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Full Length Research Paper

Effect of altitude and animal age on the prevalence of dictyocaulosis in cattle in the Northern Province of Rwanda

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This research was done in the North-western region of Rwanda and the aim of the study was to determine the prevalence of bovine dictyocaulosis and influences of altitude and age on infestation in the region. Dictyocaulosis is a parasitic disease caused by the presence and the development of parasite *Dictyocaulus species* in the lung. On a random sample of 1470 slaughtered animals, the study revealed 68 cases of dictyocaulosis, which represents 4.6% of the total of the slaughtered animals, with variations of between 1.3 and 7.5% in different sites. The study showed a variation of the prevalence, which is related to altitude (from 1470 to 3000 m) and age ($p < 0.05$). There is need to craft specific measures against dictyocaulosis in the areas of high altitude of Rwanda.

Key words: Altitude, bovine, dictyocaulosis, lung, prevalence, Rwanda.

INTRODUCTION

In Rwanda, agriculture underpins the livelihoods of at least 90% of the population. Between the years 1990 and 2002, exportable products from agriculture have accounted for 50% of the national Gross Domestic Product (GDP) (MINECOFIN, 2002). The livestock sub-sector has increasingly become eminent in terms of its contribution to household nutrition and food security and nationally through exports over the last few years. However, sustainability of this sector has been negatively affected by the high incidence of animal diseases and pests. Losses attributable to livestock diseases account for 25% of the value of cattle production. Common diseases in Rwanda include trypanosomiasis, anthrax, brucellosis, tuberculosis, foot-and-mouth disease (FMD) and contagious bovine pleuropneumonia (CBPP).

However, dictyocaulosis disease has rarely been given much attention in the country even though it has a significant yet unrecognized impact on livestock through put and ultimately on sustainable development of the livestock sector in the country. Dictyocaulosis is parasitic disease caused in cattle by *Dictyocaulus viviparus*, it is found in the temperate climate zones characterized by high seasonal rainfall. The parasite is located in the lungs.

In Rwanda, no study has been done to elucidate the existence of such information which would be useful for research as well as treatment and prevention of this parasitic disease. It is in this context that an epidemiological study was undertaken on bovine dictyocaulosis in the North Western region of Rwanda. This area is characterized by a high altitude ranging from 1470 to 4500 m above sea level and average annual rainfall of 1400 mm compared to regions of the country which lie below 1470 m above sea level and receive less than 1400 mm of annual precipitation.

The objectives of the study were to determine the prevalence of the bovine dictyocaulosis in the high altitude areas of Rwanda and to investigate the influence of altitude and age of the animals on the prevalence of the disease.

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Table 1. Variation of the infestation in different districts according to the altitude.

Origin of animals	Altitude (m)	Examined animals	Animal with dictyocaulosis	Rate of prevalence
Nyabihu	2500 - 3000	389	29	7.5
Ngororero	2000 - 2500	543	32	5.9
Rubavu	1470 - 2000	538	7	1.3

MATERIALS AND METHODS

Area of study

The area is located in the North West of Rwanda. This region comprises a mountain named "Crete Congo Nil" which separates Nile and Congo basins. It covers four Districts of the Western Province of Rwanda, namely Rubavu, Nyabihu, Rutsiro and Ngororero. In terms of landscape, this area is characterized by high mountains and volcanoes. Its altitude varies between 1470 and 4500 m above sea level. The highest altitude in the areas used for animal husbandry is 3000 m and the lowest altitude is 1470 m, near Lake Kivu. The temperature varies according to the altitude. It is moderate in the areas of low altitude located in the South-East and in the West with an average temperature of 22°C, more or less cold and rainy in its central part dominated by the summit of Congo Nile Mountain. At this location the mean annual minimum temperature is 5.9°C while the mean annual maximum is 25.4°C. The average annual temperature is 15.9°C.

Currently the area constitutes one of three dairy basins of the country and accommodates more than 30,000 dairy cows these being predominantly imported breeds Holstein and Jersey breeds and their crosses. The concerned sectors in the areas are Rambura, Bigogwe in Nyabihu District (2500 – 3000 m), Gaseke, in Ngororero District (2000 – 2500 m); Nyamwumba, Cyanzarwe, Gisenyi in Rubavu District (1470 - 2000).

Animals

The study was carried out on 1470 slaughtered animals in the abattoir of Rubavu district from May 2006 to September 2006. All animals sent to the abattoir possess a certificate delivered by the local authority. The certificate shows the identification of the animals, their origin and the name of the owner.

Data collection

Data was collected through post-mortem examination of the lungs. An incision was made over the entire length of the trachea, the bronchi and bronchioles. After this operation, parasites are isolated. Data was analyzed using analysis of variance (ANOVA) in SPSS Version 12.

RESULTS

Among one thousand four hundred and seventy (1470) carcasses examined animals, 68 (that is 4.6%) were infected with dictyocaulosis. The distribution of the disease was unequal across the different sites.

Variation of prevalence with altitude

In Nyabihu District, which is characterized by high altitude (2500 – 3000 m) and where the temperatures are mostly below 18°C, with very humid conditions, the infestation is high and it represents 8.5% in Bigogwe and 6.8% in Rambura sectors. In Ngororero District (2000 – 2500 m), which is characterized by an intermediate climate, the infestation is 5.9% in Gaseke sector. In Rubavu District (1470 – 2000 m), the infestation is low and represents 1.5% in Cyanzarwe, 1.3% in Nyamyumba and 0.0% in Gisenyi where the altitude is around 1470 m. The average infestation is 7.5% in Nyabihu District, 5.9% in Ngororero District and 1.3% in Rubavu District as shown in Table 1.

The statistical analysis by ANOVA showed that the variation of prevalence is significantly different in accordance with the altitude ($p < 0.05$) as reflected in Table 2.

Frequency of the dictyocaulosis according to the age

Considered separately according to age, the prevalence of the disease is 5.8% among young animals (young bulls and heifers) and 2.4% among adult animals (Table 3).

This confirms the vulnerability of the young animals and a special care to be taken to this significant group. Statistical analysis showed that there is a significant influence of age on the incidence of infestation as p-value is smaller than 0.05 (Table 4).

The two variables, altitude and age where considered separately for analysis. However, if the two factors are combined, their influence is significant ($p < 0.05$). But, in the study, the researchers found that R-squared is low. This implies that there are other factors influencing the infestation depending on the level of managerial practices used by farmers in the respective regions (Table 5).

DISCUSSION

Dictyocaulosis in cattle is widely present in temperate and subtropical areas. It is very common in regions with a moist temperate with mild climate and high rainfall (Lat-Lat et al., 2006; Jiménez et al., 2008). Thamsborg et al. (1998) confirmed the presence of Lungworm infection

Table 2. ANOVA Result of effect of altitude on infestation.

Source	Type III sum of squares	DF	MSE	F	P-value
Corrected model	0.950	1	0.950	21.018	0.000
Intercept	2.306	1	2.306	52.933	0.000
Altitude	0.915	1	0.915	21.018	0.000
Error	63.939	1468	0.043		
Total	68.000	1470			
Corrected Total	64.854	1469			

R-squared = 0.014, Adjusted R-squared = 0.013.

Table 3. Prevalence of dictyocaulosis according the age.

Groups of age	Examined animals	Animals with dictyocaulosis	Rate of prevalence (%)
Young animals	968	56	5.8
Adult animals	502	12	2.4
Total	1470	68	4.6

Table 4. ANOVA Result of effect of age on infestation.

Source	Type III sum of squares	DF	MSE	F	P-value
Corrected model	0.381	1	0.381	8.674	0.003
Intercept	0.011	1	0.011	0.0255	0.614
Age	0.381	1	0.381	8.674	0.003
Error	74.473	1468	0.044		
Total	68.000	1470			
Corrected Total	64.854	1469			

R-squared = 0.006, Adjusted R-squared = 0.005.

Table 5. ANOVA Result on the effect of age and altitude on infestation.

Source	Type III sum of squares	DF	MSE	F	P-value
Corrected model	1.819	2	0.910	21.170	0.000
Intercept	0.168	1	0.168	3.901	0.048
Altitude	1.438	1	1.438	33.474	0.000
Age	0.904	1	0.904	21.035	0.000
Error	63.025	1467	0.043		
Total	68.000	1470			
Corrected Total	64.854	1469			

R-squared: 0.028, Adjusted R-squared: 0.027.

(*D. viviparus*) in dairy cattle farms in tropical highlands of Tanzania. This infection is also recognized in certain areas of Ethiopia and Kenya in areas characterized by high altitudes (Chartier et al., 2000; Taylor et al., 2008). An analysis of variance of the study results showed that the disease is significantly present in high altitude region of Rwanda with a high rainfall and the prevalence varies depending on the altitude and age.

CONCLUSION AND RECOMMENDATIONS

This work which focused on the prevalence of bovine dictyocaulosis in areas of high altitude in Rwanda, where

the climate is almost temperate, showed that dictyocaulosis is present in the region. The average infestation of the disease among the animals is 4.6%, with a maximum of 8.5% in the areas with higher altitude and a minimum of 0% when the altitude decreases to 1470 m. The young animals are more parasitized (5.8%), than older animals (2.4%). It is recommended to consider the presence of dictyocaulosis in the region and to integrate with common practices, strategies to fight the parasite, specific measures against the dictyocaulosis in high altitude areas of Rwanda.

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