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Prevalence of theileriosis in *Theileria parva* in the Luhwindja Chiefdom, Mwenga Territory, South Kivu

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Abstract
A study was carried out on theileriosis at *Theileria parva* in cattle reared in the Luhwindja chiefdom. The main purpose of this study was to determine the prevalence of this condition in this chiefdom. Parasitological analysis of blood smears from 300 cattle showed an overall prevalence of 69, 33%. This apparent prevalence varied according to the group of origin of the cattle, unlike the sex, age and overweight factors which had no influence.

Keywords: Theileriose, *Theileria parva*, prevalence, cattle, luhwindja

Introduction
The ECF is probably the most important of tick-transmitted diseases in the terms of economic losses and limitation of livestock in affected countries [1, 2]. In central, eastern, and southern African annual losses due to ECF are estimated at $US 168 million including the deaths of more than 1.1 million cattle [3]. It remains very important to the South Kivu because the tropical theileriosis is enzootic in this country and seen the economic importance of this disease (high mortality and morbidity rate, resulting in considerable economic losses in cattle farms either in milk or meat). East Coast Fever is a disease caused in cattle by the protozoan *Theileria parva* which is carried by the tick *Rhipicephalus appendiculatus* during their blood meal [4, 2]; the presence of this ticks has already been reported in South Kivu, DRC by [5], work carried out in the Bugorhe, Irambi and Kabare groupements in the DRC reported a prevalence of 3.2% for this Theileriosis in cattle [6]. A study conducted in Rwanda on the theileriosis in *Theileria parva* in cattle revealed a prevalence that varied between 83 and 85% [7], while another carried out in the same animal species in Northern Tanzania reported a prevalence of 31.7% [8, 9], also obtained a 43% prevalence in cattle in Northern Cattle North-Kivu in the DRC.
The ticks by *T. parva* are influenced by climatic conditions in favor of their [10] and by the presence of a host in the clinical phase or in a state of asymptomatic carrying [11], state that is characterized by the coexistence in the animal of a high level of immune resistance and a subclinic infection [12, 13, 14]. In the DRC, [15]; have estimated the legality following a clinical episode in local metis animals, hybrid, and improved breed a mortality and infestation rate in exotic cattle and local Ankole cattle as a reservoir with a rate that can be 60% in animals. The problem of bovine theileriosis is spread over several aspects in studies elsewhere as in Luhwindja, where bovine remains a flagship animal following its uses and considerations by society. In this region, however, bovine, while having its socio-cultural considerations is subject to several diseases.

Materials and Methods
Study Sites
The study in question was carried out in Luhwinja, one of the chiefdoms in the Mwenga territory, whose description corresponds more or less to the following coordinates:
The chiefdom of Luhwinja is located in the east of the Democratic Republic of Congo, west of

Bukavu, 65 km away. The Luhwindja chiefdom covers an area of 183 km² and is one of the six communities that make up the Mwenga territory. It is bordered to the north by the Ngweshe chiefdom, to the west by the Burhinyi chiefdom, to the east by the Kaziba chiefdom and to the south by the Lwindi chiefdom. As a customary decentralized territorial entity, it is administratively subdivided into 9 groupments (Mulama, Karhundu, Kabalole, Bujiri, Cibanda ii, Idudwe, Luduha, Luchiga and Burhembo). The Karhundu, Idudwe, Luduha and Burhembo groups were not included in this study because local people were not involved in cattle rearing.

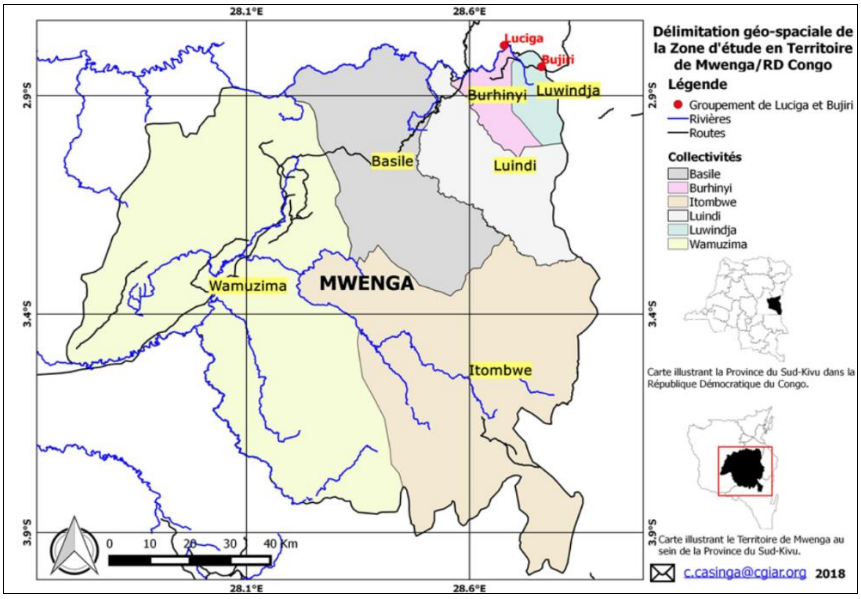


Fig 1: Study area with the location of Luhwindja villages sampled. Casinga C., 2018

Data Collection

Our biological material was 300 cattle on which 300 blood samples were taken and analyzed. Among these cattle, 239 were female and 61 males. As for cattle compared to their origin: 57 were from KABALOLE, 45 for MULAMA, 74 for BUJIRI, 49 for CIBANDA II and 75 for LUCHIGA. For their breed, 297 cattle were of local race and 3 of improved breed including 2 fries and 1 hybrid.

In order to achieve this study, here are the materials used: The mounted clamp to immobilize the animal during the sampling, The rope to tie the animal, Gloves for infection protection when handling, syringes to extract the blood from the jugular vein, Aoute: on which we puted alcohol for sterilizing the seat to swipe; the twisted alcohol 70% of concentration for disinfecting the seat to swipe and the needle before taking away the blood; the Blades on which the thin smear was made; immersion oil to make the contents of the smear visible; methanol to fix the parasites when spread on the slide; Giemsa for smear staining; slide box; light microscope: magnifying equipment for visualising the contents of smears; plates to identify piroplasms during microscopy; a GPS for taking geographical coordinates; a camera for taking photographs, plaster: piece of adhesive cloth wrapped around the slide to carry the animal's number.

The present study covered 300 cattle reared in the Luhwindja chiefdom, where only 5 groups were involved, since most of the herds are in these groups. The animals were selected on the basis of their overweight, sex and age in each of the groups. The size of the sample was determined according to the formula proposed by [16], which we reproduce below:

$$n = \frac{[(1,96)^2 p.q]}{d^2}$$

In this expression, n represents the sample size, p the estimated apparent prevalence of the disease (p = 31.7%, a prevalence obtained from studies carried out in Tanzania by [17], a country that is not only a neighbour but also trades cattle with neighbouring countries that supply us with cattle), q equals one minus p, d the degree of precision, which is 5%, i.e. 0.05, and 1.96 the value corresponding to the 95% degree of confidence. The application of this formula resulted in a sample to be examined of 338 cattle which, given the practical difficulties in terms of finance, security and accessibility, was not achieved. As a result, 300 cattle were examined instead of 338.

Data Analysis

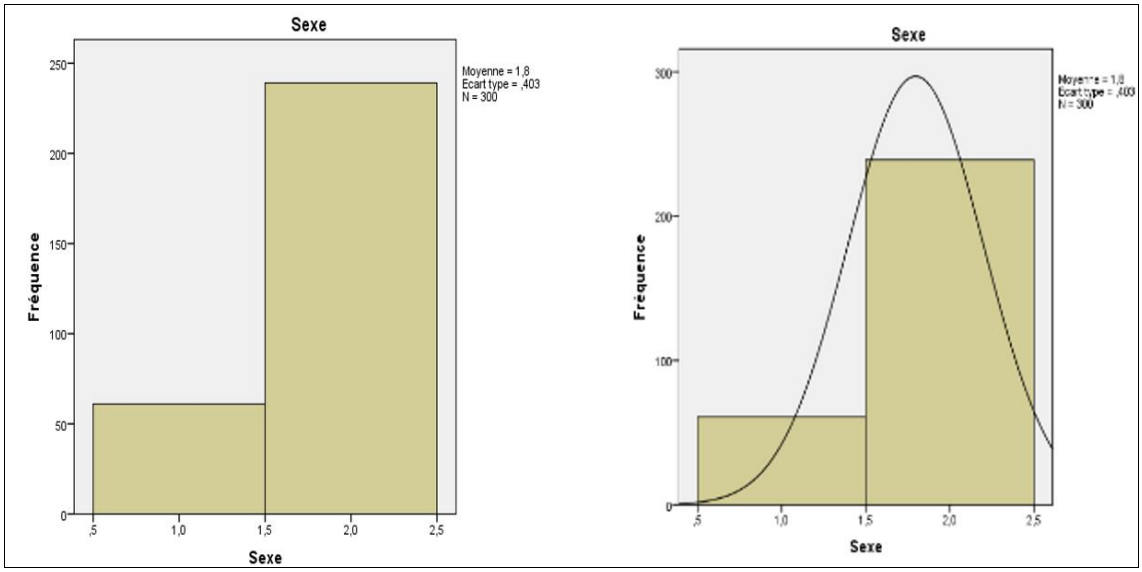
Breeders were identified beforehand, followed by the animals to be examined according to the above-mentioned criterion. The study took a total of 7 months, from July 2019 to January 2020. Blood samples were taken from the jugular vein using a syringe. Thin smears were made immediately after sampling and the prepared slides were transported using a slide box. Once transported to the laboratory, the blood smears were stained with Giemsa according to the technique recommended by [17]. After staining, the preparations were examined under an electric microscope, binocularly, with an immersion objective. The piroplasms were identified on the basis of their morphological characteristics summarised in the form of plates. The results of parasitological examinations of Giemsa-stained blood smears were subjected to Pearson's Chi-square test using the model recommended by [16], with a p threshold of 5%, based on 2x2 or Rx2 contingency tables. Below we repeat the Chi-square formula:

$$x_c^2 = \sum^{n} = \frac{(Oi - Ci)^2}{Ci}$$

With Oi the observed frequencies on a sample n and Ci the expected frequencies.

Results

Parasitological examinations of 300 blood samples from 300 cattle in the Luhwindja chiefdom yielded an overall apparent prevalence of 69.33%, as shown in Tables I, II, III and IV. These tables present the results for the different variables studied, namely the sex, group of origin, age and overweight status of the animals examined. Table I below shows the results relating to the apparent prevalence of East Coast Fever according to sex.

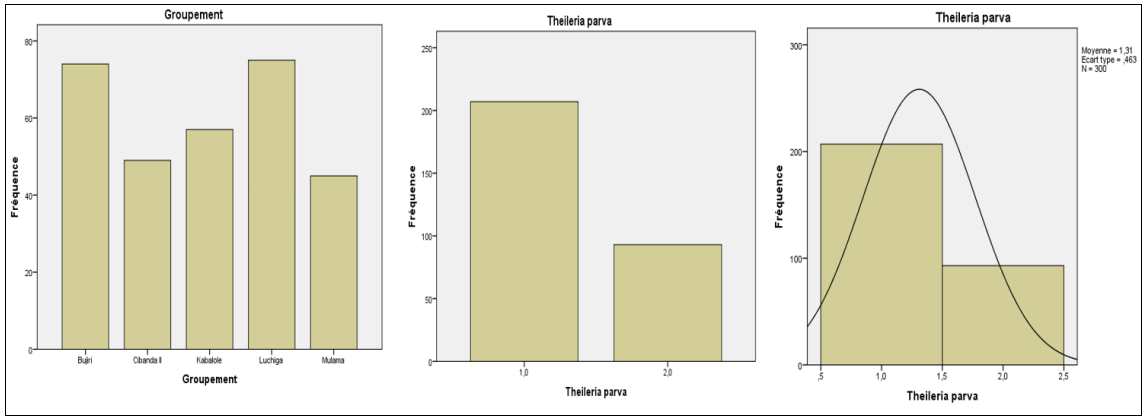


Graph 1: Prevalence of East Coast Fever by sex of cattle.

According to this graphic, the males (1) are less infected while the females (2) are more infected. The observations presented in this graphic show us that out of 239 females examined, 170 (71.12%) were infected, compared with 38 out of 61 males (62.29%). Statistical analysis of these results showed that sex had no influence on the apparent prevalence of *Theileria parva* theileriosis, which was comparable in the two groups (1.77, ddl = 1; p>0.05).

Table 1: Below shows the apparent prevalence of *Theileria parva* Theileriosis according to the groups of origin of the cattle examined.

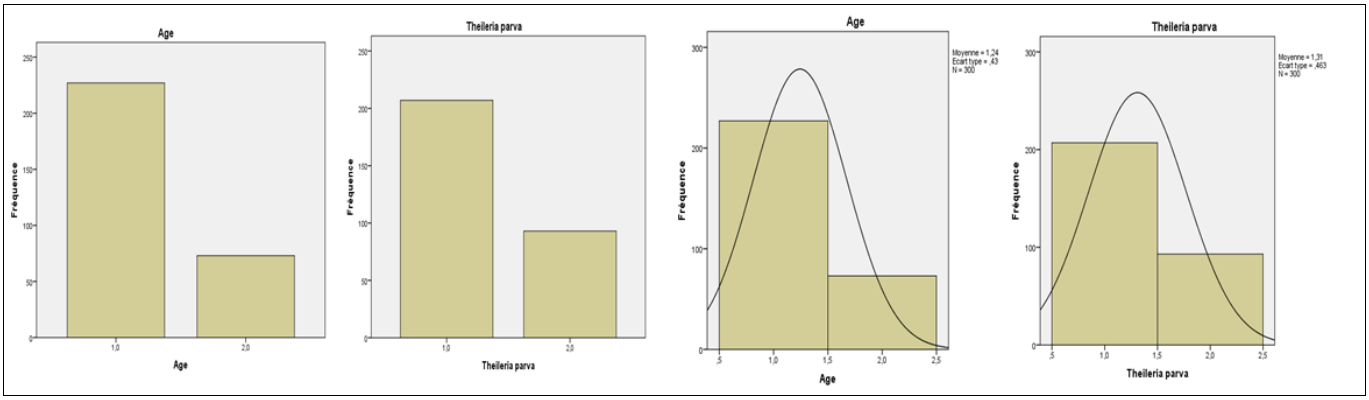
Groupement					
		Fréquence	**Pourcentage**	**Pourcentage valide**	**Pourcentage cumulé**
Valide	Bujiri	74	24,7	24,7	24,7
	Cibanda II	49	16,3	16,3	41,0
	Kabalole	57	19,0	19,0	60,0
	Luchiga	75	25,0	25,0	85,0
	Mulama	45	15,0	15,0	100,0
	Total	300	100,0	100,0	



Graph 2: Apparent prevalence of East Coast Fever by group of origin of cattle examined.

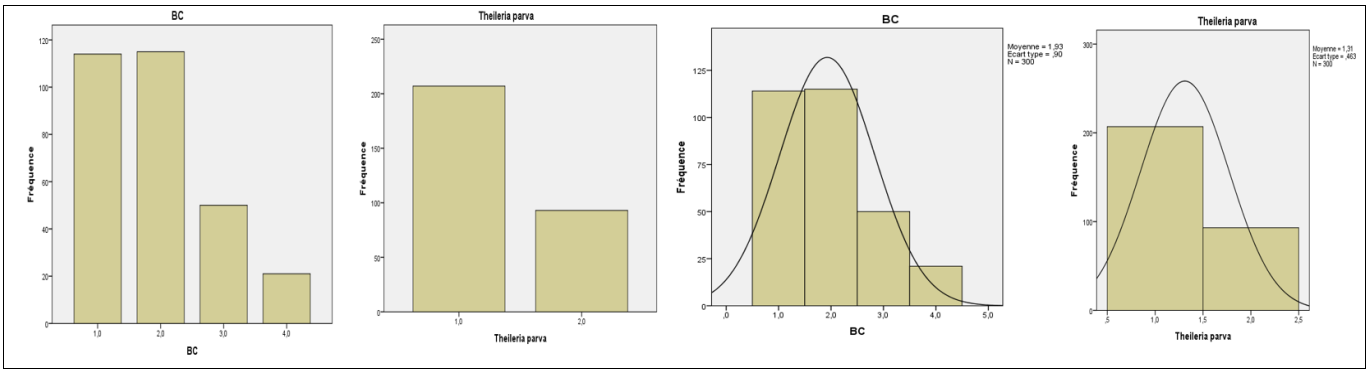
According to the observations made by this graphic of the various groups, 1 are highly infected females than males in addition the group of Luchiga and Bujiri represent a significant number of animals that are infected. The graphic shows that the cattle examined in the Luhwindja chiefdom came from 5 groups, namely Mulama, Luchiga, Kabalole, Bujiri and Cibanda II, with a prevalence of 80%, 76%, 73.68%, 60.81% and 57.14% respectively. According to the results of the statistical analysis, the apparent prevalence differed between groups (10.39; ddl = 4; p<0.05). Cattle from

the Mulama group were the most infected (80%). Comparing the groups in pairs, the prevalence differed between certain groups, in particular: Mulama (80%) and Bujiri (60.8%); Mulama (80%) and Cibanda II (57.1%); Bujiri (60.8%) and Luchiga (76%); Cibanda (57.1%) and Luchiga (76%). The influence of the age of the cattle was also studied, as shown in Table III.



Graph 3: Apparent prevalence of East Coast Fever by age of cattle examen

The graphic deals with the age and the 1 represents the adult animals and the 2 for the young. The adults were more infected by *Theileria parva* than the young. In the light of this table, an apparent prevalence of 70.83% was observed in adult cattle, compared with 65.47% in young cattle. Analysis of this result showed that there was no statistical difference between the prevalence observed in adults and that obtained in young cattle. (0.8; ddl = 1, p>0.05). Table IV below shows the apparent prevalence of East Coast Fever according to the overweight status of the animals examined.



Graphic 4: Apparent prevalence of East Coast Fever according to overweight status of cattle examined.

This graphic shows how overweight the animals examined were. The result presented in the graphic above shows that the 300 cattle examined comprised 4 groups according to their overweight status. These were animals in very good condition (1), good condition (2), fair condition (3) and poor condition (4). After statistical analysis of the observations relating to this variable, it emerged that the apparent prevalence of East Coast Fever did not vary (1.55; ddl = 3, p>0.05).

Discussion

During the present study, the apparent overall prevalence of *Theileria parva* was 69.33% in cattle reared in the LUHWINDJA chiefdom. This value was higher than those of 3.29%, 43% and 31.7% obtained respectively by [6] in South Kivu (in cattle from the Bugorhe, Kabare and Irhambi groups), [9] in cattle in North Kivu and [8] in Tanzania, [7] for cattle in Rwanda. The high prevalence of theileriosis in this chiefdom is thought to be linked not only to the fact that prophylactic control measures are less applied, but also to the high frequency of the vector tick *Rhipicephalus appendiculatus* in this breeding area [18] and in the Great Lakes countries in general [19]. In relation to the sex (Table I), age (Table III) and overweight status (Table IV) of the animals examined, the prevalence of East Coast Fever was comparable in the different groups. This equality of rates indicates that these cattle would have the same risk of infection whatever their sex, age or overweight status. These results contradict [20] assertion that females, young animals and animals in poor general condition are more affected. We think that the homogeneity of the prevalences is linked to the fact that these animals are generally precarious and likely to favour the disease. In our study area, the animals are reared in an almost traditional system where tick control is almost non-existent and animal movements are less controlled. Feeding is focused on unimproved pasture with no supplements or regular prophylactic care. However, [8] observed a difference in the prevalence of *T. parva* according to the age of the cattle, with young cattle under 6 months of age (33.8%) being more infected in northern Tanzania. As for the group of origin of the animals (Table II) from which blood samples were taken, a difference in prevalence was observed, with cattle from the Mulama group showing a higher rate (80%). Also, when comparing them two by two, a difference in prevalences was observed, with the Mulama and Luchiga groups having high prevalences. The difference in rates between groups suggests that, despite the generally poor rearing conditions, there are certain particularities for each group with regard to the application or non-application of prophylactic control

measures against East Coast Fever. The apparent prevalence of East Coast Fever was studied in the cattle of the Luhwindja chiefdom in relation to the sex, age, group of origin and overweight status of the animals examined.

Conclusion

The observation of the results obtained from parasitological examinations of Giemsa-stained blood smears has led to the following conclusions: Theileriosis caused by *Theileria parva* remains a threat to cattle in the Luhwindja chiefdom, where the overall apparent prevalence was 69.33%; this prevalence varied according to the group of origin of the cattle examined, with cattle from the Mulama group being more infected (80%) than others; no influence of sex, age or overweight status on the apparent prevalence of this disease was observed. As a result of these results, we feel that it is imperative to reinforce the level of application of prophylactic and curative control measures against theileriosis in this chiefdom in particular and in the areas that exchange animals with it in general. In this context, we feel that it is necessary to set up an acaricide control schedule for ticks in each group and/or on each farm. Improving grazing by paddocking and treating animals according to a schedule is of great value in the first instance, as the disease and the vector tick are endemic in the region. These recommendations are aimed in particular at livestock farmers, veterinarians and the government departments that have the power to apply them or have them applied. At a later stage, it will be necessary to study the possibility of this disease having a seasonal nature in the study area and neighbouring livestock farming areas.

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