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Dynamics and spatial distribution of *Culicoides* (Diptera: Ceratopogonidae) biting midges, potential vectors of African horse sickness and bluetongue viruses in Senegal.

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Background

In Senegal, the 2007 epidemic of African horse sickness (AHS) caused the death of 1,169 horses and considerable economic loss (Akakpo et al. 2011). The vectors responsible for biological transmission of the virus belong to the genus *Culicoides* (Diptera: Ceratopogonidae). In Senegal, studies on *Culicoides* are rare, out of date and did not specifically target the species in the vicinity of horses. Thus we initiated a study in 2011 to better understand the dynamics of the *Culicoides* of Senegal and their involvement in the transmission of African Horse sickness virus (AHSV).

Methods

A one-year monthly trapping campaign using two OVI light traps (Figure 1) for three consecutive nights in five sites of the Niayes region (Figure 2) was carried out from June 2011 to may 2012 to identify potential *Culicoides* vectors of AHSV and describe their dynamics. In September-October 2012, a nation-wide *Culicoides* trapping campaign was set up to better describe spatial distribution of *Culicoides* in Senegal. In this second study, two successive collection nights using OVI light traps were carried out in 98 sites in 12 (out of 14) regions of Senegal (Figure 3). *Culicoides* were identified using the morphological keys of Cornet (Cornet 1969; Cornet 1981; Cornet & Brunhes 1994) and Boorman (Boorman 1989; Boorman & Mellor 1982).



Figure 1: OVI trap used for *Culicoides* captures

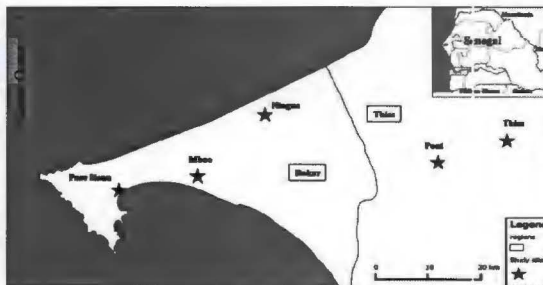


Figure 2: Locations of *Culicoides* trapping sites in the Niayes of Senegal



Figure 3: Locations of the nation-wide *Culicoides* trapping campaign sites in Senegal

Results

Population dynamics

- ✓ 224 665 specimens of the *Culicoides* genus (in 354 collections) belonging to at least 24 different species were captured during the one-year monthly trapping campaign.
- ✓ The most abundant species (Figure 3) were *C. oxystoma*, *C. kingi*, *C. imicola*, *C. enderleini* and *C. nivosus*
- ✓ Peaks of abundance coincide with the rainy season in September and October (Figure 4).

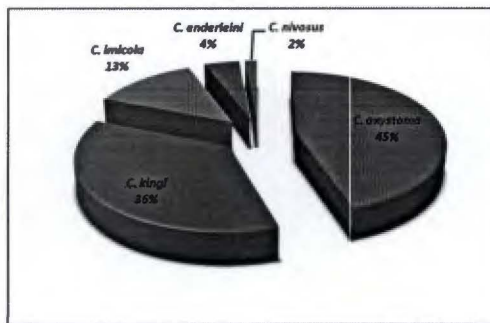


Figure 3: Proportion of total catch for the dominant *Culicoides* species in the Niayes of Senegal

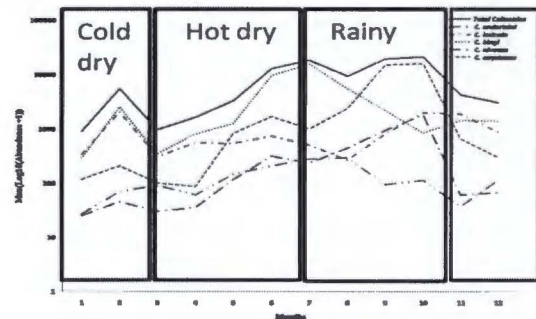


Figure 4: Seasonal variations of dominant *Culicoides* species in the Niayes of Senegal.

See complete results in Diarra *et al.*
Parasites & Vectors 2014, 7:147.



Spatial distribution

- ✓ More than 1,367,000 *Culicoides* belonging to at least 35 species were collected during this spatial survey (Figures 5 and 6).

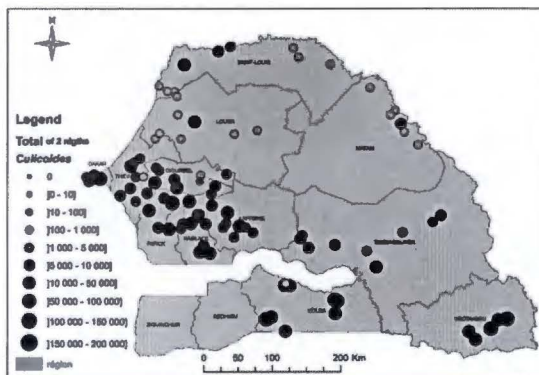


Figure 5: Spatial distribution of *Culicoides* in Senegal

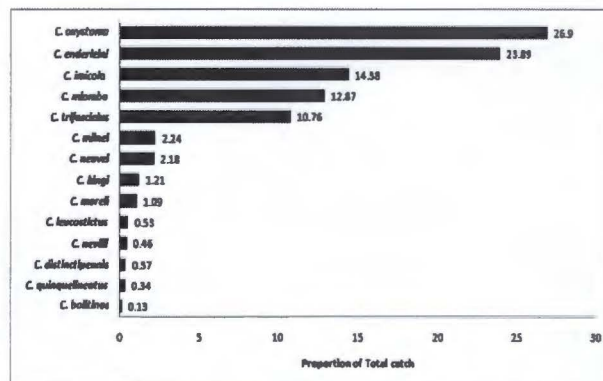


Figure 6: Diversity of *Culicoides* species in 2012 Species with proportion of total catch > 0.1%

The figure 7 shows the spatial distribution of the five most abundant species (>10% of the total captures).

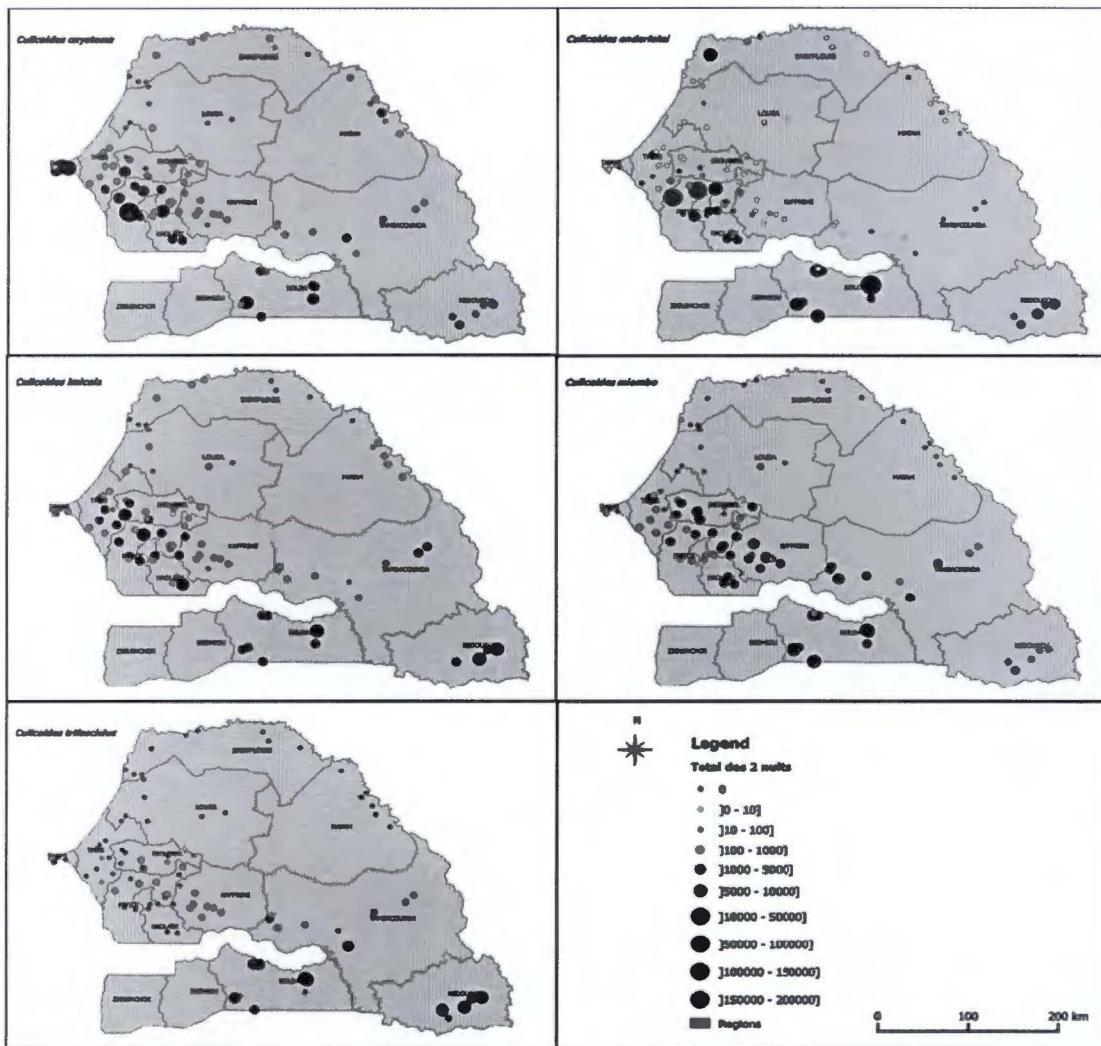


Figure 7: spatial distribution of the five dominant species of *Culicoides* ($n > 10\%$ of the total captures) in Senegal

Conclusion

Overall, this work allowed updating the list of *Culicoides* species of Senegal and their spatial distribution, describing the dynamics of the potential vectors of AHS and bluetongue viruses in Senegal.

Acknowledgement

This study was funded partly from the EU FP7-HEALTH-2010-single-stage grant 261504 EDENext (<http://www.edenext.eu>). The contents of this publication are the sole responsibility of the authors and do not necessarily reflect the views of the European Commission.

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FICHE TECHNIQUE



**An update of the list of *Culicoides* species (Diptera :
Ceratopogonidae) of Senegal**

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Background

Midges of the genus *Culicoides* Latreille are small biting dipterans (1 to 4 mm in length) that belong to the Ceratopogonidae family. *Culicoides* present a worldwide distribution. Some 1,357 species have been recorded [1], some of which are vectors of viral and parasitic (both protozoan and nematode) pathogens. Their impact is mainly on animal health: in particular, the transmission of virus of two epizootic diseases in horses and ruminants, respectively African horse sickness (AHS) and bluetongue (BT) [2]. Up to 1994, 34 *Culicoides* species were recorded in Senegal [1, 3-5]. Amongst these are *Culicoides imicola* Kieffer is a proven vector of AHSV in southern Africa [6, 7]. To identify all potential *Culicoides* vectors in Senegal, we carried out a one-year monthly light and horse-baited traps collection in an area which severely impacted by the outbreaks of AHSV in 2007. The study aimed among other to draw up an inventory of the *Culicoides* species relevant for animal health in the Niayes area of Senegal.

Methods

Culicoides were collected using a horse-baited trap identical to the one used by Fall *et al.* (2011) for entomological investigations of mosquitoes' vectors of West Nile fever [8, 9] (Figure 1A). In parallel, two light traps of the OVI (Onderstepoort Veterinary Institute) type were operated to compare host-baited collections with this more widely used *Culicoides* trapping method [10, 11] (Figure 1B). Both sampling methods were used at each of the five sites (Figure 2) for three consecutive nights per month from July 2011 to June 2012 at Parc Hann, Mbao, Thies and Pout sites and from November 2011 to October 2012 at Niague. The horse-baited trap and the light traps were activated simultaneously, operating from 6 p.m. to 8 a.m. based on the dusk/dawn and night-time activity of most *Culicoides* species. Morphological identification of *Culicoides* species was conducted by examination of the wing pigmentation pattern using a stereomicroscope. Several identification keys were used depending on the species found and their subgenus or group [4, 5, 12-17].



Figure 1. Description of the: A) horse-baited trap; B) light trap, to collect *Culicoides* at 5 sites in the Niayes area in Senegal from July 2011 to October 2012

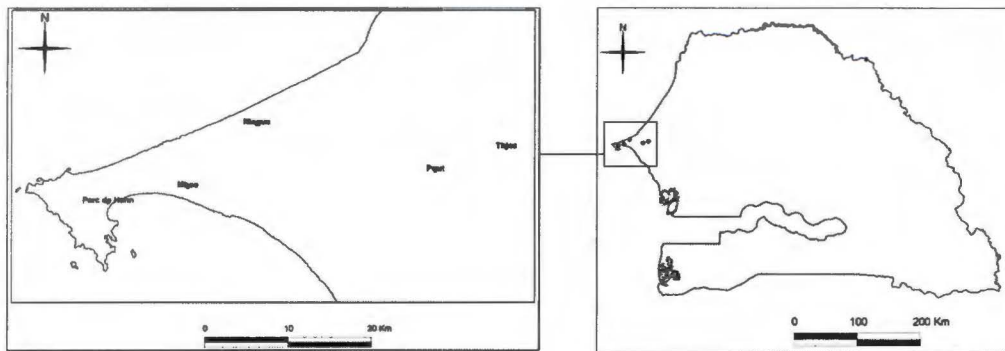


Figure 2: Locations of *Culicoides* trapping sites in the Niayes area of Senegal

Results

A total of 254,338 specimens of the *Culicoides* genus, of which 209,543 females (82.4 %) and 44,795 males (17.6%) were collected using the two sampling methods over the 515 nights of trapping: 181 and 178 for each light trap and 156 for the horse-baited trap. After complete identification, we finally identified at least in light trap and horse-baited trap collections, 19 of which are new distribution records in Senegal. Hence the list of *Culicoides* in Senegal now comprises 53 species (Table 1).

Table 1 - New list of *Culicoides* species found in Senegal.

Reported species not found	Reported species found	Newly recorded species
<i>C. africanus</i> [†] Clastrier	<i>C. accraensis</i> ² Carter, Ingram and Macfie	<i>C. austeni</i> ^{†1} Carter, Ingram and Macfie
<i>C. camicasi</i> Cornet and Château	<i>C. clarkei</i> ² Carter, Ingram and Macfie	<i>C. azerbaijdzhanicus</i> ² Dzhafarov
<i>C. chateaui</i> Cornet	<i>C. congolensis</i> ² Clastrier	<i>C. bolitinos</i> ^{†1} Meiswinkel
<i>C. dasyops</i> Clastrier	<i>C. dekeyseri</i> ² Clastrier	<i>C. hortensis</i> ^{†1} Khamala and Kettle
<i>C. dutoiti</i> de Meillon	<i>C. dispar</i> ² Clastrier	<i>C. leucostictus</i> ¹ Kieffer
<i>C. grahamii</i> Austen	<i>C. distinctipennis</i> ¹ Austen	<i>C. milnei</i> ^{†1} Austen
<i>C. kobae</i> Cornet and Château	<i>C. enderleini</i> ^{†1} Cornet and Brunhes	<i>C. miombo</i> ^{†1} Meiswinkel
<i>C. krameri</i> [†] Clastrier	<i>C. expectator</i> ² Clastrier	<i>C. murphyi</i> ¹ Clastrier and Wirth
<i>C. micheli</i> Cornet and Château	<i>C. fulvithorax</i> ² Austen	<i>C. nigripennis</i> ² Carter, Ingram and Macfie
<i>C. moucheti</i> Cornet and Kremer	<i>C. gambiae</i> ¹ Clastrier and Wirth	<i>C. oxystoma</i> ^{†1} Kieffer
<i>C. peretti</i> Cornet and Château	<i>C. imicola</i> ^{†1} Kieffer	<i>C. pretoriensis</i> ¹ Kremer and Nevill
<i>C. saboyae</i> Cornet	<i>C. kingi</i> ^{†1} Austen	<i>C. punctithorax</i> ² Carter, Ingram and Macfie
	<i>C. moreli</i> ^{†1} Clastrier	<i>C. quinquelineatus</i> ^{‡2} Goetghebuer
	<i>C. neavei</i> ² Austen	<i>C. sellersi</i> ² Boorman and Dipeolu
	<i>C. nevilli</i> ^{†1} Cornet and Brunhes	<i>C. translucens</i> ² Khamala and Kettle
	<i>C. nivosus</i> ¹ de Meillon	<i>C. trifasciellus</i> ² Goetghebuer
	<i>C. pseudopallidipennis</i> ^{†1} Clastrier	<i>C. vomensis</i> ² Boorman and Dipeolu
	<i>C. pycnostictus</i> ² Ingram and Macfie	<i>C. wansoni</i> ^{‡2} Goetghebuer
	<i>C. ravus</i> ² de Meillon	<i>C. yankari</i> ² Boorman and Dipeolu
	<i>C. robini</i> ² Cornet	
	<i>C. similis</i> ¹ Carter, Ingram and Macfie	
	<i>C. vicinus</i> ² Clastrier	

* species in the Imicola group; † species in the Schultzei group; ‡ species in the Milnei group

1: species captured in horse-baited trap and light trap 2: species captured only in the light trap

Conclusion

This study allows an update of list of *Culicoides* species of veterinary interest in Senegal (53 species to date). These preliminary results should however be improved by extending such studies in the whole country to complete the list of the *Culicoides* of Senegal.

Acknowledgement

This study was funded partly from the EU FP7-HEALTH-2010-single-stage grant 261504 EDENext (<http://www.edenext.eu>). The contents of this publication are the sole responsibility of the authors and do not necessarily reflect the views of the European Commission.

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