Form No.5

Abstract of Thesis/Dissertation

Applicant: **Simon Peter Musinguzi**

Doctoral Program in **Animal and Food Hygiene**

Graduate School of Animal Husbandry

Obihiro University of Agriculture and Veterinary Medicine

Student ID: **26332**

Signature of Applicant:

Title : **Molecular epidemiological studies on trypanosomosis and piroplasmosis among livestock in southern Africa and central Asia**

(南部アフリカおよび中央アジアにおけるトリパノソーマ症およびピロプラズマ症の分子疫学調査)

Abstract

Livestock plays a central role to the economies of developing countries and are usually a means of transitioning from poverty to wealth. Endemic parasites are a major source of economic loss in animal husbandry, especially in developing countries, but the extent of those losses has yet to be accurately specified. Knowledge about the economics of treatment of these diseases is inadequate, mostly because the damage functions, and in addition, the response functions to treatment are not yet very well known. The relative significance of most vector borne diseases in livestock is extremely difficult to quantify, because in most countries there is no formal reporting, poor diagnosis, and no surveillance or collated assessment of prevalence or economic impact. In sub-Saharan Africa and central Asia, trypanosomosis and piroplasmosis are a very big threat to the livestock industry and epidemiological studies of these diseases can help to effectively assess their status for

effective control. African livestock trypanosomes are threatening 48 million cattle in an area of 10 million square kilometers in 37 African countries; they cause disease syndromes responsible for major production losses including death in the absence of treatment. In Asia, trypanosomes in domestic animals mainly cause surra and dourine. *T. evansi* and *T. equiperdum* are continuously present eastwards, and throughout the whole of Asia. Piroplasmosis in domestic animals is mainly caused by *Babesia* and *Theileria* species. These main agents of animal piroplasmosis are vectored by ticks thus making tick borne diseases a major cause of concern to livestock producers. Tick borne protozoan diseases (e.g., theileriosis and babesiosis) pose important problems for the health and management of domestic cattle in developing countries. Piroplasmosis affects many domestic and wild animals but the most important disease syndromes are equine and bovine piroplasmosis. Vector borne hemoprotozoan parasites continue to cause devastating diseases in developing countries crippling their agricultural and food security mechanisms thus threatening their livelihoods. Prevalence studies of these diseases will provide information to decision makers on the extent of the problem and thus provide insights into finding the mitigation measures for these problems. This study considers PCR based molecular epidemiological studies on two of the most devastating animal parasitic diseases in two developing countries with two contrasting livestock systems in different continents and climatic zones; one in tropical Sub-Saharan Africa and another in temperate central Asia.

In the Chapter 1, I examined the prevalence of trypanosomosis and selected piroplasms in cattle and goats in Zambia. The livestock sector in Zambia is characterized by small holder farmers with basically low input and low output. Productivity per animal is of minor importance and emphasis is put on the number of animals. Livestock especially cattle

are considered a symbol of family wealth. The animals are fed by grazing on open pastures and crop residues. In this study, 38.1% of all the animals sampled were positive for at least one of the parasites. This shows that these diseases are very important to the livestock sector and if not addressed they can lead to huge economic losses. The goats had a significantly higher prevalence of trypanosomosis compared to the cattle despite a relatively normal PCV ($p<0.05$). This shows that despite the infection with trypanosomosis, goats rarely show clinical disease or come down with mild symptoms that do not warrant the attention of the farmers. This then marks them out as reservoirs of trypanosomosis since they are usually left untreated. Bovine babesiosis was found to be in all the 3 sampled areas making it the most wide spread disease. In Zambia, farmers pay more attention to theileriosis because of its dramatic and acute nature and forget about babesiosis which is usually chronic and debilitating. This study shows that babesiosis is wide spread and also needs attention. According to the hematocrit values, the packed cell volume (%) among the cattle with mixed infections was significantly lower than that of the other cattle. The presence of multiple parasite species and mixed infections among the Zambian cattle and goat populations is of both clinical and economic importance to livestock farming. The absence of trypanosomosis among the samples from Monze can be attributed to tsetse eradication efforts that took place around Lake Kariba. This shows that the prevention and control of the vectors of these parasitic diseases can have a significant impact on the disease status, which can translate directly into the improvement of the livestock sector in Zambia.

In Chapter 2, the study focused on the prevalence of trypanosomosis and piroplasmosis in several domestic animal species in Mongolia. The Mongolian livestock industry depends on nomadic systems of husbandry where a variety of animals is herded

together. It is characterized by low input and large herds grazing across pastures in the open country. Like the Zambian livestock system, it also emphasizes the numbers as compared to the productivity of the individual animal and adaptation to the environment is also considered an important factor. However, unlike Zambia, Mongolia's agricultural sector and livelihood heavily depends on livestock production. In this study, I found that trypanosomosis was prevalent in all the livestock species at 21.3% which raises a possibility of cross infection, with sheep and goats showing a significantly higher prevalence ($p<0.0001$) thus marking them out as possible reservoirs of trypanosomosis. Males also had a significantly higher prevalence rate than females ($p<0.05$), this is because the female animals get attention from the farmers during milking and thus it is easy to notice the abnormalities compared to the males which rarely interact with the farmers. Adult animals had a significantly higher prevalence of trypanosomosis than young animals. This is because the young animals are usually kept apart from the adults and there is also less exposure and vector attraction to young animals because of their relatively smaller bodies which produce low amounts of odor plumes to attract vectors than the adults. The study also found that the sheep in Bayan-olgii province had a significantly lower prevalence than those in Hovd province ($p=0.0017$). The sheep in Bayan-olgiy are mainly Kazakh breed which are adapted to the mountainous terrain of Bayan-olgiy. However, no previous study has linked this breed to trypanosomosis resistance before. The horses in Bayan-olgiy however had a significantly higher prevalence of trypanosomosis than those in Hovd province ($p=0.0001$). This could be attributed to the herd structure of the livestock in the two places whereby in the mountainous Bayan-olgiy, all the livestock graze in a compact group whereas in the plains of Hovd, the horses are usually scattered away from the rest of the herd thus decreasing the chance of cross infection. The

study found piroplasmosis only among the equines at 29.8%, thus highlighting the importance of equine piroplasmosis in Mongolia. This study also highlighted the effect of husbandry system regarding a particular animal species to the disease prevalence.

The two chapters show that small ruminants could possibly be a reservoir for animal trypanosomosis in the two study areas. The study also highlights the importance of vector control in control of vector borne diseases. This study shows that it is very important to know the prevalence of a disease because it highlights the various characteristic of the disease in the affected area thus making it easier to put in place effective and efficient intervention measures.

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