

Identification and Distribution of Ticks Infesting Cattle in Ituri Province, DRC

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ABSTRACT

A study on the distribution of ticks infesting cattle in ituri province was undertaken. A thousand two hundred (1200) specimens of ticks collected and thousand six hundred and fifty – two (2652) cattle of local race mainly (Hema, Alur , Lugbara) and Sanga or metis from crossing between locals composed the study equipment the determination keys used were those of Chartier et.al, 2000 ; Bouattour, 2002 ; Walker et al., 2003. At te end of the observations, the results obtained are that : The cattle in the Province are infested by *Ambyomma hebraeum*, *A. latum*, *A. variegatum*, *Demacentor marginatum*, *Haemaphysalis punctata*, *Hyalomma marginatum*, *Ixodes pilosus*, *I. ricinus*, *Rhipicephalus appendiculatus* and *R. microplus* ;*A. variegatum* (100%) and *R. microplus* (96,66%) are the mos tat abundant folow – up of *Hyalomma marginatum* (46%), *Ixodes pilosus* (38,34%) and *A. hebraeum* (34%) are relatively few ;The territoires of Mahagi and Djugu have a tick resemblance of 85% and these with that of Aru 62%. These three territoires resemble that of Irum in ticks by 28% ; The means of control of ticks used are above all the chemical control followed by rotation of animals on the meadows and finally, the use of bush fire.

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I. Introduction

Livestock production is one of the agricultural sectors that contributes to food security and the economic and social development of the world's population (Micol, 1980; Landrieu, 1980; CIRAD GRIT, 2006). However, it is not very productive in most developing countries (Tobback, 1951; Kalume et al., 2013; Nsalambi et al., 2019 and Omasombo et al., 2021). The main constraints are generally feed and livestock diseases (Tobback, op. cit.; Diffissa, 2000; Farougou, 2007; Farougou et al., 2007; Martineau and Morva, 2010). In the DRC in general and Ituri Province in particular, one of the major pastoral livestock sectors supplying meat has been facing serious recurring problems over the past decade, with diseases, especially blood parasitic diseases, including tick-borne diseases (Kalume et al., op. cit.; Omosombo et al., op. cit.).

These diseases significantly affect large and small livestock populations, particularly ruminants, and consequently continue to decrease the volume and production of these beef crops. However, the need for meat in this Province has only increased over the years, and to partially cope, the Province resorts to importing meat from neighboring countries, particularly Uganda and the Central African Republic (Bunia City Hall, 2024).

Finally, this article focuses on understanding the current status of species and the distribution of ticks infesting domestic cattle in the said Province so that, upon the return of effective peace, this beef crop is guaranteed.

II. Environment, Materials and Methods

II. 1. Environment

The work was carried out in the four territories of Ituri Province, namely Aru, Djugu, Irumu, and Mahagi. This province is located in the eastern DRC, between 1° and 3° 4' North latitude and 28° and 31° East longitude. It covers an area of approximately 65,658 km². It is bordered by Uganda to the east, South Sudan to the north, Haut-Uélé and Tshopo Provinces to the west, and North Kivu Province to the south.

Its climate is subequatorial (Am3-4) in mid-altitude areas, temperate (Cfb) in high areas, and tropical Sudanese (Aw4) in low-altitude areas according to the Köppen classification. Its vegetation is very varied, including dense forests (mainly the Mambasa Territory and part of Irumu), secondary forests, gallery forests, wooded savannahs and grasslands. There is a great diversity of plant species (Omasombo et al., 2021). The soils are generally sandy-clay and fertile, thus favoring agricultural and para-agricultural activities throughout the Province (Anonymous, 2020). The relief of Ituri is dominated by stepped plateaus whose altitude varies between 900 m and 2000 m (Omasombo et al., op. cit.). The Ituri shares its waters with both the Nile River basin and the Congo River basin. In general, Ituri is a well-drained region, providing sufficient water supply to the population practicing agro-sylvo-pastoral activities despite climatic problems (Anonymous, 2021). Finally, the majority of the population lives from primary activities based on land capital (Mongo et al., 2009 and Anonymous, 2019), including

traditional cattle breeding, agricultural and fishing activities, forestry and mining.

II.2. Materials and Methods

The study material consisted of one thousand two hundred tick specimens collected during rainy and dry periods, as well as 2,652 cattle, mainly from local breeds (Hema, Alur, Lugbara) and Sanga or crossbred cattle from crossbreeds between local cattle and a few male sires of imported breeds raised in a generally free-range pastoral system.

Ticks were first collected from each cattle 3 minutes after spraying with the 5% xylol solution. They were then preserved, by anatomical region (ears, head-neck, abdomen-legs, anogenital, thighs and foot), in labeled 250,000,000 IU penicillin-type bottles containing 70% alcohol, bearing the harvest date, the name of the farm or breeder, the Territory, the anatomical region concerned, the age of the cattle (young cattle from 0-12 months which is the weaning age and adult cattle > 12 months) and the sex.

In addition, the sample from each Territory was placed in a 10L plastic bucket and tightly covered with a bag on its lid to limit the loss of the preservative used. However, these samples were taken to the laboratory of the Animal Production Section of ISP - Bunia for analysis. In the laboratory, tick identification was performed under a Would 2500 binocular microscope. It was based on the morpho-anatomical characteristics described by certain authors (Chartier et al., 2000; Bouattour, 2002; Walker et al., 2003).

The number of ticks collected was recorded in a spreadsheet by species, by month, and by anatomical region for each Territory. Monthly tick count averages for the four Territories were calculated, by species, by anatomical region, and/or by species, using Microsoft Excel software. Means were compared after testing for normality, and the t-test and Tukey's HSD test were used to determine the significance of differences between means using Statistica 8 software. Past .04, version 2015, was used to analyze the diversity of ticks collected in these four territories.

The control methods used in Ituri Province were obtained through ad hoc research and guided interviews, supported by a specially designed questionnaire.

III. Results

III.1. Species and Relative Specific Abundance of Ticks in the Territories

The table below shows the relative abundance of tick species infesting cattle by Territory under investigation.

The table above shows that of the 1,200 tick specimens collected, they are grouped into 6 genera and 10 species. Of these, *Amblyomma variegatum* (100%) and *Rhipicephalus microplus* (96.66%) are relatively more common in these four territories, followed by *Hyalomma marginatum* (46%), *Ixodes pilosus* (38.48%), and *A. hebraeum* (34%). The remaining species are very poorly represented and less abundant. Furthermore, the structure (1.74) and distribution (0.924) of tick species are more interesting in the Irumu territory, followed by the Mahagi (1.63 and 0.9379) and Djugu (1.522 and 0.9456) territories, and finally, less so in the Aru Territory (1.433 and 0.9215).

Table 1. Tick species infesting cattle identified by Territory (in %)

Species	Territories				Σ
	Djugu	Aru	Irumu	Mahagi	
<i>Ixodes pilosus</i>	6,67	21,67	0,00	10,00	38,34
<i>Ixodes ricinus</i>	0,00	0,00	0,00	4,67	4,67
<i>Amblyomma variegatum</i>	26,67	30,00	25,67	25,66	100
<i>Amblyomma hebraeum</i>	17,33	0,00	0,00	16,67	34
<i>Amblyomma latum</i>	0,00	14,00	14,00	0,00	28
<i>Rhipicephalus microplus</i>	28,33	29,00	16,00	23,33	96,66
<i>Rhipicephalus appendiculatus</i>	0,00	0,00	9,33	0,00	9,33
<i>Hyalomma marginatum</i>	21,00	5,33	0,00	19,67	46
<i>Dermacentor marginatus</i>	0,00	0,00	20,67	0,00	20,67
<i>Haemaphysalis punctata</i>	0,00	0,00	14,33	0,00	14,33
Total	100	100	100	100	///////
Fairness index	0,9456	0,9215	0,9728	0,9379	///////
Shannon's index	1,522	1,483	1,743	1,68	///////

III.2. Cattle infestation rate by sex and season

The rate of cattle infestation by sex and season is shown in the figure below.

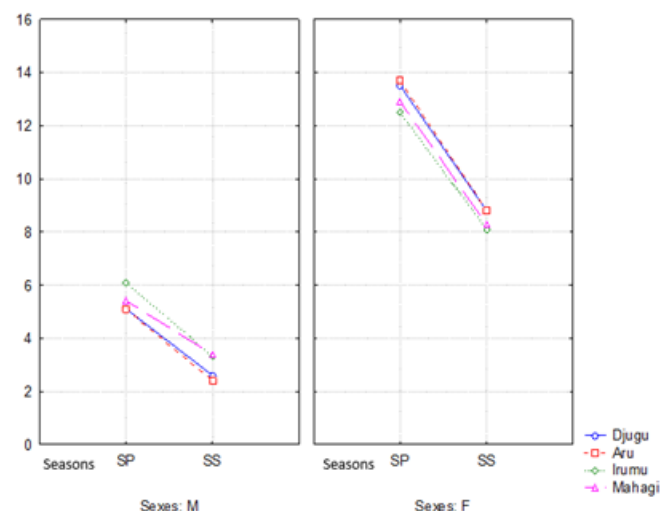


Fig. 1.

III.3. Degree of Similarity of Tick Species from Different Territories

The degree of similarity in tick species composition between the four Ituri Territories under study is shown in the dendrogram below.

(Mahagi, Djugu; Aru and Irumu. The vertical axis represents the level of similarity (from 0 to 1), while the horizontal axis shows the hierarchical grouping.)

The dendrogram above shows that the territories of Mahagi and Djugu have an 85% similarity in ticks infesting cattle. These two territories have a 62% similarity in these blood-sucking vectors with that of Aru. Finally, these three territories are 25% similar in the aforementioned vector species with that of Irumu.

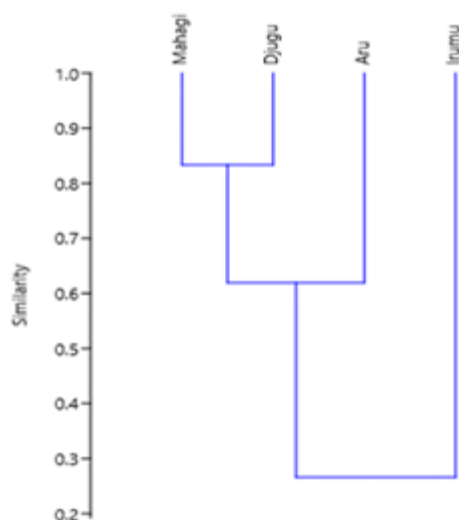


Fig. 2. Dendrogram of Similarity of Territories in Tick Species

III.4. Tick Control Methods Used

The figure below presents the control methods used to control ticks infesting cattle in the selected territories.

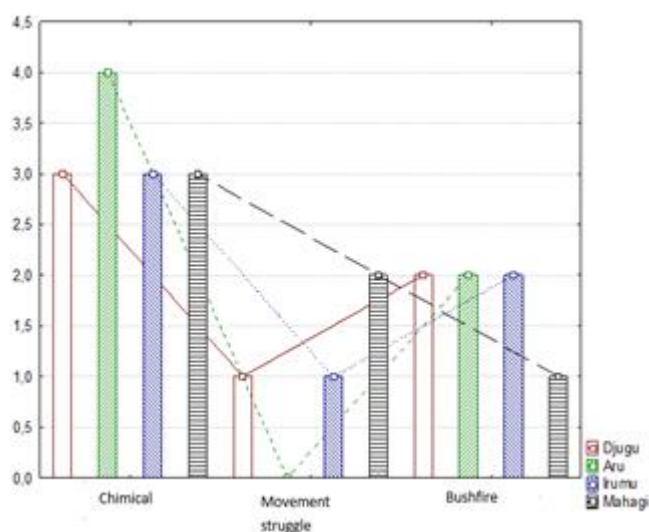


Fig. 3. Tick control methods used by territory

This figure above clearly shows that the three most common methods of controlling ticks in cattle, in descending order, are chemical control, moving cattle from infested pasture to less infested pasture, and the use of bushfires in all the Territories under review.

Chemical control without moving cattle from infested pasture is most widely used in the Aru Territory, while the Mahagi Territory leads the way, albeit last, in the aforementioned bushfire control.

IV. Discussion

The results obtained are that *A. variegatum* hylomma marginatum are more common and abundant in the four Territories, while *I. pilosus* and *A. hebraeum* are very poorly represented and abundant. These species appear to have relatively the same infective powers or similar hematophagic capacities, the same biology and evolutionary cycles, ecologies, physiologies, and habits, as well as hosts, as suggested by Bazarusanga et al. (2007) in Rwanda, Rubaire-Akiiki et al. (2004) in Uganda. They have very high endophilic and exophilic strategies, and consequently, cattle would be their preferred hosts according to Boulenger and

Mcloy (2015). On the other hand, those that are less widespread and less abundant would have facultative infective powers, while those that are more ubiquitously represented and less abundant would not be their preferred hosts. As a result, they accidentally infested the bovine victims in order to survive.

The above results showed that in all the territories under study, female cattle are relatively more infested than males. All other things being equal, and in agreement with Bondombe (2023), females are generally less agile than males, on the one hand, and on the other hand, their numbers in herds are often higher, conferring an unbalanced sex ratio in their favor (1/25, or 0.04), and their muscular structures are relatively tender, also offering a high possibility for ticks to pierce them.

These observations are quite similar to those of Sylla et al. (2022), who noted that cows are more infested than bulls; and of Mebanga et al. (2014), who observed a significant difference between males and females. And even Pagot (1985), cited by Mebanga et al. (2014) and Bonnet et al. (2015), points out that female cattle are naturally more vulnerable to tick attacks.

Furthermore, cattle are relatively more infested during rainy periods than during dry periods. Bondombe (2023) states that the rainy season favors the infestation of definitive hosts or the life cycle of most blood-sucking vectors for the simple reason that at this time, the reservoir hosts in the grassland region are more active in their search for fodder, and tick spread and reproduction are generally very rapid and high. During this period, the hatched larvae develop relatively quickly and climb onto the grasslands, whereas during dry periods, they are on the ground or in soil infarcts to protect them. The hematophagic efficiency of these vectors is generally higher during rainy periods than during dry periods.

These opinions are quite similar to those obtained by Rubaire-Akiiki et al. (2004) in Uganda, Bazarusanga et al. (2007), Farougou (2007) in the Soudanian zone of Benin, Mshamiyimana and Mutandwa (2010) in Rwanda, Kalume (2011) in Butembo, and Boudenda (2017) in Algeria in the same bovine hosts.

The above dendrogram showed that the Mahagi and Djugu Territories have a degree of resemblance in ticks infesting cattle of 85%. These two Territories have a similarity in these blood-sucking vectors of 62% with that of Aru. Finally, these three Territories resemble the aforementioned vector species of Irumu by 25%.

In view of the above, and sharing the opinions of Bisusa et al. (2014) and Bondombe (2023), the Territories with similar specific resemblances in ticks have ecology (latitude, altitude, vegetation, livestock management more or less similar), target hosts and benefit from collection efforts of these similar vectors and resilience capacities of these identical ticks. On the other hand, the Territory with low capacity of resemblance in ticks therefore has inverse capacities. The results of this study identified three means of tick control and the most used is chemical control, followed by moving cattle from an infested pasture to another relatively free of these vectors and finally bush fires in the pasture. Chemical control is more used in the Territory of Aru without moving animals from the infested pasture while the Territory of Mahagi excels in the use of bush fires. The use of chemical control is justified by the fact that it does not have enough requirements in terms of labor and time while the

other two means of control are demanding in terms of time, labor, distance to be covered and possible risk precautions. Tick control can be done on the ground or on the hosts but the best and most lasting results are obtained with control on the host. Aside from chemical control, other control methods such as biological control (using predators and pathogens), genetic means, and anti-tick vaccines can be used depending on the possibilities, but these are not yet in use in the said province.

Thus, in the study by Mebanga et al. (2014), Wakwa is the locality where the average number of ticks on animals is quite low due to the semi-intensive livestock farming system, which uses tick baths and mechanical spraying. They explain that extensive livestock farming is more infested than semi-intensive livestock farming due to the methods used for tick control, as tick removal is mainly manual and, exceptionally, acaricide spraying is used in cases of massive infestation, or sometimes the use of medicinal plants. In semi-intensive livestock farming, tick control is achieved using tick baths or by weekly or bi-weekly spraying of acaricides, which helps reduce the parasite load.

Thus, Kasonia and Yamalo (1994), cited by Matzigkeit (1997) and Kalume (2011), recommend regular tick control on a weekly basis, especially during rainy periods, limiting the practice of free-range livestock farming, which has a very high impact on tick infestation, and the use of biopesticides or biosides as an alternative method for tick control, because, according to Kalume et al. (2009), good quality acaricides are rare and very expensive on local markets. However, experimental research must be conducted to validate the effectiveness of the proposed plants.

Mohamed (2020) adds that the active ingredients as well as the specialties of antiparasitics are very numerous; thus the clinician's choice is based first of all on the parasitic species (importance of a precise parasitological diagnosis), on the stage in question (importance of knowing the exact biological cycle of the parasite), the host (age, breed, sex, use, etc.), the expected benefits of this control action and the economic criteria (price of the drug, waiting time, withdrawal times, cost of application). The fight against parasites must necessarily combine medical measures and sanitary measures. The dosage must be respected because several of these molecules are toxic to animals. In addition, overdosing increases the cost of control and underdosing results in therapeutic failures.

Bondombe (2023) adds that untimely tagging treatments, that is to say, the clumsy use of acaricide products, are stimuli for increasing resistance for ticks in livestock farming regions through lethal biological amplification.

V. Conclusion

A study on the identification and distribution of ticks infesting cattle in Ituri province was conducted to consider effective control methods to promote cattle farming after the return of effective and lasting peace.

One thousand two hundred tick specimens and 2,562 cattle of all ages constituted the study material. The identification keys used were those of Chartier et al. (2000), Bouattour (2002), and Walker et al. (2003).

The results obtained from the observations are as follows:

- From 1,200 tick specimens collected, 6 genera and 10 species were identified, including *A. hebraeum*, *A. latum*, *A. variegatum*, *Demacentor marginatus*, *Haemaphysalis*

punctata, *Hyalomma marginatum*, *Ixodes pilosus*, *I. ricinus*, *Rhipicephalus appendiculatus*, and *R. microplus*;

- Of these ten acarine species, *A. variegatum* (100%) and *Rhipicephalus microplus* (96.6%) are the most abundant, followed by *Hyalomma marginatum* (46%), *Ixodes piulosis* (36.66%), and *A. hebraeum* (34%);

- These acarine species are very evenly distributed throughout the territories under study, but more so in the Irumu (0.928) and Djugu (0.9456) territories;

- The Mahagi and Djugu territories have a tick similarity level of 85%, and these have a similarity level with that of Aru of 62%. These three territories have a similarity level with that of Irumu of 28%;

- The control methods used to control ticks are chemical control followed by animal rotation on the different meadows and finally, bush fires.

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