Prevalence of ticks infesting grasscutters (Thryonomys swinderianus Temminck, 1827) in the south of Côte d’Ivoire

Zouh Bi Zahouli Faustin1*, Touré Alassane2-3, Oka.Komoin Clarisse2, Karamoko Yahaya1 & Fantodji Agathe1
1Nangui Abrogoua University, Livestock Productions Research Pole, 02 BP 801 Abidjan 02, Côte d’Ivoire
2LANADA, Laboratoire Central Vétérinaire de Bingerville (LCVB), BP 206 Bingerville, Côte d’Ivoire
3Centre International de Recherche-Développement sur l’Élevage en zone Subhumide (CIRDES), BP 454 Bobo-Dioulasso, Burkina Faso
*Corresponding author: Tel.: +225 49 05 47 75, Email: zouhbifaut@gmail.com / zouhfaust@yahoo.fr

Original submitted in on 23rd January 2015. Published online at www.m.elewa.org on 31st March 2015
http://dx.doi.org/10.4314/jab.v87i1.10

ABSTRACT
Objective: Ticks play a significant role in the transmission of pathogenic agents to animals. In Côte d’Ivoire, there is little information on those of grasscutters.
Methodology and results: Thus, 150 wild grasscutters and 150 farm grasscutters from the south of Côte d’Ivoire were examined from April 2010 to October 2012. Ticks collected were identified under binocular lens and optical microscope. The species identified were confirmed at CIRDES (Bobo-Dioulasso). The species Ixodes aulacodi, Rhipicephalus simsoni, Rhipicephalus (Boophilus) microplus, Amblyomma compressum and Haemaphysalis leachi were identified. Farm grasscutters were not infested but 92% of wild grasscutters were infested by at least one species. The most abundant species was I. aulacodi. It accounted for 67.98% of all collected ticks and was encountered on 75.33% of wild grasscutters. The second one was R. simsoni (29.11% of collected ticks and collected on 54% of wild grasscutters). The three other species were slightly encountered (less than 2% of collected ticks and prevalence lower than 7%). Similarly, the infestation level by I. aulacodi was the highest (7±5 ticks per grasscutter against less than 4 for the others).Ticks belonging to R. simsoni, R. microplus and Ha. leachi were adults. On the other hand, 9.16% of I. aulacodi and 25% of A. compressum were nymphs.
Conclusion and application of results: Farm grasscutters in Côte d’Ivoire do not carry some ticks. But five species were found on wild grasscutters. Ticks and pathogenic agents that they transmit and for which some are responsible for zoonosis, could constitute a major obstacle for the development of grasscutters’ farming and constitute a problem of public health. This study gives an update on diversity and database information for surveillance and prevention of zoonosis and their vectors.
Keywords: grasscutters, Ticks, Prevalence, Côte d’Ivoire.
RESUME
Objectif: Les tiques jouent un rôle très important dans la transmission d’agents pathogènes aux animaux. En Côte d’Ivoire, il existe peu d’information sur celles rencontrées chez les aulacodes.
Conclusion et application des résultats: Les aulacodes d’élevage en Côte d’Ivoire ne portent pas de tiques. Cependant, 5 espèces ont été rencontrées sur les aulacodes sauvages. Les tiques et les agents pathogènes qu’elles transmettent et dont certains s’ont responsables de zoonoses, pourraient constituer un obstacle majeur au développement de l’aulacodiculture et constituer un problème de santé publique. Cette étude représente donc une base de l’information pour la surveillance et la prévention de zoonoses et leurs vecteurs.
Mots-clés : Aulacodes, Tiques, Prévalence, Côte d’Ivoire.

INTRODUCTION
In order to cater for animal proteins requirements, Côte d’Ivoire has put in place semi-intensive farming of animals with short biological cycle (poultry, pigs, rabbit). Local breeds of small ruminants and fish farming have been improved (Fantodji & Mensah, 2000). Then, farming in captivity of certain species of wild animals such as giant snails and grasscutters has been initiated. Since 1995, grasscutters farming, one of the most important bushmeat in West Africa (Abé, 2009), shows a considerable development in Côte d’Ivoire. According to Soro (2007), grasscutter represents around 60% of bushmeat consumption in Côte d’Ivoire. The current level of exploitation could lead to the decrease of the whole natural stock of grasscutter. To prevent this decrease and to reduce animals proteins imports, research has been carried out on grasscutters growth, reproduction and feeding (Soro, 2007). Research has been made done on the pathology of this animal and allowed the identification of numerous parasites namely: protozoans (Arène, 1986), gastro-intestinal parasites (Omonona, 2011 ; Zouh Bi, 2013), blood parasites (Opara & Fagbemi 2010) and ectoparasites mainly represented by ticks (Yeboah & Simpson 2004 ; Abé, 2009). As the second most important diseases vectors around the world, after mosquitoes (Parola & Didier 2001), ticks could transmit zoonotical parasites which could cause a problem of public health. So far, no investigation has been conducted in Côte d’Ivoire in order to establish their prevalence in grasscutters. Therefore, it could be useful to carry out a study on ticks infesting grasscutters in Côte d’Ivoire. It is the target of this study, which aims at identifying and determining abundance and prevalence of ticks on wild and farm grasscutters.
MATERIAL AND METHODS

Study areas: Côte d’Ivoire, a country located in the northern hemisphere in the humid and coastal zone of west Africa, is between the tropic of Cancer and the Equator, precisely between 4th and 10th degree of latitude north, and 2nd and 8th degree of longitude west. The study has been carried out on grasscutters selected from eight regions of the south: Districts of Abidjan and Yamoussoukro, regions of Agnéby-Tiassa, la Mé, Grands Ponts, Lôh Djiboua, Sud Comoé and Belier located in forest zone with high rainfall. These regions have been chosen because of many existing grasscutters’ farms.

Animals: The study was conducted on 150 farm grasscutters from fifteen farms. One hundred and fifty (150) wild grasscutters were also submitted for investigations and were from the regions quoted above.

Tick collection: Tick collection was done from April 2010 to October 2012. The fur was explored with care and all the ticks found were collected with a pair of tongs preventing the hypostom from breaking. The ticks collected on a grasscutter were conserved in a bottle with a hermetic latch containing Ethanol 70%. Each bottle was labelled with the following: ordinal number of the sample, farm where sample was collected (name of the District or the region), date of collection, sex of the host.

Tick identification: Tick identification has been performed at the Veterinary Central Laboratory of Bingerville (LCVB). The content of each bottle was poured into a kneaded box, and then the parasites were separated and counted by the ornamentation of the body, by the sex and by the physiological stage. The species identification was completed under binocular lens (CETI) at 80-fold magnification and optical microscope (Leica DMLS) at 100-fold magnification. It bases on the morpho-anatomic characteristics (Arthur, 1956; Aeschlimann, 1963; Morel & Mouchet 1965; Walker et al., 2003). Indeed, the female of the species Ixodes aulacodi Arthur, 1956 were identified by the presence of fine long hairs on the alloscutum, triangular form of basis capituli, genital opening between coxae IV and anal valves large and eccentrically placed. For the male, the scutum punctuation and genital aperture position between coxae III was searched for. Regarding the species Rhipicephalus simpsoni Nuttall, 1910, characteristics of the female observed were long scutum without interstitial punctuations and little superficial punctuations. The male were discriminated by the sickle form of adanal plates. Concerning Rhipicephalus (Boophilus) microplus Canestrini, 1888, we discriminated with microscope at 100-fold magnification. We highlighted on layout of dentition, the existence of ventro-internal protuberance bearing setae near the rostr. As far as concerning Amblyomma compressum Macalister, 1872, there is no ornamentation on the scutum. The marginal furrow is short but distinct for the male and absent for the female. Teeth are distributed in three pairs of files on each hypostom and the spur of coxae IV for the male is particularly robust. The species Haemaphysalis leachi Audouin, 1826 has conspicuous lateral extensions to palp articles 2, forming mouthparts with a distinctive conical shape. In addition, festoons have been observed and counted. All ticks were convoyed in the acarology section of CIRDES in Bobo-Dioulasso, for confirmation. Indeed, confirmation was done morphologically and the species Rhipicephalus (Boophilus) microplus was confirmed by molecular biology using a PCR–RFLP test (Lempereur et al., 2010; De Clercq et al., 2012).

Results expressing and statistical analysis: Microsoft Office Excel 2007 program was used to print data, to calculate abundance, prevalence and infestation level of each tick species. Formulas used:

**Abundance of each tick species (A):**

\[ A = \frac{\text{Total number of a given tick species}}{\text{Total number of ticks collected}} \times 100 \]
Prevalence of each tick species on grasscutters (P):

\[ P = \frac{\text{Number of grasscutters carrying a given tick species}}{\text{Total number of grasscutters}} \times 100 \]

Infestation level of each tick species (I):

\[ I = \frac{\text{Total number of a given tick species}}{\text{Total number of grasscutters carrying this tick species}} \]

The statistical comparisons of those abundances, prevalence and infestation levels have been done respectively by Chi-square test and Student t test. Difference was significant when p value was lower than 0.05 (p< 0.05).

RESULTS

A sample of 1065 ticks was considered in wild grasscutters. Ninety two per cent (92%) of wild grasscutters were carrying at least one tick species. On the other side, none of the farming grasscutters examined was carrying a single tick. The identification mainly based on morpho-anatomical characters has revealed the presence of five species of ticks from five genera on wild grasscutters: *Ixodes aulacodi* (Figure 1), *Rhipicephalus simpsoni* (Figure 2), *Amblyomma compressum* (Figure 3), *Rhipicephalus (Boophilus) microplus* (Figure 4) and *Haemaphysalis leachi* (Figure 5).

![Figure 1: Ixodes aulacodi (male)](image1)

![Figure 2: Rhipicephalus simpsoni (female)](image2)

![Figure 3: Amblyomma compressum (male)](image3)
Those ticks were collected on grasscutters from all the study areas. Indeed, the Autonomous Districts of Abidjan, the regions of Agnéby-Tiassa, La Mé, and Bélier sheltered four of the five tick species identified. It was about *I. aulacodi*, *R. simpsoni*, *A. compressum* and *R. microplus*. Concerning the Autonomous District of Yamoussoukro, three species that were *I. aulacodi*, *R. simpsoni* and *A. compressum* were met whereas grasscutters from Lôh Djiboua region lodged *I. aulacodi*, *R. simpsoni* and *Ha. leachi*. At last, only two species namely *I. aulacodi* and *R. simpsoni*, were collected on grasscutters from Grands Ponts and Sud Comoé regions.

- **Abundance and prevalence of the different species identified:** Among all the ticks collected, the species *I. aulacodi* was the most abundant. It represented 67.98% of ticks’ total number. This value was higher than the one of *R. simpsoni* (29.11%). The three other species were very lowly represented (1.7% for *A. compressum*, 1.12% for *R. microplus* and 0.09% for *Ha. leachi*) (Figure 6).

![Figure 4: Rhipicephalus (Boophilus) microplus (male)](image)

![Figure 5: Haemaphysalis leachi (female)](image)

**Figure 6:** Abundance (%) of each tick species
As far as concerning the different species prevalence on grasscutters, the one of *I. aulacodi* (75.33%) was once again higher than the one obtained for *R. simpsoni* (54%), which also was higher than ones of *A. compressum* (6%), *R. microplus* (5.33%) and *Ha. leachi* (0.66%) (Table 1). According to regions, the prevalence obtained for *I. aulacodi* was included between 52% and 95%. The lowest value (52.94%) was recorded in the region of Grands Ponts and the highest one (95%) was observed in Agneby-Tiassa. These values of prevalence were higher than ones of *R. simpsoni*, according to all regions. Indeed, the prevalence of this species was between 38.88% (Lôh Djiboua region) and 75% (Agneby-Tiassa region) (Figure 7). As far as concerning the species *A. compressum*, its lowest prevalence (5.26%) was obtained in the Autonomous District of Yamoussoukro and the highest one (15%) in Agneby-Tiassa region. The prevalence of *R. microplus* species was 22.22%, 10%, 5.55% and 5% respectively for Agneby-Tiassa région, la Mé région, Autonomous District of Yamoussoukro and Bélier region. The species *Ha. leachi* was found only on one grasscutter in Lôh Djiboua region. Its prevalence was 5.55% in this region (Figure 7).

**Table 1**: Prevalence (%) and ticks’ burden of wild grasscutters

<table>
<thead>
<tr>
<th>Tick species</th>
<th>Prevalences on grasscutters</th>
<th>Infestation level</th>
<th>physiological stages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Adults</td>
<td>Nymphs</td>
</tr>
<tr>
<td><em>Ixodes aulacodi</em></td>
<td>75.33%&lt;sup&gt;a&lt;/sup&gt; (113/150)</td>
<td>7±5&lt;sup&gt;a&lt;/sup&gt; (1-47)</td>
<td>90.84% 9.16%</td>
</tr>
<tr>
<td><em>Rhipicephalus simpsoni</em></td>
<td>54%&lt;sup&gt;b&lt;/sup&gt; (81/150)</td>
<td>4±2&lt;sup&gt;b&lt;/sup&gt; (1-9)</td>
<td>100% 0%</td>
</tr>
<tr>
<td><em>Amblyomma compressum</em></td>
<td>6%&lt;sup&gt;c&lt;/sup&gt; (9/150)</td>
<td>2±0.5&lt;sup&gt;c&lt;/sup&gt; (1-3)</td>
<td>75% 25%</td>
</tr>
<tr>
<td><em>R. (Boophilus) microplus</em></td>
<td>5.33%&lt;sup&gt;e&lt;/sup&gt; (8/150)</td>
<td>2±0.5&lt;sup&gt;c&lt;/sup&gt; (1-2)</td>
<td>100% 0%</td>
</tr>
<tr>
<td><em>Haemaphisalis leachi</em></td>
<td>0.66%&lt;sup&gt;d&lt;/sup&gt; (1/150)</td>
<td>1±0&lt;sup&gt;c&lt;/sup&gt; (1)</td>
<td>100% 0%</td>
</tr>
</tbody>
</table>

ab means in the same column with dissimilar superscripts are significantly different (p<0.05)
Table 1: Percentage of ticks from grasscutters

<table>
<thead>
<tr>
<th>Infestation level of the different tick species collected</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. aulacodi + R. simpsoni</td>
<td>75.36%</td>
</tr>
<tr>
<td>I. aulacodi + A. compressum</td>
<td>12.33%</td>
</tr>
<tr>
<td>I. aulacodi + R. microplus</td>
<td>10.72%</td>
</tr>
<tr>
<td>I. aulacodi + H. leachi</td>
<td>1.58%</td>
</tr>
</tbody>
</table>

Table 2: Poly-parasitism of wild grasscutters

<table>
<thead>
<tr>
<th>Bi-infestations</th>
<th>Percentage</th>
<th>Tri-infestations</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. aulacodi + R. simpsoni</td>
<td>75.36%</td>
<td>I. aulacodi + R. simpsoni + A. compressum</td>
<td>66.66%</td>
</tr>
<tr>
<td>I. aulacodi + A. compressum</td>
<td>12.33%</td>
<td>I. aulacodi + R. simpsoni + R. microplus</td>
<td>33.33%</td>
</tr>
<tr>
<td>I. aulacodi + R. microplus</td>
<td>10.72%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. aulacodi + H. leachi</td>
<td>1.58%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

This study represents the first inventory of grasscutters ticks in the south of Côte d'Ivoire. During the investigation, no tick was collected on the farm grasscutters. This could be explained by the care hygiene given by the grasscutter farmers in the management of their farms and by the method of drying fodder before they distribute it to animals. In fact, enclosures of grasscutters are cleaned every day and sanitized monthly. The fodder is dried up in the sun 24 hours before distribution in order to eliminate ectoparasites and endoparasites possibly present (Soro, 2007). Schrage & Yewadan (1995) also did not meet any tick on the farm grasscutters in Benin. On wild grasscutters, five ticks species from five genera have been collected. The species I. aulacodi and R. simpsoni have been the major species encountered with respective prevalences of 75.33% and 54%. Hence, they represent specific ticks to grasscutters (Morel, 1963; Morel & Mouchet, 1965) and they had been recorded since 1963 on grasscutters in Côte d'Ivoire, in the departments of Tiaissalé and Toumodi (Morel, 1963). Furthermore, Yeboah & Simpson (2004) had also found on grasscutters of Ghana the following species: I. aulacodi, Ixodes oldi and R. simpsoni. The three other species in this study (A. compressum, R. microplus and H. leachi) were revealed at a proportion lower than 7%. Indeed, A. compressum is known to be specific tick of Manis tricupis and Manis tetradactyla (Aeschlimann, 1963). The species R. microplus has been introduced in Côte d'Ivoire during importation of Girolando bovines from Brasil (Madder et al., 2007). Moreover, this species has been collected in Côte
They are kind of ticks. On the other hand, wild grasscutters carry some, at least five species belonging to five genera. Grasscutter would be one of its new hosts. As for Ha. leachi, this species is never in a large number. The immature ticks engorge themselves on micro-mammals belonging to Leggada, Pramodys and Hydromelus (Graf et al., 1981). Among the others adults hosts namely sheep, goat and dog, grasscutter constitute the new host for adults of this tick species in Côte d'Ivoire, as well as human (Morel & Mouchet, 1965). In addition, Yeboah & Simpson (2004) have collected another species of Haemaphysalis named Haemaphysalis parmata on wild grasscutters in Ghana. The prevalence of the four tick species I. aulacodi, R. simpsoni, A. compressum and R. microplus obtained in Agneby-Tiassa region were higher than ones of the other regions. Therefore, grasscutters of this region are the most infested.

CONCLUSION
In the foreground, this study highlighted that farm grasscutters in Côte d'Ivoire do not generally carry any kind of ticks. On the other hand, wild grasscutters carry some, at least five species belonging to five genera. They are I. aulacodi, R. simpsoni, R. microplus, A. compressum and Ha. leachi. The species I. aulacodi and R. simpsoni are more abundant, more prevalent and are considered specific to grasscutters. Nymphs were met only in I. aulacodi and A. compressum species. This study represents the first inventory of grasscutter ticks in the south of Côte d'Ivoire.Ticks are known to be vectors of many pathogens including zoonosis causative agents. Therefore, this work will continue in terms of diagnosis of blood parasites in the sampled ticks.

ACKNOWLEDGEMENTS
This study is part of a project funded by WELCOME TRUST through the Consortium AFRIQUEONE “One Health Initiative African Research Consortium for Ecosystem and Population Health”. We would like to express our gratitude toward its initiators. We would also like to thank Laboratoire Central Vétérinaire de Bingerville (LANADA-LCVB) where the work has been performed, and CIRDES of Bobo-Dioulasso for the confirmation of ticks' species.

REFERENCES
Prevalence of ticks infesting grasscutters (Thryonomys swinderianus Temminck, 1827) in the south of Côte d’Ivoire


