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Geometric morphometric analysis of tsetse flies in Kiéré (Côte d'Ivoire): towards a targeted strategy to combat animal trypanosomiasis

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Introduction

- Côte d'Ivoire eliminated human African trypanosomiasis as a public health problem in December 2020 and is currently aiming to halt transmission by 2030.

- Animal trypanosomiasis, meanwhile, continues to be prevalent throughout the country, with a high incidence in the north (Djakaridja et al., 2014).

- It is within this framework that the Pierre Richet Institute, in agreement with the Veterinary Services Directorate and their partners, is involved in the **COMBAT** project, '**Controlling and gradually reducing the burden of African trypanosomiasis**.'

- Among other things, this project aims to provide endemic countries such as Côte d'Ivoire with tools such as geometric morphometrics (GM) to identify isolated tsetse fly populations with a view to their sustainable elimination.

Introduction

- Although population genetics is often used to identify isolated populations for targeted control, this method remains costly.

- Geometric morphometrics is a scientific discipline used to study and analyse the shape of a structure, whether biological or otherwise, and is a less expensive alternative that is accessible to all.

- **How can phenotypic markers help in choosing an effective control strategy?**

Introduction

Objective: To assess gene flow between tsetse fly populations in the Kiéré riparian zone and those in the neighbouring localities of Sibirinakaha and Sindia in the Korhogo area.

Materials and methods

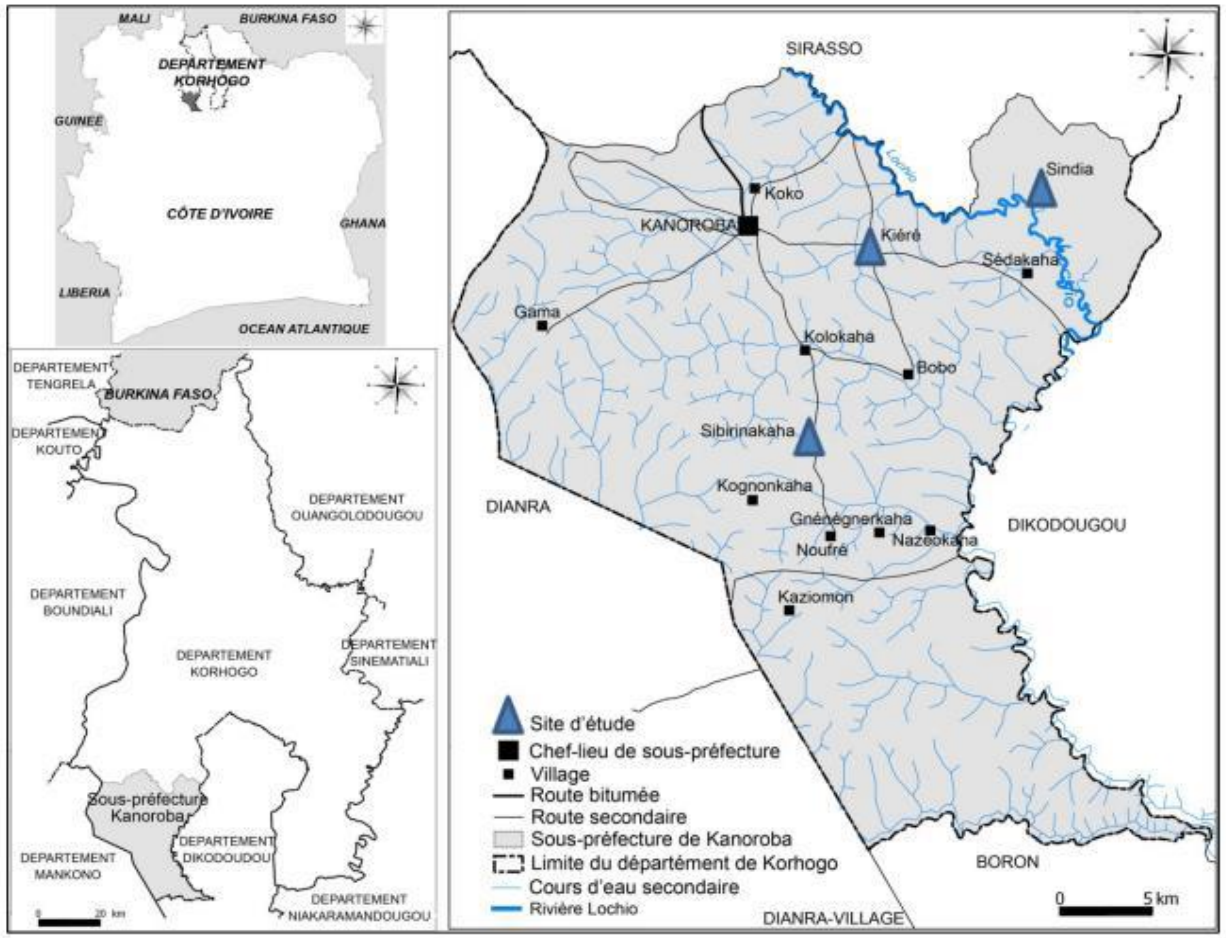


Figure 1: Study area

- ❖ The department of Korhogo covers an area of 12,500 km².
- ❖ Sudano-Guinean tropical climate,
- ✓ Rainy season: May to October,
- ✓ Dry: November to April
- ❖ Vegetation: grassy and wooded savannahs

- Annual rainfall varies between 1,200 mm and 1,400 mm.
- The study was conducted in June 2023.

Capturing tsetse flies

A total of 48 ‘Vavoua’ traps were set

- ✓ Sindia: 19 traps
- ✓ Sibirinakaha: 15 traps
- ✓ Kiéré: 14 traps

- on the outskirts of villages, along watercourses
- The captured insects were collected every 24 hours.
- All trapping sites were georeferenced using GPS
- The tsetse flies captured were identified by species and sex

Sampling of tsetse wings

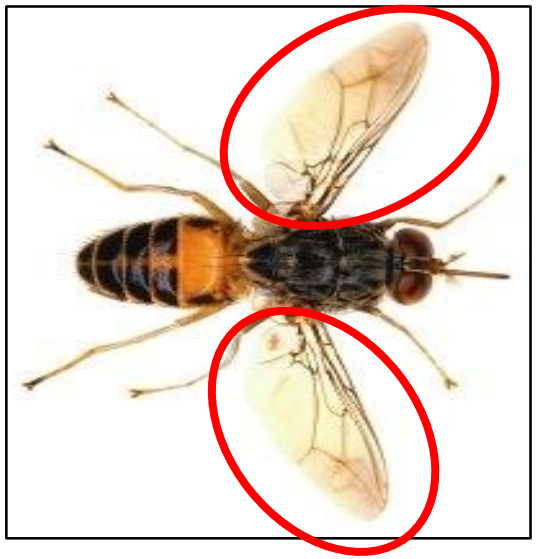
- ✓ These tsetse flies have been identified as belonging to the species ***Glossina palpalis gambiensis***
- ✓ Wings: 63 tsetse flies, isolated, for a morphometric study

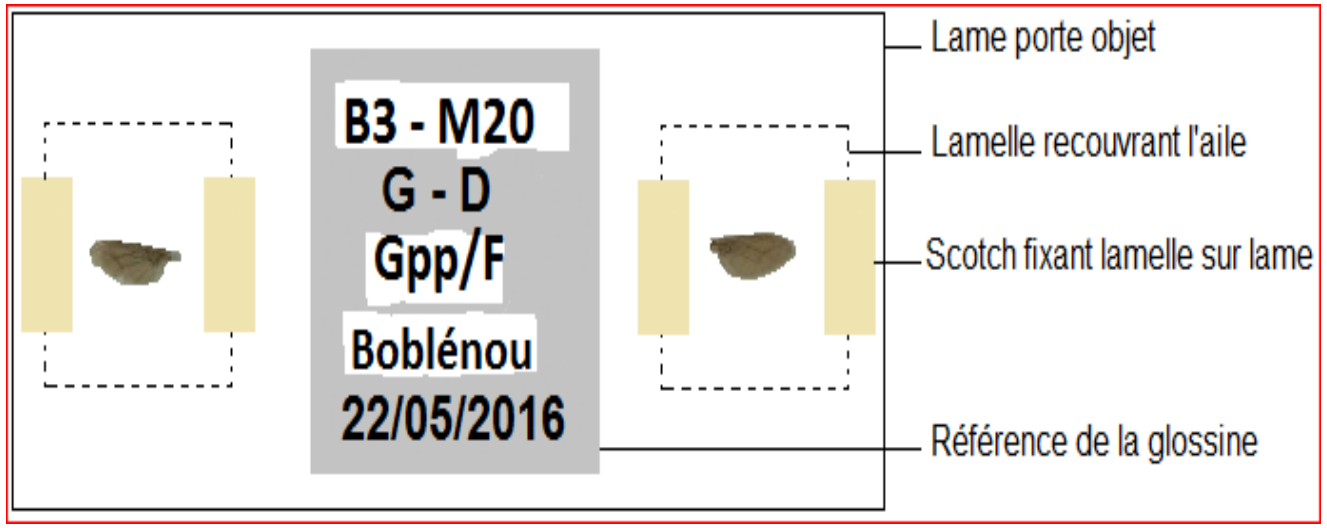
Table 1: Number of wings in each location included in the morphometry study

Localities	Numbers
Kiéré	**25**
Sibirinakaha	**18**
Sindia	**20**
Total	**63**

Materials and methods

Scanning wings







Dinolite



Digitazation of homologous points on the wings

- Wings: digitized 11 reference points, wing vein intersections
- Landmarks: counterparts each wing

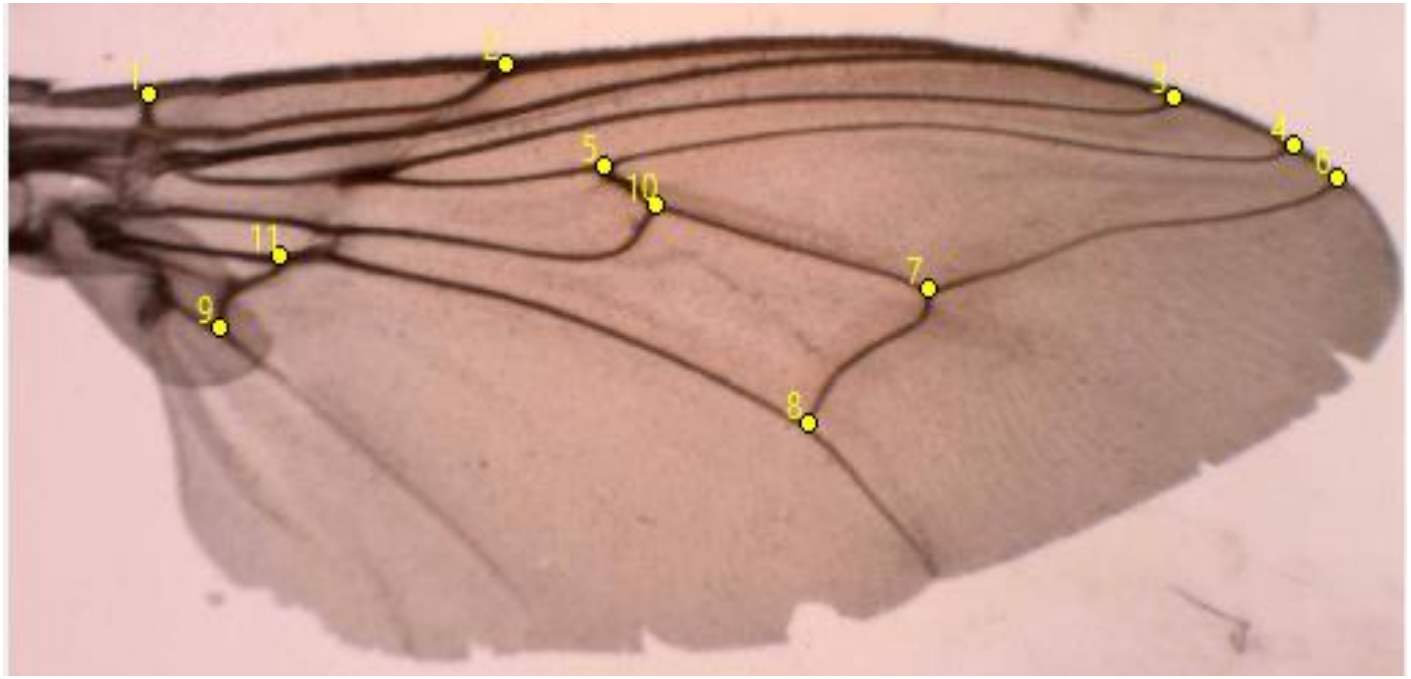


Figure 2: Tsetse wing, *Glossina palpalis gambiensis*, landmarks (left to right 'LM1' to 'LM11')

Material and methods

Data analysis

- **Logiciel CLIC version 98** (http://mome-clic.com)
- **Online program XYOM (**https://xyom.io.)

✓**Discriminant Analysis (DA):** identification of groups of individuals by their shape

✓**Mahalanobis distances (MD):** identifying the existence of gene flow between tsetse populations

Results and discussion

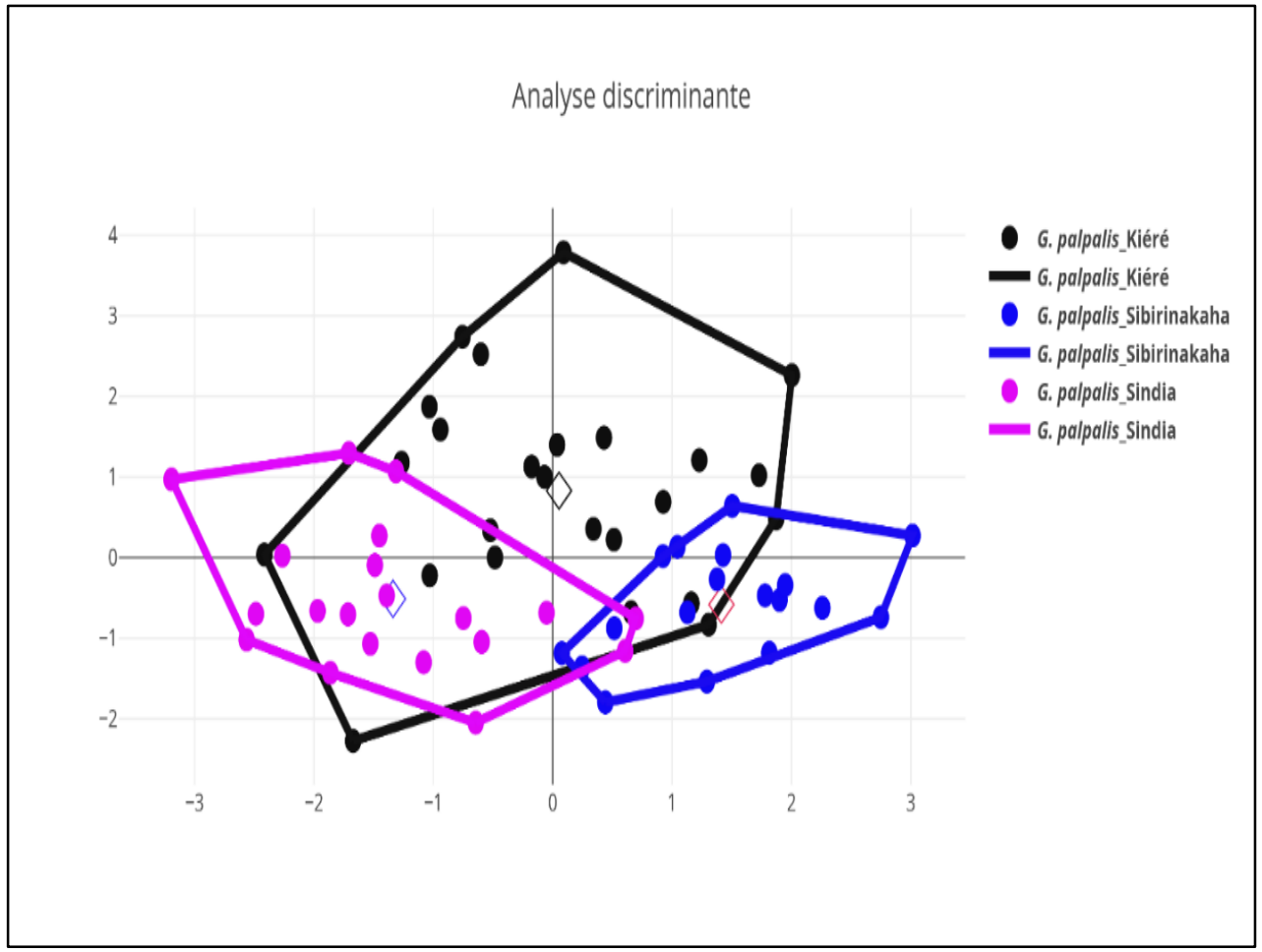


Figure 2: Factor map of discriminant analysis

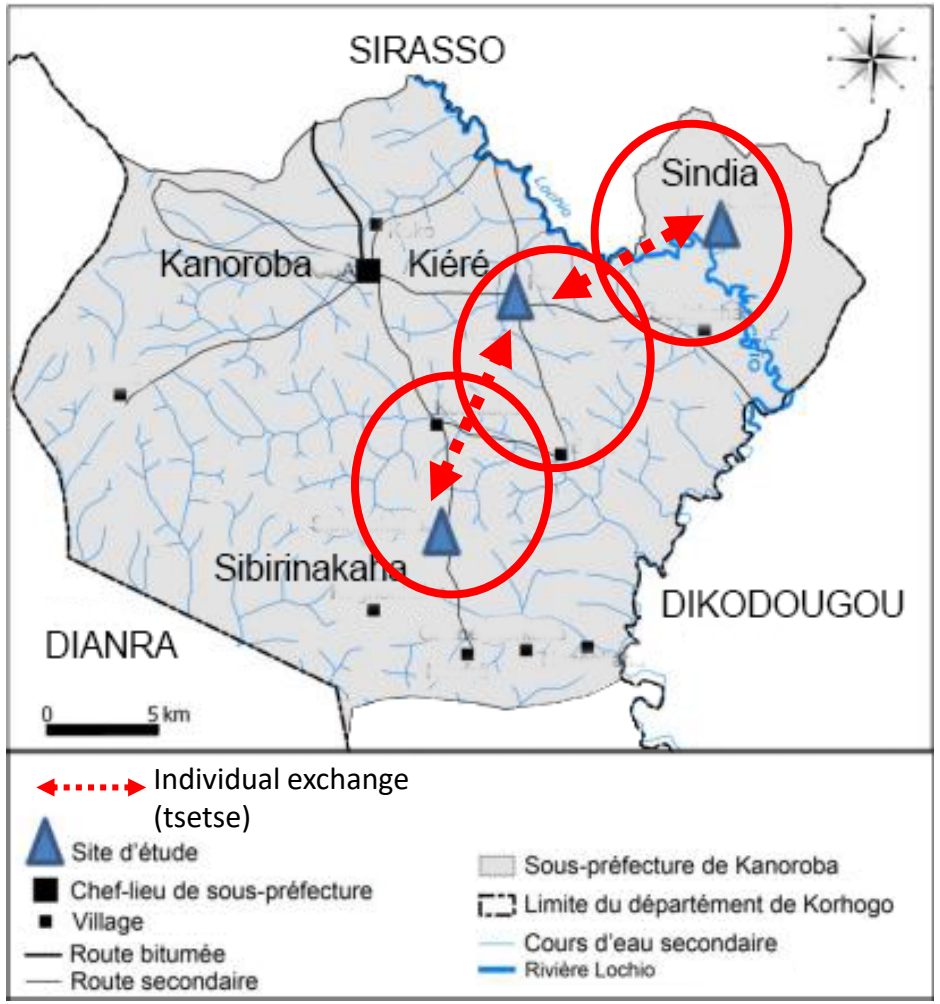
- superposition of polygons on top of each other
- The tsetse populations of the three localities have the same form, same species
- Concorde work of **Launois et al. (2004)**

Results and discussion

Table 2: Mahalanobis distances between groups of two

Localities	Distances (Km)	DM	Test** p<0,01667
Kiéré-Sibirinakaha	12,9	1,961	**0,039**
Kiéré-Sindia	7,9	1,933	**0,025**
Sibirinakaha-Sindia	15,2	2,752	**0.001***

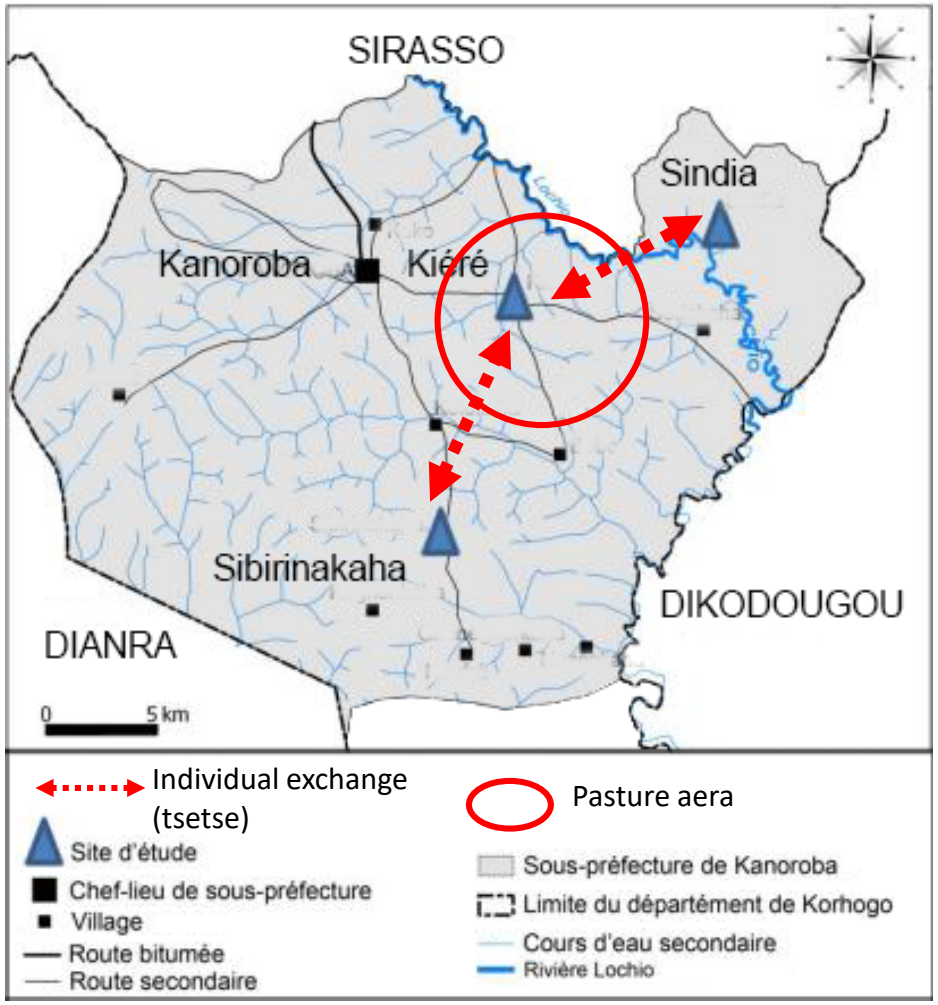
Legend: Km: Kilometer; DM: Mahalanobis distances ** Bonferroni correction by the 1000-round permutation test. The test is significant at 5% risk if p < 0.01667. * significant test



- The non-significant difference between Kiéré and Sindia and between Kiéré and Sibirinakaha
  ➔ Exchange between Kiéré and Sibirinakaha and between Kiéré and Sindia
- Geographically, this can be explained by distance, but it can also explain the grazing areas of cattle raised in different localities.

Results and discussion

Tsetse control strategy



- The choice of control strategy will be discussed between elimination and sequential eradication by placing tiny targets

- A control strategy centred on Kiéré and extending to the other two localities will yield better results (Vreysen et al., 2007).

Conclusion

- Extend the study to the all northern region of Côte d'Ivoire in order to identify isolated populations capable of being eliminated or even eradicated

- The implementation of this strategy will reduce the burden of the AAT, increasing livestock production as desired by the Ivorian government.





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THANK YOU!