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Bovine Trypanosomosis and Tsetse Fly Distributions as a Vector in Hababo Guduru District, Horo Guduru Wollega Zone, Oromia Regional State, Ethiopia

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Abstract: The study was conducted from March to August 2020 to determine the status of bovine trypanosomosis and *Glossina* species in Hababo Guduru district. A parasitological study using buffy coat technique was used to determine prevalence of trypanosomosis. Among 384 cattle selected randomly from the study population of two representative Peasant Associations(PAs) of Ref toko tane and Biftu nu bate kidame 22 (5.73%) animals were found to be positive for trypanosomosis infection. The infection rate was found to be different between species; higher prevalence of *T.vivax* 14 (3.65%) than *T.congolense* 6 (1.56%) and lower 2 (0.52%) mixed infection of these two species was recorded. The highest prevalence of trypanosomosis was observed in poor 13 (9.6%) body condition than that of those with medium 6 (4.7%) and good 3 (2.5%) body condition. Furthermore, the infection rate was higher, 19 (12.9%) in animals with PCV value of smaller than the normal mean value and low infection rate 3 (1.3%) was recorded in animals with PCV value greater than the normal mean value. A total of 54 traps were deployed in Ref toko tane and Biftu nu bate kidame PAs and 119 flies were caught. All flies were *Glossina morsitans* 119 (100%). Of all 119 *G. morsitans* 41 (34.45%) were male while 78 (65.55) were female. The overall apparent density of tsetse flies was 1.1 fly/trap/day. The result dictated that as tsetse fly is an inciting agent for animal trypanosomosis; there should be strategic vector control measures in the area.

Key words: Infection · Buffy Coat · PCV · Body Conditions · Prevalence · Apparent Density · Traps and Attractants

INTRODUCTION

Ethiopia is known for its large and diverse livestock resource endowments. Livestock is primarily kept on small holdings where it provide drought power for crop production, manure for soil fertility and fuels, serves as a sources family diet and sources of cash income (from livestock and livestock products). Despite large livestock population, Ethiopia fails to optimally utilize this resource due to different constrains facing the livestock subsector [1].

Trypanosomosis is a complex immunosuppressive disease caused by unicellular, eukaryotic, hetero specific haemo- parasites (trypanosomes) of blood and other tissues of vertebrates including cattle and man [2]. Trypanosomes are flagellated protozoan parasites that live in the blood and other body fluids of vertebrate hosts [3]. Bovine trypanosome is one of the diseases that are caused by this flagellated protozoal parasite belonging to the genus *Trypanosoma* [4]. Trypanosomosis has long been recognized as a massive constraint on animal husbandry, livestock production and mixed farming in vast areas of rural sub-Saharan Africa [5]. Since more than 90% of crop production in Ethiopia are dependent on animal draught power mainly on ploughing oxen, many large fields lie fallow due to lack of these animals in trypanosomosis infested area [6], which worsen the food supply and living conditions in affected areas.

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In Ethiopia, trypanosomosis is widespread in domestic livestock in the Western, South and South-western lowland regions and the associated river systems (Abay, Ghibe Omo and Baro/Akobo). Locally in Amharic language trypanosomosis in cattle referred, as "Gendi" is a serious constraint to livestock production in areas of the north and southwest Ethiopia at an altitude of below 2000 m.a.s.l [7].

Tsetse fly is a blood sucking insect, genus *Glossina* with about 31 different species. The fly is found in three different ecological conditions that means along river basins (riverine group), in the Savanna grassland (Morsitans group) and in dense forest (Fusca group) [8]. Among the 31 species of tsetse flies five species are found in Ethiopia; these are *Glossina morsitans submorsitans*, *Glossina pallidipes, Glossina tachinodes*, *Glossina fuscipes fuscipes* and *Glossina longipennis*. Tsetse flies in Ethiopia are confined to southern and western regions between longitude 33° and 38° East and latitude 5° and 12° North which amounts to about 200, 000 Km^2. Tsetse infested areas lied in the low lands and also in the river valleys of Blue Nile, Baro Akobo, Didessa, Ghibe and Omo. Out of the nine regions of Ethiopia five (Amhara, Beninshangul Gumuz, Gambella, Oromia and Southern Nation Nationalities and peoples) are infested by more than one species of tsetse flies [9]. Tsetse fly is the vector for the parasite trypanosome, which causes Animal trypanosomosis. Trypanosomosis is an endemic disease to east Africa including Ethiopia [10].

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The effects of trypanosomosis is not only the direct losses resulting from mortality, morbidity, infertility of the infected animals and costs of controlling the disease, but also due to indirect losses, which include exclusion of livestock and animal power based crop production from the huge fertile tsetse infested areas [11].

Bovine trypanosomosis is a disease that affects cattle, resulting from infection with protozoa of the genus Trypanosoma transmitted primarily by tsetse fly and also by other haematophagous flies. *T. vivax, T. congolense*, *T. brucei brucei* and *T. simiae* are the four main species responsible for African trypanosomosis affecting virtually all domestic mammals. *T. vivax and T. congolense* are the main pathogens of cattle [12].

Tsetse flies infest 10 million square kilometers of Africa involving 37 countries. Hence, nagana is today the most important disease of livestock in the continent. Since nagana is a wasting disease, affected animals are chronically unproductive in terms of milk, meat, manure and traction and the mortality rate can be high [13]. The disease in Africa costs livestock producers and consumers an estimated US$1340 million annually [14].

Tsetse Fly and Parasitic Investigation: Monoconical standard traps were to be deployed in the study area for tsetse fly trapping. All the traps were baited uniformly with octenol (1-oct-3-nel), acetone and phenol. All odors were placed on the ground about 30 cm upwind of the trap. The apparent density of the tsetse fly was calculated as the number of tsetse catch/trap/day [15]. Blood sample was collected by puncturing of the marginal ear vein of each animal with a lancet and drawn directly into heparinized capillary tube and centrifuged with capillary hematocrit centrifuge. Positive samples were further processed for thin blood smear for confirmation of trypanosome species using their morphological characteristics with Giemsa staining techniques [16, 17].

Objective: The study was undergone to determine the status of trypanosomosis and *Glossina* species distribution in Hababo Guduru district.

MATERIALS AND METHODS

Study Area: The present study was carried out in selected villages of Hababo GuduruWoreda which is found in Oromia National Regional state, western Ethiopia. The woreda is located at 306 km away from Addis Abeba and has a total population of 59, 191 and land area of about 97352.031 hectares. The woreda had 14 kebeles and was bounded by guduru and chelia woreda at south, Gindeberet at east and Amhara National Regional State at north west patticularly sharing borders with Abay kola, Guzamin, basoliban, dinguabe, anjimo, zenbol yechara and kome zome kebeles [18].

The study area has an altitude range of 1500-2400M above sea level and receives the rain fall of 500-1500 ml annually. The temperature range is 18°C to 31°C and the annual average is 25°C according to the Hababo Guduru Woreda Agriculture and rural development office [18].

Agro-climatic classification of the woreda is low land 35% and midland 65 % coverage. The farming practice in the area is mixed where a crop production and all classes of livestock except camels are found, population of cattle 75886, sheep 19722, goats 16541, horses 1859, donkey 9671, mules 801 and poultry 52562 [18].

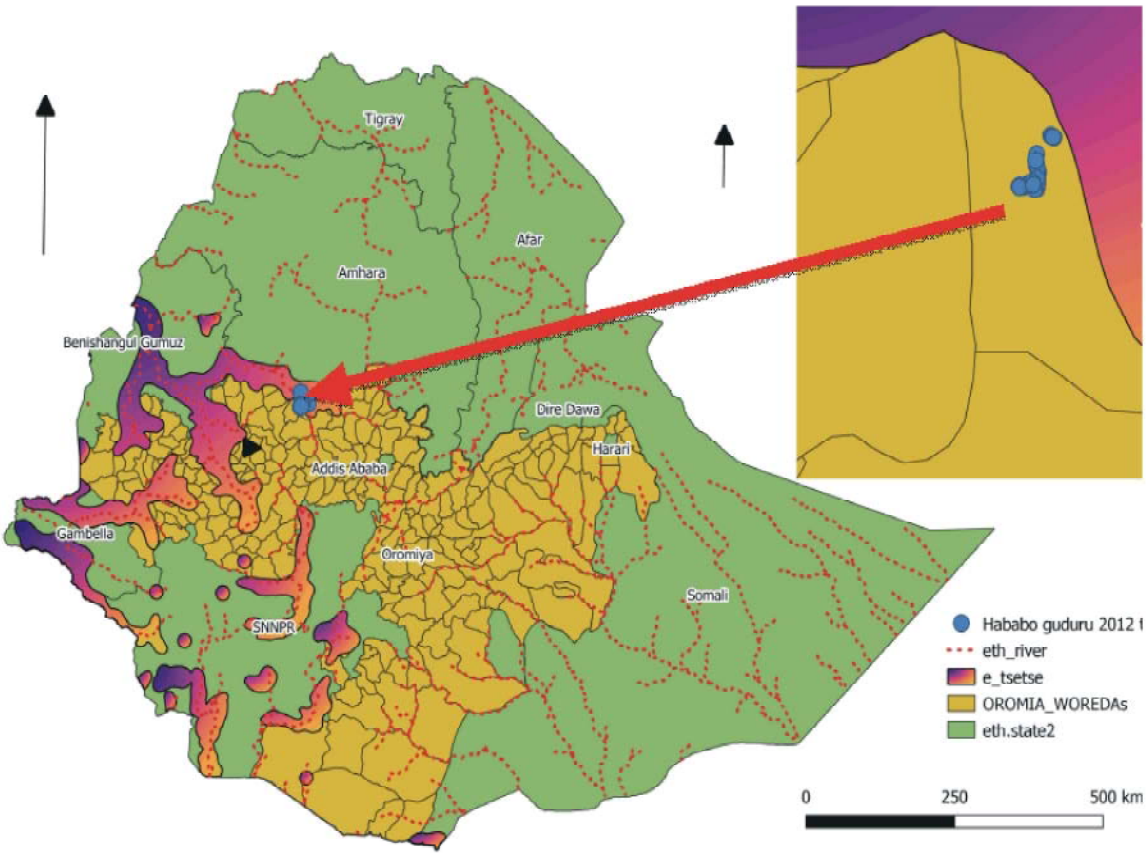

Fig. 1: Ethiopian Map illustrating Hababo Guduru woreda; Ref toko tane and Biftu nu bate kidame kebele by QGIS 3.4

Study Population: The study was conducted on local zebu cattle. These animals were raised in different villages of Hababo Guduru district. The animals examined in this particular study were representing different kebeles, sex, body condition and age groups (young and adult) and reared in extensive management system.

Study Design and Sample Size Determination: A cross sectional study was conducted in order to determine the prevalence of bovine trypanosomosis and associated risk factors from selected kebeles of the woreda. The size of sample was determined by the following formula [19] with 95% confidence and an expected prevalence of 50 and at 5% absolute precision. Based on the formula the total sample size was 384.

$$N = \frac{1.96^2 \times P(1-P)}{d^2}$$

where,
N = The sample size
P = The expected prevalence
d = The desired absolute precision

Sampling Procedures: The sampling site (marginal ear vein) of the cattle was prepared and disinfected with ethanol. Then the ear vein was punctured by lancet and the blood sample was collected by heparinized capillary tube. One end of the tube was sealed by crystal seal and finally, the blood samples were immediately transported to Dedu, the town of Hababo Guduru district, health post laboratory in tightly closed ice box.

Sample Processing and Examination Techniques

Thin Blood Smear: A small drop of blood from a micro-hematocrit capillary tube was applied to a clean slide and spread by using another clean slide at an angle of 45°. The smear was air dried and then fixed for 2 min in methyl alcohol. The thin smear was flooded with Giemsa stain (1:10 solution) for 30 min. Excess stain was drained and washed by using distilled water. Then it was allowed to dry by standing up right on the rack and examined under the microscope (x100) oil immersion objective lens [20].

Buffy Coat Technique: Heparinized micro haematocrit capillary tubes, containing blood samples were

centrifuged for 5 min at 12, 000 rpm. After the centrifugation, trypanosomes were usually found in or just above the buffy coat layer. The capillary tube was cut using a diamond tipped pen 1 mm below the buffy coat to include the upper most layers of the red blood cells and 3 mm above to include the plasma. The content of the capillary tube was expressed onto a glass slide and covered with cover slip. The slide was examined under x40 objective and x10 eye piece for movement of parasite [1]. Trypanosoma species were identified according to their morphological descriptions on Giemsa stained blood film as well as movement in wet film preparations [12].

Data Management and Analysis: The data was analyzed using SPSS version 20 Statistics and Pearson's Chi square tests was used to analyze the association between trypanosome infection and attributes of study animals such as age, sex, body condition and PCV range [19].

RESULTS

In this study among five existing species in Ethiopia; one species which is savanna species, *G. morsitans submorsitans* were identified in Ref toko tane and Biftun nu bate kidame peasant associations (PAs). Entomological survey was undertaken deploying 54 monoconical traps at Ref toko tane and Biftun nu bate kidame peasant associations. For the attraction of the tsetse flies to traps Acetone, Octanol and Phenol was used locating 30cm above the ground under each traps deployed. From one hundred nineteen (119) total tsetse flies cought 45 male and 23 female tsetse flies were from Ref toko tane while 18 male and 33 female from Biftun nu bate kidame PAs. The FTD (which is the calculation of Fly cought per traps per day or Fly/Trap/Day) of Ref toko tane was 1.23 (68/27/2) and that of Biftun nu bate kidame was 0.9 4(51/27/2). The overall FTD of the woreda,

Table 1: Tsetse fly distributions in Ref toko tane and Biftu nu bate kidame PAs

		Tsetse fly species counted			
		Glossina morsitans submorsitans		Total	
Peasant association (PA) (Trap deployment site)	No of trap deployed	Male	Female	Total	FTD
Ref toko tane	27	23(33.82%)	45(66.18%)	68(57.14%)	1.23
Biftu nu bate kidame	27	18(35.29%)	33(64.71%)	51(42.86%)	0.94
Total	54	41(34.45%)	78(65.55%)	119(100)	1.1

Table 2: Trypanosomosis in different peasant associations, PCV, sex, the infection in different age groups and body condition status of the cattle

Variables	No of Negative values	No of positive values	Total	
		Peasant Association (PA)		
Ref toko tane	194(93.7%)	13(6.3%)	207(53.9%)	
Biftu nu bate kidame	168(94.9%)	9(5.1%)	177(46.1%)	
Total	362(94.27%)	22(5.73%)	384(100)	
		PCV		
≤ 24	128(87.1%)	19(12.9%)	147(38.3%)	
> 24	234(98.7%)	3(1.3%)	237(61.7)	
		Sex		
Male	167(92.3%)	14(7.7%)	181(47%)	
Female	195(96.1%)	8(3.9%)	203(53%)	
	362(94.27%)	22(5.73%)	384(100)	
		BCS		
Good	118(97.5%)	3(2.5%)	121(31.5%)	
Medium	122(95.3%)	6(4.7%)	128(33.3%)	
Poor	122(90.4%)	13(9.6%)	135(35.2%)	
Total	362(94.27%)	22(5.73%)	384(100)	
		Species		
T. vivax	14(3.65%)			
T. congolense	6(1.56%)			
Mixed	2(0.52%)			
Total	22(5.73%)			
Young (1-3)	98(94.2%)	6(5.8%)	1.56%(384)	104(27.1%)
Adult (> 3)	264(94.3%)	16(5.7%)	4.17%(384)	280(72.9)
Total	362(94.27%)	22(5.73%)	5.73%(384)	384(100)

Hababo Guduru was 1.1 (119/54/2). Due to wide expansion of Agriculture and Fincha Sugar Factory particularly from the west of the woreda which particularly sharing a border with Ref toko tane kebele (PA) the habitat will no longer enhance the existence of the vector *Glossina*.

From the total cattle examined (n=384), 22(5.73%) were found to be infected with trypanosomes. Out of the total examined, 13(3.4%) cattle were positive for trypanosomosis in Ref toko tane and 9(2.3%) in Biftun nu bate kidame PA. infection rate was 7.7% in male while 3.9% in female cattle population among sampled. The overall mean PCV distribution of study animals was found to be 25.67% Higher prevalence of trypanosomosis was recorded in anemic cattle with PCV value less than or equal to 24 (PCV= 24) than those with PCV values within the normal range (25-48) ranges (Table 2). The proportion of trypanosome infection with species level indicated 6 (1.56%) were found to be *T. congolense*, while 14 (3.65%) *T. vivax* and 2 (0.52%) were the mixed, that means *T. congolense* and *T. vivax* (Table 2). The prevalence in male was higher compared in femal. Higher prevalence was recorded in adult animals compared to young age categories. Higher prevalence was recorded in animals with a poor body condition 13 (9.6%) than in those in medium 6 (4.7%) and good body condition 3 (2.5%). This dictates as nutrition has a lasting support in boosting immunity.

DISCUSSION

In the present study, the entomological survey of two representative kebeles or peasant associations of Ref toko tane and Biftun nu bate kidame revealed that the existence of only one savanna species of tsetse fly among the five species which existed in Ethiopia. The *Glossina* species that was identified upon deployment of 54 monoconical traps in different PAs was *G.m.submorsitans* and it is a savanna fly in nature. These tsetse species was reported by Lelisa [21] in different lowland areas of Southwestern Ethiopia. The total tsetse flies caught upon deploying traps in two PAs was one hundred nineteen (119) (100%) and it was *G.morsitans*. The apparent density of *G. morsitans* was 1.23 and 0.94 fly/trap/day in Ref toko tane and Biftun nu bate kidame, respectively. This result is too lower compared the Omobeyan FTD report of Aliyu [22] and Damena [23] report in Chewaka District Buno Bedelle Zone, Oromia National Regional State while to some level in agreement with the Dagnachew [24] report. This difference could be the result of variation in altitudinal, moisture and nature of vegetation Murray [25] and ecological disturbance incase Hababo Guduru from Agricultural expansion of sugarcane for Fincha Sugar Factory. The sex category of tsetse flies caught implies as female outnumbered the male accounting 78 (65.55%) and 41 (34.45%) respectively. In this study the female were higher in number compared male, this might be due to the longer lifespan of female than male [22].

The prevalence of bovine trypanosomosis in Hababo Guduru areas, which was located along the Abay kolla valley during the study period was found to be 5.73%, this figure is fairly similar with the report of the mandura district, north western Ethiopia which was 5.43% [21]. Prevalence difference between Ref toko tane and Biftun nu bate kidame was not observed significant (P>0.05) (P=0.982) implying that having similar ecology and altitude range. The blood parasitological investigation of the two PAs revealed that as two species of trypanosomes, *T. vivax* and *T. congolense* and their mixed infection prevails in Hababo Guduru district. The result dictated that as *T. vivax* 14 (3.65%) infection rate outnumbered *T. congolense* 6 (1.56%) infection rate and their mixed infection 2 (0.52%) rarely observed. Our study was in agreement with the report of Aliyu [22] where *T. vivax* was the prevalent species. The prevalence of trypanosomosis in male and female animals was 7.7% and 3.9% respectively. The difference in prevalence between sex groups was statistically significant (p<0.05) (P<0.001), this could be incase of low fly contact of female animals compared male, it is usual female animals specially lactating cows graze nearer to the home and they unlikely go like male animals to grazing land far from the home or to the lowland area. The other inciting factor could be higher production of CO_2 by ox than cows which could be an attractant for vectors [26]. Prevalence between age and different body condition groups revealed as higher in adult (4.17%) lower in young (1.56%) and higher infection rate in poor (9.6%) than medium (4.7%) and good body condition (2.5%). This report coincides with that of Morka [1] and the difference could be due to contributions of maternal immunity in young and nutrition effect in different body condition scores. The PCV distributions of study animals was normal with the mean of 25.67% (standard deviation of 5.93 and P value 0.001) and infection rate was higher 19 (12.9%) in animals with below the mean PCV value (Table 2) and low infection rate 3 (1.3%) were recorded in animals with the PCV above the normal mean value. This dictated as trypanosomosis is among the inciting factor for the occurrence of anemia and our finding is in agreement with the finding of

Behablom [27]. Therefore, vector controlling and frequent chemotherapeutic measures along good husbandry management for cattle should mitigate the challenges of trypanosomosis in Hababo Guduru District.

CONCLUSION AND RECOMMENDATION

Hababo Guduru District is a land of a variety of resource endowments among the districts in Horo Guduru Wollega Zone. And the district is rich in livestock resources, besides a variety of constraints to the livestock subsector. Bovine Trypanosomosis and Tsetse Fly challenge are the frontline constraints to the livestock subsector development. Therefore, there should be strategic vector control measures, aimed for eradication of tsetse fly in the area.

REFERENCES

1. Morka Amante and Ebisa Bane and Eyob Hirpa, 2014. Prevalence of Bovine Trypanosomosis in Guduru District, Guduru, Horo Guduru Wollega, Ethiopia. African Journal of Basic & Applied Sciences, 6(4): 98-102, 2014.
2. Uilenberge, G., 1998. A field guide for diagnosis, treatment and prevention of African animal trypanosomosis. Adopted from the original edition by Boyt W.P. FAO, Rome, pp: 43-135.
3. International des Epizooties (OIE) Terrestrial Manual, 2013. Trypanosomosis (Tsetse transmitted), http://www.oie.int/en/ourscientific expertise/reference-laboratories/list-of-laboratories/ http://www.oie.int/).
4. Jember, T. and B. Mitiku, 2013. Prevalence of Bovine Trypanosomosis and Distribution of Vectors in Hawa Gelan District, Oromia Region, Ethiopia. J. Vet. Adv., pp: 238-244.
5. Oluwafemi, R.A., 2014. Tsetse/trypanosomosis challenges and rural poverty in Africa: Implications for food security. Res. J. Agric. Environ. Manage., 3(3): 158-161.
6. Kenaw, B., G. Dinede and T. Tollosa, 2015. Bovine Trypanosomosis in Asossa District, Benishangul Gumuz Regional State, Western Ethiopia: Prevalence and Associated Risk Factors. European J. Appl. Sci., 7(4): 171-175.
7. Tadesse, A., 2010. Bovine trypanosomosis and its vectors in two districts of Bench Maji zone, South Western Ethiopia. Tropical Animal Health and Production, 06/26/2010 europepmc.org/ abstract/med/20577803
8. Leak, S.G.A., 1999. Tsetse biology and ecology: Their role in the epidemiology and control of trypanosomosis CABI & ILRI. Nairobi, Kenya.
9. Abebe, G. and Y. Jobre, 1996. Trypanosomosis, A threat to cattle production in Ethiopia. Rev. Med. Vet., 147: 897-902.
10. NTTICC, 2000. Annual Report on Tsetse and Trypanosomosis Survey, National Tsetse and Trypanosomosis Investigation and Control Center, Bedele, Ethiopia.
11. Awoke, K.M., 2000. Study of trypanosomosis and its vectors in Humbo and Merab Woredas; EVA Journal, 4(1): 61
12. Radostitis, O.M., C.C. Gay, K.W. Hinch and P.D.C. Cliff, 2007. Disease associated with Trypanosomes. In: Veterinary Medicine, Textbook of disease of cattle, horses, pigs and goats 10th ed. Elsevier, UK, pp: 1531-1554.
13. Jano, A.A., 2016. Study on the Prevalence of Trypanosomes Affecting Bovine in Tsetse Infested Asossa District of Benishangul Gumuz Regional State, Western Ethiopia, World Rural Observations, 8(3) http://www.sciencepub.net/rural.
14. Ayisheshim, A., S. Abegaz, S. Derso, M. Shewatatek, H. Hailemariam, B. Shiret and M. Natnael, 2015. Review on Bovine Trypanosomosis in Ethiopia, European J. Biol. Sci., 8(1): 01-07.
15. Desta, M., 2014. Trypanosome infection rate of Glossina morsitans and trypanosomosis prevalence in cattle in upper Didessa valley western Ethiopia Ministry of Agriculture National Tsetse and Trypanosomosis Investigation and Control center Bedelle -Ethiopia. Int. J. Curr. Microbiol. Appl. Sci., 3(3): 378-388
16. Tekle, Y., 2012. Prevalence of bovine trypanosomosis in tsetse controlled and uncontrolled areas of Eastern Wollega, Ethiopia, Priory Lodge Education Limited, www.priory.com.
17. Fayisa, G., A. Mandafro, B. Hailu, C. Gemechu and G. Alemayehu, 2015. Epidemiological status and vector identification of bovine Trypanosomosis in Didesa District of Oromia. Int. J. Nutri. Food Sci., 4(3): 2327-2694.
18. Agricultural Bureau of Hababo Guduru district, 2020. Data recording of Animal population of the Woreda.
19. Thrusfield, M., 2005. Veterinary Epidemiology. 3rd edition. UK, Blackwell science Ltd., pp: 233-250.
20. OIE (Office Internationale des Epizooties), 2008. Trypanosomiasis (Tsetse transmitted): Terrestrial Manual. Office Internationale des. Epizooties (OIE), Paris, France.

21. Lelisa, K., D. Damena, M. Kedir and T. Feyera, 2015. Prevalence of Bovine Trypanosomosis and Apparent Density of Tsetse and Other Biting Flies in Mandura District, Northwest Ethiopia. J. Veterinary Sci. Techno., pp: 6.
22. Aliyu Nesru, 2019. Distribution and Density of Tsetse Fly as Vector for Bovine Trypanosomosis In Omobeyam District Jima Zone Oromia Region Ethiopia, 2(3): 5.
23. Damena Dalesa, M. Kedir, K. Lelisa, T. Feyera and S. Debela, 2016. Bovine Trypanosomosis and Tsetse Fly Density in Seyo District, Kellem Wollega Zone, Western Ethiopia. Austin J. Vet. Sci. & Anim. Husb, pp: 3.
24. Dagnachew, S., A.K. Sangwan and G. Abebe, 2005. Epidemiology of bovine trypanosomosis in the Abay (Blue Nile) Basin Areas of Northwest Ethiopia. Rev. D"Elev Et De Med. Vet. Des. Pays. Trop., 58: 151-157.
25. Murray, M., J.C.M. Trail, D.A. Turner and Y. Wissocq, 1983. Livestock productivity and trypanotolerance: Network training manual. International Livestock Centre for Africa (ILCA), Addis Ababa.
26. Abebe, G. and Y. Jobre, 1996. Trypanosomosis, A threat to cattle production in Ethiopia. Rev. Med. Vet., 147: 897-902.
27. Behablom, M., 2018. National Institute for Control and Eradication of Tsetse Fly and Trypanosomosis, Kaliti Tsetse fly Mass Rearing and Irradiation Center, P.O. Box: 19917, Addis Ababa, Ethiopia.