revealed infection rates of 12.8% and 6.5% in *G. pallidipes* and in *G. fuscipes fuscipes* respectively [20]. In both studies, the infection rate in *G. pallidipes* is higher than in *G. fuscipes fuscipes* although, the studies were conducted at different areas. Waiswa *et al.* [19] reported trypanosome infection rate in *Glossina fuscipes fuscipes* with overall infection rate of 1.55% in south eastern Uganda. On the other hand Mohamed and Dairri [21] reported trypanosome infection rate in *Glossina pallidipes* with overall infection rate of 2.6% and 1.5% in the wet and dry seasons respectively at Mareery in Somalia.

The infection rates of *Glossina pallidipes* in the current study were 16.5% by *T.vivax*, 7.5% by *T. congolense* and 0.5% by *T. bruce.* while in *G. fuscipes fuscipes*, the infection rate was 14.7% by *T. vivax*, 8.2% by *T. congolense* and 0% by *T. brucei*. The infection rate of *T. vivax* group was more than twice that of *T. congolense* group in *G. pallidipes*, while in *G. fuscipes fuscipes*, infection rate of *T. vivax* group is almost twice that of *T. congolense* group. However, the lower rate of infection was recorded in *brucei* group in both species of flies. This is in agreement with the results of Tesfaye [20] at Mettu Sor hydroelectric power station in *G. pallidipes* where the infection rate with *T. vivax* was 8.5%, 4.3% with *congolense* and 0% with *T. brucei*, while in *G. fuscipes fuscipes*, the infection rate was 4.3% with *T. vivax*, 2.2% with *T.congolense* and 0% with *T. brucei*. This is also inline with Lojino *et al.* [22] who found the Trypanosome infection rate of 4.32% for *T. vivax* and 1.15% for *T. congolense* in *Glossina fuscipes fuscipes* in Buvuma Island, in Uganda. Woolhouse *et al.* [23] reported trypanosome infection rate of 6.2% for *T. vivax* and 3.1% for *T. congolense* in *Glossina pallidipes* in Luangwa Valley, Zambia. The infection rates of *T. vivax* group were higher than *T.congolense* group in both types of tsetse flies in the above mentioned counties.

In the present study, the infection rates with trypanosomes were higher in female flies than in male flies in both *G. pallidipes* and *G.fuiscipes fuscipes* and the difference was statistically significant (P<0.05) in trypanosome infection rate between male and female *G. pallidipes* fly species. However, no statistical significant difference (P> 0.05) between trypanosome infection rates of male and female *G. fuscipes fuscipes* fly species. When sex is considered, female flies are known to live longer than males and hence their infection rates will be higher than males [10, 24].

The results of the present study indicated higher trypanosome infection rates in *Glossina pallidipes* and in *Glossina fuscipes fuscipes* than trypanosome infection rates of *Glossina pallidipes* and Glossina *fuscipes fuscipes* indicated in other countries like Uganda, Somalia and Zambia. The difference in the trypanosome infection rates in these tsetse flies might be due to differences in their hosts, in the investigated area, the average age of the fly population and the temperature of the environment.

CONCLUSIONS AND RECOMMENDATIONS

The present results showed higher infection rates of trypanosomes in *G. pallidipes* than in *G. fuscipes fuscipes* however, the difference was not statistically significant. There was statistical significant difference between male and female *Glossina pallidipes* fly species in trypanosomes infection rates, but not in *Glossina fuscipes fuscipes* fly species. The result proved that *Trypanosoma T. vivax* was much common parasites than *T. congolense* and *T. brucei* and *T. brucei* was the least one. Based on the above conclusive remarks the following recommendations are forwarded:

- It would be necessary to apply large scale tsetse control method in the Gojeb valley areas, by giving priority for *G. pallidipes.*
- Further studies should be under taken in order to give priority in the control of tsetse flies to alleviate the serious Trypanosomosis problem in the study area, to prevent further spread of tsetse flies and to identify the most dangerous parasite and to take specific measures for that particular parasite.

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