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# Distribution of Tsetse Fly in Selected Sites of Upper Omo Belt, Southern Ethiopia

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**Abstract**
The study of distribution of tsetse fly was carried out in selected sites of upper Omo belt, Southern Ethiopia. The purposes of study were to identify tsetse species involved in the area, to recognize the abundance of tsetse fly and to realize the community knowledge about the impact of tsetse fly. Community members of Badaye and Ajora Gadala Peasant Association's (PA) (n=16) were interviewed using prepared questionnaire format. The study was conducted during early wet season. For both savanna and riverine tsetse species catches, biconical traps which are the most widely used traps were used. Traps were baited with cow urine and acetone (fly attractants). For sampling purpose totally 10 biconical traps were deployed along Omo River tributaries of each Badaye and Gadala PA's. The traps were positioned around animal grazing and watering points for both savanna and riverine species, respectively. The collected catches of tsetse flies were identified, sexed, counted & recorded. The result of questionnaire revealed that all respondents know that tsetse fly transmit animal trypanosomosis which is prevalent for more than 40 years in the area. All of them responded that both the trend of tsetse and animal trypanosomosis is decreasing. Out of respondents of Badaye and Ajora Gadala PA's 67% and 33% depend on Veterinary clinics and black markets to treat their animals, respectively. They responded that they use to treat each animal two times per year. During the study period two species of tsetse flies were identified. These were *G. pallidipes* and *G. fuscipes*. In Badaya PA both *G. Pallidipes* and *G. fuscipes* catches were registered. The catches were 0.05f/t/d and 0.11f/t/d for *G. pallidipes* and *G. fuscipes*, respectively. In Ajora Gadala PA only *G. Pallidipes* was caught from grazing areas of AJacho River. Based on these results it is possible to conclude that, as a result of change in tsetse habitat and tsetse control interventions so far done, the registered low abundance of tsetse fly and the changes occurred in the distribution have negative impact on animal trypanosomosis. Therefore, it needs to increase the cattle population in the study area in order to alleviate the poverty of the society.
**Keywords**: Abundance, Distribution, Omo belt, Poverty, Trypanosomosis, Tsetse fly

## 1. INTRODUCTION

Tsetse flies are crudely similar to other large flies, such as the housefly, but can be distinguished by various characteristics of their anatomy, two of which are easy to observe. Tsetse flies fold their wings completely when they are resting, so that one wing rests directly on top of the other over their abdomen. Tsetse fly also has a long proboscis which extends directly forward and is attached by a distinct bulb to the bottom of their head (Mulligan, 1970). Genus *Glossina* comprises of 23 species. The distribution of all tsetse species covers most of Africa between the Sahara and the Kalahari deserts and the highest is in the western central and western parts of the Continent (Mulligan, 1970). Tsetse fly exacts a high public health burden and has a devastating impact on livestock and agriculture. One of such disease that has plagued sub-Saharan Africa is caused by protozoan African trypanosomes (the trypanosome species) and transmitted by tsetse flies (Aksoy and Rio, 2005). Therefore, Tsetse flies through the cyclical transmission of trypanosomiasis to both humans and their domestic animals greatly influence food production, natural-resource utilization and the pattern of human settlement throughout much of sub-Saharan Africa. It is estimated that the annual direct production losses in cattle alone the amount is between US$ 6,000 million and $12,000 million, while animal deaths may reach 3 million. Tsetse flies are confined to sub-Saharan Africa mostly in the rural areas and their deleterious effects on livestock production are enormous (FAO, 1995).

According to Lehane *et al.* (2003), tsetse flies transmit African trypanosomosis leading to half a million cases annually and that the diseases known as Nagana in animals remain a massive break on African Agricultural development. Over the past 100 years, a lot of efforts have been put on initiatives aimed at controlling the tsetse fly. There has however been limited impact in terms of reducing the problem (Anon, 2000). Some of the areas where tsetse fly populations were considerably reduced have become re-infested due in most cases to lack of consolidation of achievements (Oluwafemi, 2006).

In the past study Langridge (1976) revealed the distribution of various tsetse fly species in the country and had contributed a lot by availing valuable data's and based on that tsetse and trypanosomosis control interventions were made in various regions. The current study is focusing on the upper Omo belt (Wolaita Zone Area). Omo River and its tributary consists various types of vegetations which favor conducive microclimate for existence of different types of tsetse species. Moreover, the presence of wild and domestic hosts also plays a

 

great role being as food source for tsetse species.

## 2. LITERATURE REVIEW

### 2.1 Morphology and life cycle of tsetse fly

#### 2.1.1 Morphology of tsetse fly

Tsetse flies are elongated and robust, of various shades of brown ranging from yellowish to grayish to dark or blackish brown but never metallic. The males are usually smaller than the females (Mulligan, 1970). When the fly is at rest the wings overlap one over the other. In the middle of each wing there is distinctive shape, which is a powerful imagination can compel with a butcher's cleaver with edge facing forwards. This is called a "hatchet cell" and is a useful diagnostic character which may make it possible to identify badly managed specimens as being certainly *Glossina* (Soulsby, 1992; Itard, 1981). The males are readily distinguished by the presence of hypopygium centrally at the tip of the abdomen. It is said that the male's eyes are larger, or alternatively that the space between the eyes is smaller, but this character is not distinctive enough for field use (Mulligan, 1970).

#### 2.1.2 Life cycle of tsetse fly

As in other Dipteral, the female has a pair of spermathecae in which sperm acquired very early in life is stored and lasts the female's life span. The two sexes emerge in equal numbers; it follows that if one mating per life is usual in females, a male must on average mate only once. Females usually mate at the age of 2-3 days and the males after age of 7-8 days. During copulation, the sperm are transferred from the male to the uterus of the female. As the egg of a female fly passes from the ovary into the uterus it is fertilized by sperm, which pass down the duct from spermathecae (where they are stored after copulation) to the uterus. The egg hatches in the uterus and the first instars larvae feeds by mouth on a secretion produced by milk gland. After a molt, the second instars larvae continue to feed on the same milk. After the second molt the larva is extruded, it is now in its third instars and weighs nearly as much as its mother (Mulligan, 1970).

The third instars larvae have respiratory lobes called polypneustic lobes and it burrows and hides in the soil and assumes the shape of the barrel, its integument becomes rigid and darkens and is now known as a puparium. Within the puparium two moults take place, the first produces the pupa and the second the imago, a process often called eclosion of the adult (Newstead *et al*., 1924). The pupa stage lasts 2-13 weeks. It depends on temperature and humidity. Emergence from puparium takes place between 12:00 and18:00 hrs that is within a few hours of the daily maximum temperature. This rhythm is maintained under conditions of constant temperature but displaced if the temperature rhythm is altered. On emergence the wings are crumpled, but they are expanded in about five minutes and the tsetse can fly in an hour or two (Mulligan, 1970; Newstead *et al*., 1924).

### 2.2 The distribution, habitat and importance of tsetse fly in Africa

The limits of *Glossina* distribution are determined primarily by the climate and secondly by the vegetation, which can often mitigate the severity of climate. It could be observed that the huge central tsetse area is bounded by country having less than twenty inches of rainfall. The area with over sixty inches of rain per annum which extends along the coast of longitude $30^0$E; this is the area of equatorial forest. Surrounding it is a vast area, with sixty to twenty inches of rainfall, which is wood land savannah or grass land. The broad picture of rain forest surrounded by savannah, ending in desert or the sea, should be remembered, as the distribution of the different species of tsetse is closely related to it (Table 1). Nevertheless, it must be appreciated that the great forest belt used to be far more extensive than it is now and that relict forest and forest species of tsetse still occur well outside the limits suggested by the over sixty inch rainfall zone. There are other localized areas of forest, such as those found around mountains and down the east coast of Africa, which are hundreds of miles from the great equatorial forest belt and unrelated to it (Langridge, 1976; Ford, 1971).

 

**Table 1** Distribution, habitat and importance of tsetse fly (**Source:** Ford, 1971)

| Species | Indication of distribution | Habitat | Importance |
|---|---|---|---|
| *G. pallidipes* | Central and East Africa, South west Ethiopia, Uganda, East Congo, Zambia, South Somalia and Zimbabwe | From light rain forest to dry thicket in arid savannah | Nagana and Rhodesian sleeping sickness |
| *G. m. submorsitans* | West Central and East Africa, Southwest Ethiopia, Uganda, Congo, Southeast Congo, Tanzania, Mozambique, Zambia And Somalia | Wood land savannah | Nagana and Rhodesian sleeping sickness |
| *G. fuscipes* | West and Central Africa from Dakar to South Sudan up to Ethiopian border from Dakar to Lake Tanganika and South Katanga from Dekar along coast to south border of Angola. | *Mangrove swamps, rain forest evergreen vegetation along the streams and around lakes rain forest evergreen vegetation along the streams and around lakes* | Nagana and Gambian sleeping sickness |
| *G. tachnoides* | Western and Central Africa along Niger, Sudan up to Ethiopia | Riverine vegetation and thicket along streams and around rivers,,usually rain forest | *Nagana* |
| *G. brevipalpis* | Central and East Africa, Eastern Congo to Indian Ocean, Northern Kenya and Northeast of South Africa | Dense ever green thicket often fringing rivers and lakes and in savannah | *Nagana* |
| *G. longipennis* | East Africa, North Tanzania to Southeast Sudan, South Ethiopia *And South Somali* | From riverine thicket to thorn bush in dry savannah or semi desert | *Nagana* |

**2.3 The distribution of tsetse flies in Ethiopia**

According to survey result conducted by Langridge (1976), five species of tsetse flies were found and identified in Ethiopia as: the Fusca group: *G.* longipennis, the Moristans group: *G. m. submoristans* and *G.* pallidipes and the Palpalis group: *G. fucipes* and *G. tachinoides*. The fly belts (infested areas) in Ethiopia extend from the southern part of the rift valley, around the southwestern corner of the country and along the western lowland and escarpment to the Abay River (Langidge, 1976).

***G. m. submoristans***

In the 1970 it was found in Didessa valley near the villages of Wonago and Lado on the eastern side of Lake Abaya, the Amaurou village in Shambo sub district, on the Abay near Deru village on the Mugher River in Shoa province, on the Dabous River in Wollega, on the Baro and Gilo Rivers in Gambella district, Illubabor, in the Savannah near Turmi in South Gamu Gofa, and near Mizan Teferi in Keffa province (Langridge, 1976). According to Langridge (1976), its infestation was associated with Abay (Blue Nile) River. *G. m submoristans* in Wollega was associated with the southern border of the province and Baro River at its tributaries. The main areas of its infestation in Illubabor were associated with Akobo (Langridge, 1976).

***G. pallidipes***

In 1970, it was recorded from lower Omo River and on the Woitto River and at Keiafer (1550 m asl) also near Bako in Gamu Gofa province. It was found along the Sagan River near Lake Chamo in Gemu Gofa. The whole of the Omo Bottego was infested with *G. pallidipes*. The Gojeb was also infested with *G. pallidipes* and this infestation extended about 20 km above the bridge on the Jimma to Bonga road. The lower Omo was also infested with this species up to down wards as far as Omorate. The areas in Gamu Gofa are divided in to two parts concerning tsetse infestation. The division is formed by the strip of highlands which runs from north to south wards (Langridge, 1976).

The eastern part is comprised of the southern rift valley and Sugan river system. This area was infested with *G. pallidipes*. It was said that quite4 possible that *G. pallidipes* in Rift valley is connected with those in Omo River area. The link is likely to be across the narrow strip which separates the upper part of the Galana Dulei valley (Woitto) with the Maze River valley (Daramalo). It was predicted that unlikely *G. pallidipes* will spread much further in the rift valley beyond its limits with exception of the north ward movement along the western side of Lake Abaya. *G. pallidipes* infestation in Sidamo extended from lower Gidabo River down the eastern sides of Lake Abaya and Chamo to the Sagan River along which it extends to Lake Chew Bahir. This eastern belt also includes the large Galana River valley between Amaro Mountains and the southern highlands. It had reached the limit of its movement eastwards to the southern high lands where it was prevented from going any further by the mountains. This species had extended along the southern border of Wollega and associated

 

with Baro River vegetation and its upper tributaries (Langridge, 1976).

***G. fuscipes***

During early time the presence of *G. fuscipes* was recorded in 1901 and in 1938, and in 1970 recorded from the Maze, Gorgora, Bazo and Cuccia Rivers in Gamu Gofa, on the Ketto tributary of the Birbir and at Degeno on the Birbir in Wellega, on the that tributary of the Gojeb in Kaffa and near the bridge on the Omo River, Addis Gimma high way. The Ghibe is only infested with *G. fuscipes* as other species have found above the bridge. The whole upper and lower Omo also were infested with it (Langridge, 1976).

***G. tachnoides***

It was found along the Abay (Blue Nile) River system. It also had infested the Belles River valley. It was predicted that it may be able to spread along the gorge and infest the riverain vegetation up a far as Mota. In Akobo River system, *G. fuscipes* was replaced by *G. tachnoides*, where the river comes out into the lowland plains (Langridge, 1976).

**2.4 The distribution of tsetse flies in the Omo belt**

During the course of survey conducted by National Tsetse and Trypanosomosis investigation and Control Centre and by Sodo Regional Veterinary Laboratory, the distribution of tsetse and trypanosomosis were recorded in upper Omo belt. Tsetse species identified from this belt were *G. m. submorsitans*, *G. fuscipes* and *G. pallidipes* (SRVL, 2004).

***G. m. submorsitans***

Its infestation was associated only with Omo River system. It seems that this species had spread from two sides: 1. Langridge (1976) in his report predicted that the species can spread south ward in the lower Omo valley from upper Akobo and then Maji which is tributary of lower Omo at west. Therefore, it seems through this area infestations took place to lower and middle Omo belt. 2. This species is also present on the Ghibe River system up to Gurage woredas in the south and its origin and route of spread to Ghibe Valley was not well known, but it seems that the invasion might be from Didessa belt (SRVL, 2004).

***G. pallidipes***

The whole Omo belts which are indicated above are infested with *G. pallidipes*. In Omo belt it was associated with Gojeb and Ghibe River systems including middle and lower Omo River system. Various types of Tsetse surveys undertaken in Kindo Koyisha and Boloso Bombe Woreda of Wolaita Zone and Zima Waruma PA of Dawro Zone revealed the presence of *G. pallidipes* (Birhanu, 1995; SRVL, 2004).

***G. fuscipes***

It was found along the Omo River system. The whole Gojeb River and its tributaries and Omo River and its tributaries were also infested with *G. fuscipes*. It was also found along Ghibe and its tributaries (SRVL, 2004; Birhanu, 1995). The flies/trap/day for *G. fuscipes* ranged from 0.05 -32 (SRVL, 2004).

Moreover, survey undertaken by Sodo Regional Veterinary Laboratory in Boloso Bombe Woreda of Mechancho River of Badaye PA and Woybo and AJacho Rivers of AJora Gadala PA revealed that the presence of *G. pallidipes* and *G. fuscipes* (SRVL, 2004).

**Table 2** Tsetse fly survey results of Omo tsetse belt

| Zone | Woreda | Month/Year | Altitude(m asl) | Tsetse species | Catches of flies/trap/day |
|---|---|---|---|---|---|
| N. Omo | Kindo Koyesha | 1996 | 1000-1400 | *G. fuscipes* | 2.1 |
| N. Omo | Lomma | 10/1997 | 1000-1500 | *G. m. submorsitans* *G. fuscipes* | 0.08<br>0.61 |
| Hadiya | Soro | 3/1996 | 1400-1500 | *G. pallidipes* | 0.12 |
| N. Omo | Lomma | 10/1994 | 1000-1500 | *G. m. submorsitans* | 0.77 |
| N. Omo | Kindo Koysha | 12/1994 | 1000-1400 | *G. pallidipes* | 0.35 |
| N. Omo | Kindo Koysha | 11/1996 | 1000-1400 | *G. m. submorsitans* | 0.28 |
| KAT | Tambaro | 3/1995 | 1320-1760 | *G. pallidipes* | 0.15 |
| N. Omo | Boloso Sore | 2/1995 | 1120-1470 | *G. pallidipes* | 0.22 |
| Wolayita | Boloso Bombe (Badaye) | 3/2004 | 1380-1410 | *G. m. submorsitans* | 0.03 |
| Wolaita | Boloso Bombe (Ajora Gadala) | 3/2004 | 1390-1410 | *G. pallidipes* | 0.11 |
| Wolaita | Boloso Bombe (Badaye) | 10/2004 | 1380-1410 | *G. fuscipes* | 0.75 |

**Source**: SRVL (2004)

 

### 2.5 Tsetse control

Taking in to consideration about tsetse fly that it is the principal vector of trypanosomosis, there are different proven and effective tsetse control or eradication methods. These methods are aerial spraying and ground spraying odor baited and non-insecticide impregnated traps, insecticide impregnated odor baited traps/targets, sterile insect technique (SIT), insecticide treated cattle, and use of trypanocidal drugs (Jordan, 1986). In the past 10 years tsetse control in Boloso Bombe and in the rest areas of the region was made mainly by Southern Tsetse and trypanosomosis Control and Eradication Project (STEP, 2013).

## 3. MATERIALS AND METHODS

Boloso Bombe Woreda is one of the Woredas' of SNNPRS, Ethioia and located along Omo River. The altitude ranges from 700 (Omo River) to 2370 (Mount Zaba) m as1. The altitude of the town of Bombe, which is the capital town of Boloso Bombe woreda is 1545 m asl and its geographical coordinates are 07° 94' 59" North and 037° 32' 87" East.

The study was conducted at Mechancho River of Badaye Peasant Association (PA) and Woybo and Ajacho Rivers of Ajora Gadala PA. The study was cover three river basins meanwhile, their watering and grazing areas. The communities of the study area use to speak in Wolaita Language and mainly engaged in livestock-crop (mixed) farming system. Cattle, Goats, Sheep, Poultry, Donkeys and Mules are kept in the study PA's. The community use to grow cash crops and other crops which are mainly early maturing, high yielding and drought resistant. Major crops growing in the area are maize, teff, ginger, sweat potato, enset and others. Tsetse transmitted animal trypanosomosis is the priority disease in the study area. There are various types of wild animals in the area, such as bush buck, warthog, leopard, hyena and others. Both human and domestic animal populations of Badaye Solko and Ajora Gadala PA's are illustrated below in the table 3 (BBWAD, 2012).

**Table 3** Human and domestic animal population of Badaye Solko and Ajora Gadala PA's

| | | Human population | | Animal population | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **No.** | **PA** | **M** | **F** | **Cattle** | **Goats** | **Sheep** | **Poultry** | **Donkey** | **Mule** |
| 1 | Badaye Solko | 3632 | 4992 | 6864 | 1286 | 154 | 6042 | 280 | 5 |
| 2 | Ajora Gadala | 4396 | 4484 | 2051 | 326 | 129 | 1084 | 169 | 2 |

**Source**: BBWAD (2012)

For sampling purpose, totally 10 biconical traps (Challier and Laviessiere, 1973) were deployed along Omo River tributaries of each Badaye and Gadala PA's. For savannah & riverine species seven and three biconical traps baited with cow urine and acetone were positioned for 72 hours at domestic animals grazing and watering points of Badaye and Ajora Gadala PA's, respectively.

The sampling of tsetse flies was carried out in order to study the distribution and abundance, since there are no alternative and easily used means to do so. For this purpose, the biconical traps, which are the most widely, used traps for sampling tsetse flies, were deployed around grazing areas and watering points of respective rivers. The portability and ease of setting this trap are practically useful when sampling. The traps were stored in a clean and dry place. Before they were set, they had checked carefully to make sure that there are holes or tears in the material, particularly in the net come and or in the net cone or in the cages. Prior to setting traps, vegetations were cleared with in a set radius around the trap to standardize visibility of the trap and then after setting the traps, grease was applied around the base of stand pole to protect ants(predators of tsetse flies) (FAO,1995).

Primary data source included observation and questionnaire whereas; the secondary data included published and unpublished documents of the GO's and NGO's. Tsetse fly species determination and density study was conducted during wet season in which more tsetse fly catches are expected. For both savanna and riverine tsetse species biconical traps (Challier and Laviessiere, 1973) which are the most widely used traps for sampling tsetse flies were used. Traps were baited with cow urine and acetone (fly attractants). Prior to setting traps the surrounding vegetation's were cleared with in a set radius around the trap to standardize visibility of the trap. The collected catches of tsetse flies were identified, sexed, counted & recorded (FAO, 1995). Eight individual farmers were interviewed from each PA using prepared questionnaire format. The testing hypothesis was the apparent density of the tsetse flies, the frequency of treatment with trypanocidal drugs and % of dependence on veterinary clinics which can reveal the impact of tsetse fly. The descriptive statistics which were used rate, frequency & percentage analysis (Stata Corp, 1999).

## 4. RESULTS AND DISCUSSIONS

All responded community members of each Badaye and Gadala PA's know riverine tsetse flies (*G. fuscipes*) because this tsetse species like human blood and bite humans when they use to go to the rivers. Whereas, in contrary all of them responded that they do not see tsetse flies (*G. pallidipes*) on grazing areas and this species do not usually bite humans. Moreover, all respondents know that tsetse fly transmit animal trypanosomosis which is prevalent for more than 40 years in the area.

 

They responded that they get tsetse flies along watering points during both dry & wet seasons. On the other hand, they assume that tsetse flies usually bite animals at watering points. All of them responded that the trend of both tsetse and animal trypanosomosis is decreasing. Out of respondents of Badaye and Ajora Gadala PA's, 67% and 33% depend on Veterinary clinics and black markets to treat their animals, respectively (Fig. 1). They responded that they use to treat each animal two times per year.

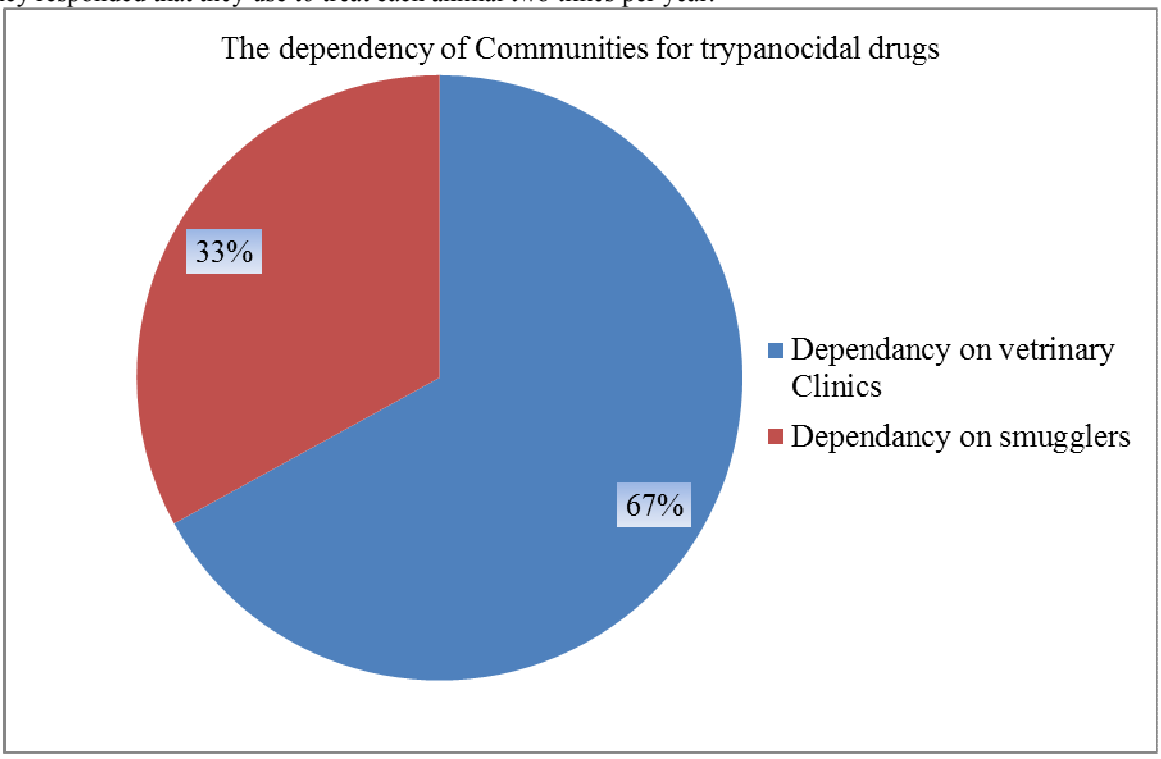


**Fig. 1** The dependency of Community for trypanocidal drugs

During the study period two species of tsetse flies were identified. These were *G. Pallidipes* and *G. fuscipes*. In Badaya PA both *G. Pallidipes* and *G. fuscipes* catches were registered. The catches were 0.05f/t/d and 0.11f/t/d for *G. pallidipes* and *G. fuscipes*, respectively. *G. pallidipes* was caught from bushes and *G. fuscipes* was caught from watering point. The grazing areas of Badaye PA are used throughout the year but watering points of Mechancho River is used only during dry season. In Ajora Gadala PA only *G. Pallidipes* was caught from grazing areas of Ajacho River. No catches of *G. fuscipes* was recorded there. The watering points of Ajacho River and grazing areas are used by domestic animals throughout the year.

**Table 4** Tsetse flies catch of Badaye and Ajora Gadala PA's

| Peasant Association | Altitude (m asl) | No of biconical traps deployed | Trapping Site | Tsetse flies | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Species | M | F | Total | f/t/d |
| Badaye | 1400-1420 | 7 | Grazing area | *G. Pallidipes* | - | 1 | 1 | 0.05 |
| Badaye | 1320-1350 | 3 | Watering points | *G. fuscipes* | - | 1 | - | 0.11 |
| AJora Gadala | 1410-1430 | 7 | Grazing areas | *G. Pallidipes* | 1 | - | - | 0.05 |
| AJora Gadala | 1380-1400 | 3 | Watering points | - | - | - | - | - |

The result of questionnaire revealed the community knowledge about tsetse flies is that they transmit animal trypanosomosis. They gain knowledge through awareness creation done by Woreda Agriculture Department and Sodo Veterinary Laboratory during the past 20 years and there by community was mobilized and embarked tsetse control activities in the area (BBWAD, 2012; SRVL, 2004). In the study area the average frequency of animal treatment was about two times per cattle per year and it was lower than the result of Muturi (1999) at Merab, Abaya, South Ethiopia (2.9 times), Afework *et al*. (2001) at Pawe, Northwest Ethiopia (3.1 times) and SRVL (2004) at Boloso Bombe South Ethiopia (3 times). The frequency of treatment was decreased due to tsetse control interventions made in the study areas in the last 10 years.

Current study revealed that the catches of *G. pallidipes* (0.05f/t/d) are less than the previous survey results of SRVL (2004) and Birhanu (1995). However, no change was made in the distribution of *G. pallidipes* until now. This might be due to availability of suitable vegetations and hosts along Omo River belt and its tributaries. The trend of abundance of this species is decreasing and this might be due to human pressure from high land area to low land area and started to practice cultivation by bush clearing and elimination of suitable

 

wild game animals (hosts) that have negative impact on tsetse abundance. In addition to that the communities involvement in tsetse control intervention minimized the abundance of *G. pallidipes* (STEP, 2013). Moreover, annual bush fire was practiced in the area during every dry seasons and again damaged suitable vegetations, which were determining factor for tsetse distribution (Leak,1999).

With regard to *G. fuscipes* its distribution in the study area is in agreement with the past survey results of Langridge (1976) and SRVL (2004). However, currently its abundance (0.11 f/t/d) was decreased as compared to SRVL (0.75f/t/d). The change in to less abundance might be associated with deforestation of riverine forest which makes conducive microclimate for the distribution of this species (SRVL, 2004). *G. morsitans submorsitans* which were registered by the previous surveys in the study area (Landgridge, 1976, SRVL, 2004) were not found in current study. This might be due to tsetse control interventions took place in the area in the past 10 years (STEP, 2013) or due to less number of traps deployed in the current study that were not able to catch this tsetse species.

## 5. CONCLUSIONS

According to the study result, communities created awareness about tsetse fly being the principal vector for animal trypanosomosis and moreover, mobilized for tsetse control interventions. They also realized the trend of tsetse distribution is decreasing. The result of present study demonstrated the presence of *G. pallidipes* and *G. fuscipes*, out of the three tsetse fly species (*G. pallidipes, G. fuscipes* and *G. morsitans submorsitans*) which were registered in the previous tsetse fly surveys. The catches of both *G. pallidipes* and *G. fuscipes* were 0.05 f/t/d and 0.11f/t/d, respectively. The current study also revealed that the trend of tsetse abundance is decreasing and moreover, realized the change in the distribution of tsetse flies. However, the study was not exhaustive and did not cover the whole seasons. Therefore, taking into consideration the above conclusions, the following remarks are recommended: further studies in tsetse fly distribution need to be undertaken to realize the absence of *G. m. submorsitans*. Since the communities have got awareness about importance of tsetse fly control so that sustainable tsetse fly controls interventions should be practiced in the area. As a result of change in tsetse fly habitat and control interventions so far done, the registered low abundance of tsetse fly and the changes occurred in the distribution have negative impact on animal trypanosomosis therefore, it needs to increase the cattle population in the study area in order to alleviate the poverty of the society.

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## REFERENCES

Afework, Y., Clausen, P. H., Abebe, G., Tilahun, G. and Dieter, M. (2001). Appearance of multiple drug resistant trypanosome populations in village cattle of Metkel District, North west Ethiopia. Livestock community and environment. Proceedings of the 10th Conference of the Association of Institute for Tropical Veterinary Medicine, Copenhagen, Denmark, 1-11pp.

Aksoy, S. and Rio, R. V. M. (2005). Interactions among multiple genomes; Tsetse, its symbionts and trypanosomes. *Insect Biochemistry and Molecular Biology* **35** (**7**): 691–698.

Anon (2000). Pan African Tsetse and Trypanosomosis Eradication Campaign (PATTEC). Plan of Action. Organization of African Unity (Now African Union), Adddis Ababa, Ethiopia.

BBWAD (Boloso Bombe Woreda Agriculture Department) (2012). Annual reports, Boloso Bombe Woreda Agriculture Department. Wolaita, South Ethiopia.

Birhanu, A. (1995). Preliminary survey on tsetse distribution and prevalence of bovine trypanosomosis in selected weredas of North Omo and Kembata Alaba Tambaro zones. AAU, Faculty of Veterinary Medicine, Debre Zeit, DVM Thesis.

Challier, A and Laviessiere, C. (1973). A new trap for capture of Gllosines. Cabiers, Entom. *Med. Parasitol.***11**: 251-262.

FAO (Food and Agricultural Organization) (1995). Training manual for tsetse control personnel. FAO, Volume 5. Rome, Italy.

Ford, J. (1971). The role of trypanosomiasis in African ecology. Clarendon Press, Oxford, UK. pp 698.

Itard, J. (1981). African animal trypanosomiasis. **In**: manual of tropical veterinary parasitology C.A.B. International, Nairobi, Kenya, 79-291pp

Jordan, A. M. (1986). Trypanosomiasis control and fArican rural development. New York: Longaman group.

Langridge, W. P. (1976). A tsetse and trypanosomiasis survey of Ethiopia. Ministry of overseas development, UK and Ministry of Agriculture 0f Ethiopia, 1-98pp.

Leak, S. G. A. (1999). *Tsetse biology and ecology*: *their role in the epidemiology of trypanosomosis*. CAB international. Nairobi, Kenya pp568.

 

Lehane, M. J., Aksoy, S., Gibson, W., Kerhornou, A., Erriman, R. A., Hanulton, J., Soares, M. B., Bonaldo, F., Lehane, S. and Hall, N. (2003). Adult midgut expressed sequence tags from the tsetse fly Glossina morsitans morsitans and expression analysis of putative immune response genes. *Gene Biology* **4**(**10**): 63.

Mulligan, H. W. (1970). *The African Trypanosomiasis*. London: Allen and Unwin, 33-212 pp.

Muturi, K. S. (1999). Epidemiology of bovine trypanosomosis in selected sites of the southern rift valley of Ethiopia. MSc thesis, Addis Ababa University with Freie Universitat, Berlin.

Newstead, R., Evan, A. M. and Otts, W. H. (1924). Guide to study of tsetse Flies Memoirs of the Liverpool School of Tropical Medicine, University of Liverpool Press, Liverpool, UK 1-332pp.

Oluwafemi, R. A. (2006). African animal trypanosomosis and tsetse fly control partnership initiative. A case study of Fulani community in BICOT project area. *J. anim. Prod Res. Adv.* ***6:*** 67-72.

Soulsby, E.J.L. (1992). Helminths, Arthropods and Protozoa of Domestic Animals. 7th Edition. Buillier,Trindall. Pp 422-423.

SRVL (Southern Regional State Veterinary Laboratory) (2004). 1994-1998 Annual Reports.Wolaita Sodo, Ethiopia.

Stata Corp (1999). Statistical software. Release 7.0. East College station, Texas, USA.

STEP (2013). Annual Reports. Addis Ababa, Ethiopia.