Trypanosome Infection Rate in Glossina tachinoides: Infested Rivers of Limmu Kosa District Jimma Zone, Western Ethiopia

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Research note

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Abstract

Objective: Trypanosomosis is a disease of domestic animals and humans resulting from infection with parasitaemic protozoa of the genus Trypanosoma transmitted primarily by tsetse flies and other hematophagous flies. The study was conducted to estimate the infection rate of trypanosome in vector flies and involved parasite species.

Result: The study result indicated that there was only one species of Tsetse fly Glossinatachinoides detected with high Flay/Trap/Day = 4.45. Total of n=284 tsetse flies were dissected and n= 5 positive for Glossinatachinoidesresulting in 1.76% infection rate. Higher trypanosome infections were observed in female tsetse with significant infection rate of 1.41%, n=4 and 0.35%, n=1 in males. Furthermore, 1.06% of the trypanosome infections carried by Glossinatachinoides were classified as Trypanosomavivax and the remaining 0.70% was Trypanosomacongolense.The study confirmed the absence of human trypanosomosis in study area with only identified trypanosome parasites were Trypanosomavivax and Trypanosomacongolense. However, the resulted FTD= 4.45 recommend control and suppression of the vector and parasite is mandatory due to Pathogenic Animal Trypanosomosis.

Introduction

Trypanosomosis is a disease of domestic animals and humans resulting from infection with parasitaemic protozoa of the genus *Trypanosoma* transmitted primarily by the tsetse fly and also by other hematophagous flies. Trypanosome parasitizes all classes of vertebrates including human beings and it is predominantly a parasite of blood [1]. Its prevalence depends on the distribution and capacity of *Glossina* species responsible for transmission. From the three groups (based on habitat) of *Glossina,* the savannah and Palpalis species are the most important since they inhabit areas suitable for grazing and watering lands of animal production [2]. At the study area, the most expected infestation of *Glossina* species was *G. tachinoides,* hence the objective of this research was to study the infection rate of the parasite in the vector flies and involved parasite species.

Materials And Methods

Description of the study area

Limmu Kosa is one of the districts located in the Oromia Regional State of Ethiopia Jimma Zone. It is bordered on the South by Kersa, on the Southwest by Mana, on the West by Gomma, on the Northwest by the Didessa River which separates it from the Illubabor Zone, on the north by Limmu Sekka, on the Northeast by the Gibe River which separates it from the West Shewa Zone and the Southern Nations, Nationalities and Peoples Region, on the East by Sokoru, and on the Southeast by Tiro Afeta. The administrative center of the District is Genet. The altitude of the District ranges from 1200 to 3020 meters above sea level. Rivers include the Awetu and the Dembi; notable landmarks include Lake Cheleleki and the Bolo Caves. A survey of the land in this District shows that 34.9% is arable or cultivable (24.6% was

under annual crops), 20% pasture, 39.7% forest, and the remaining 15.4% are considered degraded or built-up areas. Fruits and sugar cane are important cash crops. Coffee is another important cash crop of this district Over 50 square kilometers are planted with this crop [3].

Study design and methodologies

Total of 70 monoconical standard traps were deployed in main Didessa River and most tributaries located in different peasant associations with octenol (1-oct-3-nel), acetone and three weeks old cow urine baits [4]. All odors were placed on the ground about 30 cm upwind of the trap. The poles of traps were greased to prevent fly predators, mainly ants. Traps were allowed to stay at the site of deployment for a period of 48 h before collection. After 48 h of deployment, the catchments of each trap were sorted by fly species and then counted, identified and analyzed. The apparent density of the tsetse flies was calculated as the number of tsetse catch/trap/day [5]. Sex of all collected flies was identified by observing the posterior end of the ventral aspect of the abdomen by hand lens and stereomicroscope hence male flies were identified by enlarged hypopygium in the posterior ventral part of the abdomen which is absent in female flies.

In the study standard procedures were used by dissecting flies, detect the parasite from different body parts and Giemsa stained smears for confirmatory morphological identification of detected parasite using oil immersion microscope. The dissection procedure was carried out as described by the FAO Training manual for tsetse control personnel started by removing wings and legs after wing fry analysis was performed and the age of flies was recorded. Then, freshly killed tsetse flies were dissected under a dissecting microscope by using 0.9% normal saline. Trypanosome infections in dissected body parts of tsetse flies (i.e. midgut, salivary gland and mouthpart or proboscis) were identified using a compound microscope at a magnification of ×40 times [6]. Parasites detected in the midgut, salivary glands, and mouthparts (proboscis) were considered as Trypanozoon (*T. brucei*), those detected in the mouthparts (proboscis) and midguts were Nanomonas (*T. congolense*), and those found in the mouthparts (proboscis) only was considered in the group of Duttonella (*T. vivax*), immature infections considered when only found in the midgut. Finally, confirmation made by Giemsa stained smears (slides) detected by ×100 times compound microscope magnification using oil immersion [7, 13]. The Infection rate of the parasite (IR) was calculated using the following formula [6]:

$$\textbf{Infection rate (IR)} = \frac{\text{Number of tse tse flies infected} \times 100}{\text{Total number of dissected flies}}$$

Data analysis

Data collected from each deployed trap analysis were coded into appropriate variables and entered in Microsoft excel, 2010 spreadsheet. All statically analyses were performed using STATA- 12 software. The

prevalence was calculated for all data as the number of infected individuals divided by the number of individuals sampled times 100. Categorical data were analyzed by using the chi-square (c2) test of independence. In all cases, 95% of confidence intervals were used and p-value less than 0.05 were considered significant [8].

Results

Total of 623 tsetse flies were caught from 70 deployed mono conical traps during the study period. The apparent fly density was found to be 4.45 Flies/Trap/Day for *G. tachinoides* with peak infestation was resulted in Busase Peasant Association (FTD = 1.85) and low (FTD = 0.41) in Adis limat.

[Insert Table 1 here.]

Total of n = 284 tsetse flies were dissected and n = 5 positive for *G. tachinoides* resulting in 1.76% infection rate. More trypanosome infections were observed in female tsetse with significant infection rate of 1.41%, n = 4 and 0.35%, n = 1 in males (Table 2). Generally, 1.06% of the trypanosome infections carried by *G. tachinoides* were classified as *T. vivax* and the remaining 0.70% was *T. congolense.*There was strong difference between an age related effects in the number of trypanosome infections with all of infected flies were older than 31 days when compared to those aged < 20 days $p < 0.001$. There was also strongly significant difference $p < 0.001$ between hunger stages which indicated that there was no infection of trypanosomes in teneral flies as more feeding and engorged flies were highly susceptible.

[Insert Table 2 here.]

Discussion

The study result was in agreement with Vreysen *et al.* [9], who discussed the distribution and abundance of tsetse flies to be closely associated with the number and habitats of certain wild animals and low human population areas. Moreover, it is also in line with different similar researches conducted in different study areas FTD = 5.58 in Sokoru District [10] and FTD = 10.9 in Botor Tollay District, of Jimma Zone as result of similar types of vegetation [11]. Apart from this fact, there are other findings significantly vary from this result in some Southern Regions of Darmallo District FTD = 23 [12]. The overall trypanosome infection rate of 1.76% is not in agreement with Desta, *et al.* 2013 [13], 7.5% due to species involved *G. morsitans sub mor.* According to Bourn, Shaw and Torr [14], relatively low fly infection rate of 1.76%, in *G. tachinoides may* be due to low tsetse challenge which could be explained by the lower fly-animal contact at study area and trypanosome-binding lectin proteins (D+ glucosamine and D+ galactosamine) which makes *G. tachinoides (*riverine group)relatively resistant for infection than *G. morsitans sub mor* (Palpallis group). The reason for a higher infection rate in females might be due to their better life expectancy and lower infection rate found in male flies can be explained by the low average age of trapped male flies (20 days or less).

According to Adams *et al.* [15], *T. vivax* is considered to be one of the most important of the Salivarian trypanosomes because of its pathogenicity to cattle and its relatively high infection rate in *G. tachinoides* and other tsetse fly species.

Conclusion

The study was conducted to estimate the infection rate of trypanosome in *G. tachinoides* Tsetse flies in the study area which helps to implement appropriate methods for control and suppression of the disease and its vector. The study confirmed the absence of human trypanosomosis with only identified trypanosome parasites were *Trypanosoma vivax* and *Trypanosoma congolense.* However, the resulted FTD = 4.45 recommend control and suppression of the vector and parasite was mandatory due to Pathogenic Animal Trypanosomosis.

Limitation: In this study trypanosome parasite responsible for human trypanosomosis was not detected (found). The study couldn't include blood feeding preference of involved vector (G. *tachinoides)* due to lack of PCR (Polymerase Chain Reaction).

Declarations

List of abbreviations:

FTD = Flies/Trap/Day, IR = Infection Rate, G. tachinoides = Glossina tachinoides, G. morsitans sub mor = Glossina morsitans sub mor, T. congolonse = Trypanosoma congolonse, T. vivax = Trypanosoma vivax, T. brucei = Trypanosoma brucei.

Ethics approval and consent to participate:

The National Institute for the Control and Eradication of Tsetse flies and Trypanosomosis, Ministry of Agriculture, Ethiopia, authorized the fieldwork. The purpose of the study was clearly explained to veterinary officers and local administrators and informed consents were obtained through verbal consent from institute technique committee. Participants' involvement in the study was on voluntary basis; conducted entomological survey was environmentally friendly.

Availability of data and material:

Not applicable in this section however, all required Data will be available on request of correspondent Author.

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Authors' Contributions:

The following statements should be used conceptualization, D. A. and methodology, B. M.; software, D. A.; validation, B.M and D. A.; formal analysis, B. M.; investigation, B. M.; resources, B. M.; data curtain, B. M.; writing—original draft preparation, B. M.; writing—review and editing, B.M; visualization, B. M.; supervision, B. M.; project administration, B. M. All participant authors read and approved the final manuscript.

Consent for publication:

Not applicable.

Competing of interests:

The authors have not declared any conflict (competing) of interests and not applicable.

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Tables

Due to technical limitations, Tables 1 & 2 are only available for download from the Supplementary Files section.

Supplementary Files

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- supplement1.pdf
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