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The continental atlas of the distribution of tsetse flies in Africa

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The continental atlas of the distribution of tsetse flies in Africa

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[1] See www.fao.org/paat.

Abbreviations and acronyms

AAT	African animal trypanosomosis
COMBAT	controlling and progressively minimizing the burden of animal trypanosomosis
FAO	Food and Agriculture Organization of the United Nations
GIS	geographic information system
HAT	human African trypanosomiasis
PAAT	Programme Against African Trypanosomosis
WHO	World Health Organization

Foreword

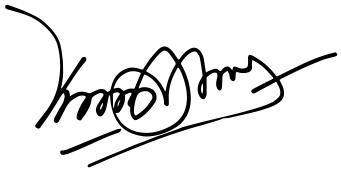
In sub-Saharan Africa, tsetse flies transmit trypanosomes, unicellular parasites that cause disease in human and non-human animals alike. The disease is widespread in livestock in Africa (where it is known as "nagana") and where it causes losses to the agriculture sector that are estimated in billions of dollars every year. In humans, the illness is known as "sleeping sickness" and it is more circumscribed than in livestock, occurring only in well-defined areas of endemicity known as "foci". After causing devastating epidemics in the last century, "sleeping sickness" has recently been "eliminated as a public health problem", with fewer than 2000 cases reported each year; more ambitious targets, including the elimination of transmission of the gambiense form of the disease, have been set for 2030 by the World Health Organization (WHO).

The Food and Agriculture Organization of the United Nations (FAO) has long recognized the severe burden that animal trypanosomosis places on livestock keeping, as well as the risk it poses to public health. Indeed, in an effort to address this often-neglected tropical disease, in 1997 FAO established the Programme Against African Trypanosomosis (PAAT), an interagency collaboration that also includes WHO, the International Atomic Energy Agency and the African Union through its Interafrican Bureau for Animal Resources. For over 25 years, within the framework of PAAT, FAO has been assisting affected countries in their efforts to lift the constraints that tsetse-transmitted trypanosomosis poses to sustainable development and health in Africa.

As the sole cyclical vector of the disease, the tsetse fly is a major target of control efforts aimed at tackling African trypanosomosis. However, an evidence-based, cost-effective targeting of field interventions is often constrained by a dearth of information on the spatial distribution of tsetse flies. Indeed, the latest continental maps depicting the geographical distribution of the different tsetse species are many decades old, and in dire need of updating. National-level maps are also few and often long outdated. To address this gap, FAO developed a new atlas of the distribution of tsetse flies in Africa. The atlas of tsetse flies is part of a two-pronged initiative also aimed at mapping animal trypanosomosis, and, for the tsetse distribution component, it summarizes information from over 600 papers published in the scientific literature between 1990 and 2020. The continental atlas also represents a blueprint for affected countries to develop national-level information systems on tsetse flies and animal trypanosomosis. The approach has already been adopted by several countries (e.g. Burkina Faso, Ethiopia, Ghana, Kenya, Mali, the Sudan and Zimbabwe), and it is believed

to represent a significant innovation to support the progressive control of the disease at the local, national and transnational levels.

We are hopeful that these tools will help reinvigorate initiatives aimed at removing this major hurdle to sustainable development in Africa, and thus contribute to the vision of a healthy world, free of poverty and hunger.



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Executive summary

Tsetse flies (genus *Glossina*) and animal trypanosomosis are a constant drain on the resources of poor livestock keepers in Africa. They also impose a public health burden by transmitting and providing a reservoir for infections to humans. The progressive control and, where possible, the elimination of the disease ought to be based on evidence-based decision-making and cost-effective interventions. In this context, comprehensive data on the geographic distribution of animal trypanosomosis and its vectors are crucial. However, the latest maps of the distribution of tsetse species in Africa were developed many decades ago, and no continental map of animal trypanosomosis occurrence has even been generated. To fill these gaps, FAO developed the continental atlas of tsetse flies and animal trypanosomosis in Africa. The present publication presents the results for the component on tsetse distribution, while the components on trypanosomal infections in tsetse flies and in other non-human animal hosts will be the subject of future publications.

A total of 669 scientific papers spanning a period of 31 years (1990–2020) were used as sources, and they provided the input data to map the distribution of tsetse flies in Africa. The publications were first stored in a digital repository, and then a spatially explicit database was developed to record the data extracted from these papers. The database underpinning the overall atlas is structured into five tables: sources, geographical data, tsetse distribution, tsetse infection and animal trypanosomosis. As regards tsetse distribution, we used the geographic information from the source papers and additional geolocation data from other sources (e.g. Google Earth, online gazetteers, etc.) to map entomological data on tsetse occurrence as point entities, with each point representing a different site or location. Most of the data included in the atlas were collected in the field with stationary traps (98.5 percent of the surveys), with more limited data collected through mobile devices such as fly rounds (1.5 percent of the surveys). Overall, 7 386 sites were mapped in 34 countries in Africa. No data on tsetse flies could be found for five countries in sub-Saharan Africa that are known or considered to be affected: Burundi, Guinea-Bissau, Liberia, Sierra Leone and Somalia. Furthermore, relatively limited information was found for several countries, and especially Angola, the Congo, the Democratic Republic of the Congo and South Sudan.

Based on the publications we reviewed, tsetse flies were reported from a maximum latitude of approximately 15° north in Senegal (Niayes Region), to a minimum of 28.5° south in South Africa (KwaZulu-Natal Province). Overall, relatively abundant data were available for the species of major veterinary and public health

importance, especially for the riverine (*palpalis*) and savannah (*morsitans*) groups, while more limited information was found for the forest (*fusca*) group. With the available data, we could develop maps for 26 out of the 31 recognized species and subspecies of Glossina. For the five remaining species and subspecies (i.e. *Glossina haningtoni*, *Glossina nigrofusca hopkinsi*, *Glossina schwetzi*, *Glossina severini* and *Glossina vanhoofi*), all belonging to the fusca group, we found no published records throughout the 1990–2020 study period. The species with the broadest geographic distribution appear to be *Glossina palpalis* and *Glossina tachinoides* in western Africa, *Glossina fuscipes* in central Africa, and *Glossina morsitans* and *Glossina pallidipes* in eastern and southern Africa.

This continental atlas establishes a new reference for the distribution of tsetse flies in Africa. It also provides a methodological blueprint for the development of national atlases in affected countries. Indeed, with FAO's support, veterinary authorities in several countries have already developed this kind of national-level information system, and many others are in the process of doing so. At the same time, many important limitations still affect this continental atlas of tsetse flies in Africa, including a total reliance on information published in scientific journals, wide geographical gaps in several countries and regions, and the exclusion of data published after 2020. Addressing these and other limitations should be the focus of future enhancements and updates of the atlas.

Chapter 1
Background

INTRODUCTION

African trypanosomoses are a group of vector-borne parasitic diseases affecting both humans and animals. In animals, the disease is normally distinguished into two forms: nagana or African animal trypanosomosis (AAT), whose main causative agents are *Trypanosoma vivax*, *Trypanosoma congolense*, *Trypanosoma brucei* and *Trypanosoma simiae* (Diall *et al.*, 2017; World Organisation for Animal Health, 2021), and surra, caused by *Trypanosoma evansi* (Desquesnes *et al.*, 2013). In sub-Saharan Africa, nagana is mainly transmitted cyclically by tsetse flies (genus *Glossina*), although the parasites can also be transmitted mechanically by other biting flies, such as *Tabindae* and *Stomoxys*. Within nagana, the mechanical mode of transmission is particularly relevant for *T. vivax*; because of this alternate mode of transmission and because of animal movement, *T. vivax* was able to spread and establish itself beyond the African tsetse belt, including in Latin America (Gonzatti *et al.*, 2014) and, as recently reported, in Asia (Asghari and Rassouli, 2022). Mechanical vectors are also central to the transmission of surra, which has a broad distribution in Africa, Asia and Latin America (Aregawi *et al.*, 2019).

In sub-Saharan Africa, tsetse flies also transmit human African trypanosomiasis (HAT), also known as sleeping sickness. The disease is caused by two subspecies of *T. brucei* (i.e. *Trypanosoma brucei gambiense* and *Trypanosoma brucei rhodesiense*) (Büscher *et al.*, 2017), and while AAT is broadly distributed within and beyond the tsetse belt, HAT only occurs in relatively small areas of endemicity known as "foci" (Simarro *et al.*, 2010).

Twenty-three species of tsetse flies are currently recognized. Based on morphological features and ecological preferences, these species are traditionally classified into three groups: *palpalis* (subgenus *Nemorhina*, including five species), *morsitans* (subgenus *Glossina* s.s., five species) and *fusca* (subgenus *Austenina*, 13 species). Because of their prevailing habitat requirements, the groups are often referred to, respectively, as riverine, savannah and forest. For six of these species, two or three subspecies are distinguished, which brings the total number of recognized tsetse species and subspecies to 31. That is, nine species and subspecies for the *palpalis* group, seven for the *morsitans* groups and 15 for the *fusca* group.

Outside Africa, tsetse flies have only been reported from the Arabian Peninsula, with first captures in 1903 (Carter, 1906) and then in 1984 (Elsen, Amoudi and Leclercq, 1990).

MAPPING TSETSE FLIES AT THE CONTINENTAL LEVEL

Past efforts and rationale for the continental atlas

Evidence-based decision-making is crucial for effective disease control, and spatially explicit information is increasingly recognized as a central component of any data management system. In the field of vector-borne African trypanosomosis, the importance of mapping the geographic distribution of tsetse flies has long been recognized (Ford, 1963). However, despite this recognition and the vast amount of entomological data collected in the field, the latest maps of tsetse distribution for Africa were published many decades ago (Ford and Katondo, 1975; Ford and Katondo, 1977a; Ford and Katondo, 1977b; Katondo, 1984). More recently, progress was made in modelling the tsetse geographic distribution by means of geospatial techniques and remote sensing data (Rogers and Robinson, 2004; Wint and Rogers, 2000). However, this progress was not matched by advances in the systematic collation of field data. As a result, spatial modelling of tsetse distribution in Africa has so far relied on long outdated input data. As regards the trypanosomal infection in tsetse flies, a systematic review and meta-analysis of the scientific literature was published in 2017 (Abdi *et al.*, 2017). However, while the authors mapped the related data

at the country level, they fell short of mapping the specific locations of the reported occurrence of tsetse infections.

Against this backdrop, over the past 15 years, the atlas of HAT has demonstrated the feasibility and desirability of continental mapping initiatives for African trypanosomoses. The atlas of HAT is a World Health Organization (WHO) initiative, jointly implemented with the Food and Agriculture Organization of the United Nations (FAO) in the framework of the Programme Against African Trypanosomosis (PAAT) (Cecchi *et al.*, 2009), and since 2010 the atlas has provided consistent and comprehensive information on the occurrence of sleeping sickness in endemic countries (Simarro *et al.*, 2010; Simarro *et al.*, 2015; Franco *et al.*, 2017; Franco *et al.*, 2018; Franco *et al.*, 2020; Franco *et al.*, 2022a; Franco *et al.*, 2024). The atlas was also extended to include the global mapping of HAT cases exported to non-endemic countries (Simarro *et al.*, 2012b; Franco *et al.*, 2022b) and the mapping of health facilities in Africa with capacity for diagnosis and treatment of HAT (Simarro *et al.*, 2014). Finally, the atlas of HAT underpins the methodology for mapping HAT risk, which is used to monitor progress towards the elimination of HAT (Simarro *et al.*, 2011; Simarro *et al.*, 2012a).

The continental atlas initiative

Spurred by the successful development of the atlas of sleeping sickness, in 2013 FAO started the development of the continental atlas of tsetse flies and AAT/nagana. The initiative had two main objectives: (1) to develop a spatially explicit database of tsetse and AAT occurrence for Africa, and (2) to provide a blueprint for AAT-enzootic countries to develop national atlases. The methodology for the continental atlas was published first for the animal trypanosomosis component (Cecchi *et al.*, 2014), and then for the component on tsetse distribution and infection (Cecchi *et al.*, 2015). Both publications also included preliminary results for Ethiopia, Kenya and Uganda. Subsequently, preliminary results for Nigeria were published in 2020 as a monographic publication (de Gier *et al.*, 2020). The launch of the "Controlling and progressively minimizing the burden of animal trypanosomosis" (COMBAT) project in 2021 (Boulangé *et al.*, 2022) allowed the continental atlas to be finalized; within this project, the scope of the atlas was also extended to include the occurrence of surra in Africa.

Throughout the long period of development of the continental atlas, FAO also assisted enzootic countries in the development of national atlases. Support was provided through direct FAO funding, mobilization of external resources, training, technical guidance, quality assurance, communication and dissemination. The first national atlas was published by Sudan (Ahmed *et al.*, 2016), followed by Mali (Diarra *et al.*, 2019), Kenya (Ngari *et al.*, 2020), Zimbabwe (Shereni *et al.*, 2021), Burkina Faso (Percoma *et al.*, 2022) and Ethiopia (Gebre *et al.*, 2022). The atlas of Ghana is in the process of being finalized. Within COMBAT, activities are ongoing to update and enhance five existing national atlases (Burkina Faso, Ethiopia, Kenya, Sudan and Zimbabwe) and to develop seven new ones (Cameroon, Chad, Côte d'Ivoire, Mozambique, Senegal, South Africa and Zambia). Beyond Africa and within COMBAT, an atlas for Spain was also developed, with a focus on *T. evansi* occurrence in the Canary Islands (Henríquez *et al.*, 2024).

Two main features distinguish the FAO continental atlas from national ones. First, scientific publications are the only source for the continental atlas, while national atlases strive to include all data collected in the country, be they published or unpublished. Second, in the continental atlas, both tsetse and animal trypanosomosis are mapped at the site/location level, and for the tsetse component one site/location normally summarizes results from several traps; by contrast, tsetse data in national atlases are recorded and mapped at the level of the individual trap whenever possible. An additional methodological difference is that, when processing scientific publications, FAO limits itself to extracting the data that can be obtained directly from the papers; this means that the authors of the papers are seldom contacted by FAO and, if they are, it is only to seek clarification regarding possible inconsistencies or challenges in the interpretation of the papers. By contrast, for national authorities in charge of developing national atlases, "processing" scientific papers means obtaining from the authors the raw data behind the publications; the extraction of data directly from the papers is only a last resort for national authorities, if raw data cannot be obtained.

Chapter 2
Methodology

The general methodology for the continental atlas of tsetse and animal trypanosomosis was inspired by previous work on malaria and its vectors, anopheles mosquitoes (Guerra *et al.*, 2007; Hay *et al.*, 2010).

The overall approach and processes are summarized in Figure 1. In a nutshell, eligible scientific publications are identified, accessed, collated and stored in a repository. Data are subsequently extracted from the papers, harmonized, georeferenced and entered into a single, spatially explicit database. Maps are then generated using the harmonized data included in the database.

SEARCHING, SELECTING AND ACCESSING THE PUBLICATIONS

Search

We used PubMed as the primary source to identify scientific publications. Other sources were also used (e.g. the PAAT Tsetse and Trypanosomosis Information Bulletin, Google Scholar, etc.). The following keywords were used for searching the online archives: "trypanosomiasis", "trypanosomosis", "animal", "bovine", "ruminant", "nagana", "surra", "tsetse" and "*Glossina*". Furthermore, while processing the selected publications, the references therein contained were assessed for possible additional eligible papers.

Selection criteria

The abstracts and, where necessary, the full papers resulting from the searches in online archives were read to establish whether they contained spatially explicit information on the occurrence of animal trypanosomosis, tsetse flies or their trypanosomal infection in Africa. In this context, by "spatially explicit information", we mean information that is or can be mapped (i.e. georeferenced). Only natural infections were included, while experimental infections were not considered. Because of the lack of pathognomonic signs for animal trypanosomosis, clinical suspicion/diagnosis was not considered, and only data based on diagnostic tests were included. Temporal criteria were also applied; in particular, this first edition of the continental atlas is based on papers published between 1990 and 2020. Furthermore, regardless of the year of publication, field data collected before 1 January 1990 were not included.

For the present publication, only the papers that provided spatially explicit information on the occurrence of the *Glossina* species are considered.

Access to the publications

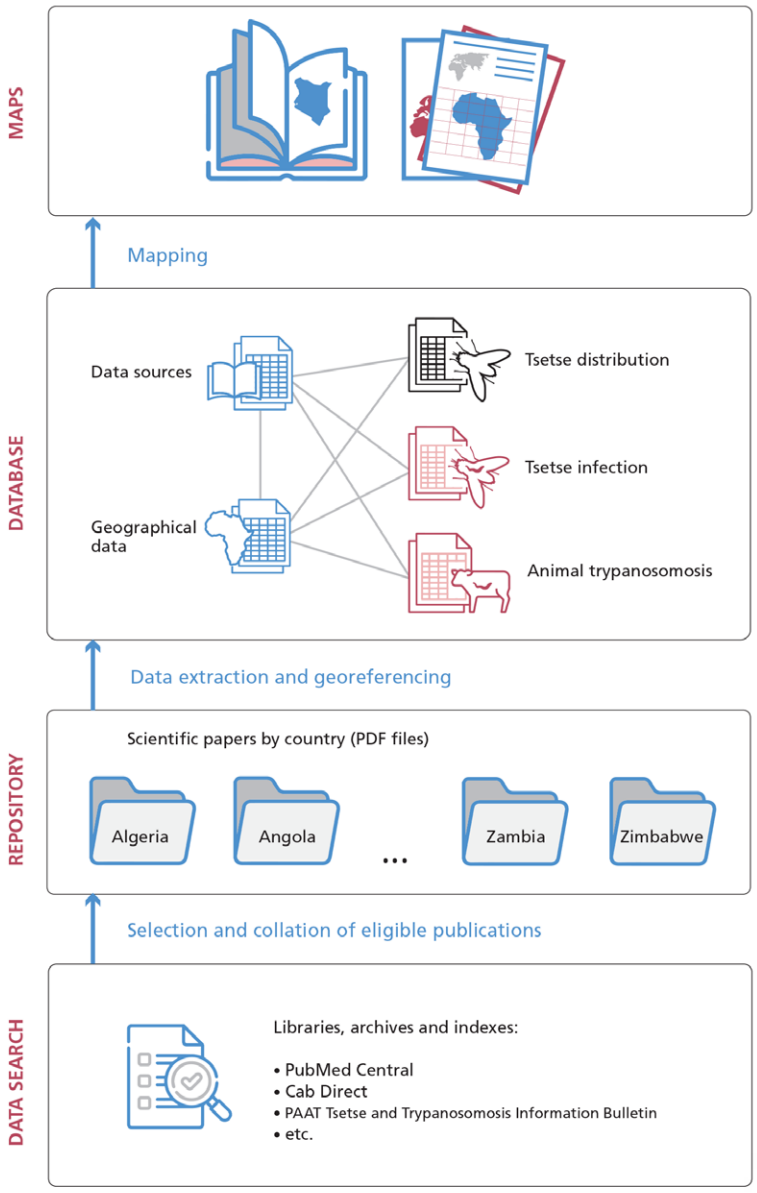
In the case of open-access journals, we directly downloaded papers from the web. For subscription-based journals, downloading from the FAO Library systems was possible for the journals to which FAO has a subscription. For other journals, access was facilitated by the FAO Library through inter-library loans. Author's copies or pre-print versions in personal or institutional repositories were also used to complement the other sources.

REPOSITORY

All publications identified, selected and accessed through the steps described above were centralized in a digital repository. Specifically, PDF versions of the articles were stored and files were organized by country. The naming of the files was standardized as "Author-surname_Year-of-publication.pdf" (or "Author-surname_et_al_Year-of-publication.pdf" in the case of multiple authors). When available, online-only supplementary files directly linked to the publication were also downloaded and stored in the repository.

Annex 1 provides the full list of scientific papers used as sources to develop the atlas of the distribution of tsetse flies in Africa, while Table 1 provides the summary by country. In total, 669 publications were used, with a few of them providing data for more than one country. As regards the language of the publications, 92 percent of the papers we used were written

FIGURE 1
The overall approach to develop the continental atlas of tsetse flies and animal trypanosomosis for Africa



Source: Authors' own elaboration.

in English and 8 percent were written in French. Annex 2 provides a summary of the papers by journal and publisher.

Figure 2 provides the number of papers by year of publication. The red line shows the total number of potentially eligible papers that were published in that year, and the blue line indicates the number of papers that were actually used for the atlas because they included data collected in the field as of 1 January 1990. An almost twofold increase in the number of potentially eligible papers was observed in 15 years, with an average of 18 papers per year published in 1990–2005 against 30 papers per year in 2006–2020.

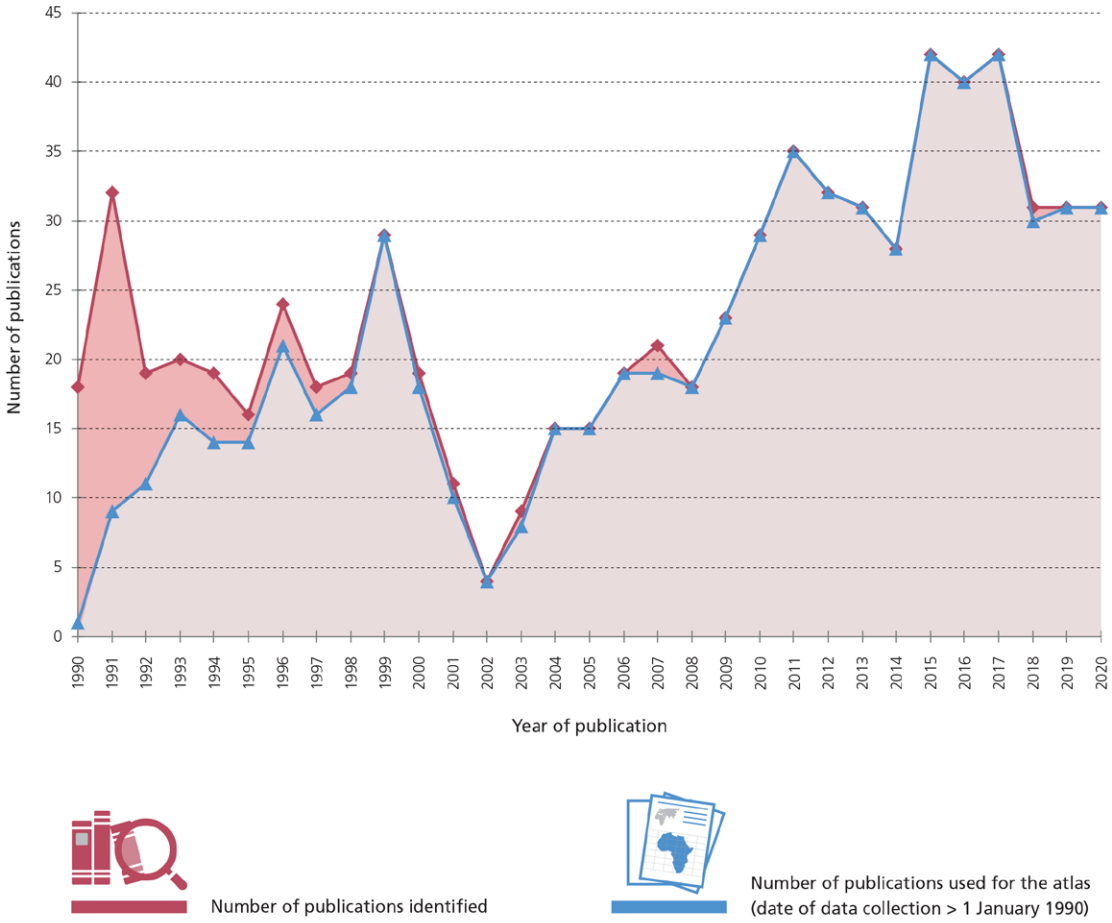
TABLE 1
Country summary of the scientific papers used as sources to develop the continental atlas of the distribution of tsetse flies in Africa (publication period: 1990–2020)

Country*	Papers (No.)	Papers (list**)
Angola	5	1–5
Benin	1	6
Botswana	3	7–9
Burkina Faso	56	10–65
Burundi	0	
Cameroon	39	4, 66–103
Central African Republic	15	104–118
Chad	3	119–121
Congo	6	105, 122–126
Côte d'Ivoire	39	4, 25–27, 43, 51, 52, 101, 105, 127–156
Democratic Republic of the Congo	21	1, 4, 32, 88, 101, 122, 145, 157–170
Equatorial Guinea	6	171–176
Eswatini	1	177
Ethiopia	131	145, 158, 164, 178–305
Gabon	16	145, 306–320
Gambia	7	25, 242, 321–325
Ghana	14	42, 326–338
Guinea	14	25, 26, 38, 42, 43, 339–347
Guinea-Bissau	0	
Kenya	91	32, 158, 164, 165, 236, 270, 271, 275, 348–430
Liberia	0	
Malawi	6	122, 431–435
Mali	16	25, 42, 342, 436–448
Mozambique	8	177, 275, 449–454
Namibia	1	9
Niger	1	455
Nigeria	45	93, 456–499
Rwanda	1	500
Senegal	13	14, 25, 26, 42, 43, 61, 342, 445, 501–505
Sierra Leone	0	
Somalia	0	
South Africa	19	164, 177, 429, 506–521
South Sudan	6	522–527
Sudan	7	270, 358, 528–532
Togo	3	533–535
Uganda	42	122, 164, 358, 369, 374, 405, 418, 427, 449, 522, 536–567
United Republic of Tanzania	56	1, 9, 32, 122, 158, 164, 236, 271, 275, 387, 403, 405, 408, 419, 452, 568–608
Zambia	29	9, 145, 164, 236, 271, 433, 452, 454, 521, 609–628
Zimbabwe	48	164, 236, 271, 365, 452, 454, 612, 629–669
Total	**669**	**(See Annex 1)**

*Djibouti, Eritrea and Lesotho, as well as Mauritania and other countries of northern Africa, are not historically considered to be affected by tsetse flies.

**The numbered list of scientific publications used as sources is in Annex 1.

FIGURE 2
Number of scientific publications used as sources for the atlas of tsetse flies by year (period 1990–2020)



Source: Authors' own elaboration.

DATA PROCESSING

Each paper included in the atlas was analysed by at least two authors. The text and data extracted from the papers were reproduced word for word for most of the information items in the database. Subsequently, for several items/columns the information was also categorized to facilitate data extraction and analysis.

DATABASE

In this paper we describe three tables of the atlas database, i.e. data sources, geographical data and tsetse distribution. The tables on tsetse infection and animal trypanosomosis will be addressed in future publications.

The structure of the database (i.e. the column-by-column description of the tables) is in Annex 3, while a summary is provided here below. Like in all relational databases, data from different tables are linked by means of primary and foreign keys. The former are unique numeric codes identifying each record in a table, while the latter are numeric codes that allow records in a table to be linked to records in other tables.

Sources

In the "Sources" table, each record refers to one publication included in the repository. In addition to the unique numeric identifier of the publication (i.e. the primary key), the table also includes the

initials and surname of the first author, full list of authors, title, year of publication, study country (or countries), file name as in the repository, external link (i.e. URL/internet address of the paper), journal and publisher.

The table also indicates the type of data the paper provided to the atlas (i.e. tsetse distribution, tsetse infection, animal trypanosomosis, or a combination thereof), and how and when the publication was accessed, downloaded or received.

Geographical data

In the table for geographical data, each record refers to one location in Africa for which entomological or epizootic data are recorded in the atlas. The table includes the unique numeric identifier of the location (i.e. the primary key), location name, name of the country and names of the corresponding subnational administrative units. All locations in the atlas are represented by point entities, and their geographic coordinates are recorded as latitude and longitude in decimal degrees. Geographic coordinates were extracted from the source papers, if available; alternatively, they were obtained from online gazetteers or other sources of geographical information, or estimated in a geographic information system (GIS) using maps and information from the papers.

Even though represented as point entities, locations in the atlas represent areas in which tsetse and/or animal trypanosomosis data were collected. In other words, a location represents an area in which a survey was carried out or from which data were reported. If available in the paper, or if possible to estimate with precision, we recorded the exact surface of the surveyed area in km^2. Alternatively, or in addition to the exact surface, the area was categorized into the following classes: ≤ 10 km^2, > 10 km^2 and ≤ 25 km^2, > 25 km^2 and ≤ 100 km^2, > 100 km^2 and ≤ 500 km^2, > 500 km^2 and ≤ 1 000 km^2, > 1 000 km^2 and ≤ 5 000 km^2, > 5 000 km^2 and ≤ 10 000 km^2, > 10 000 km^2 and ≤ 50 000 km^2, > 50 000 km^2 and ≤ 100 000 km^2 and > 100 000 km^2. Locations with estimated surveyed areas of > 100 000 km^2 were included in the database, but not used in the maps for this publication.

It is worth stressing that we mapped both animal trypanosomosis and tsetse data at the location/site level. In those rare instances in which the papers, or the supplementary information thereof, included trap-level data for tsetse, these data were aggregated at the location/site level.

Tsetse distribution

In the table on tsetse distribution, we recorded the data on the occurrence and abundance of the different species of tsetse flies. Considering that most of the field data on tsetse occurrence were collected with traps, the table on tsetse distribution was tailored to this type of tool. Specifically, records include the survey period, type of trap, odour attractant (if any), number of traps and duration of trapping (in days). The strategy of trap deployment was recorded (e.g. random or, more often, targeted to most favourable environments for tsetse), as well as information on recent or ongoing interventions against tsetse flies. The occurrence of tsetse flies was recorded on three different levels, i.e. presence or absence of detection, number of flies captured and apparent density (i.e. the number of flies/trap/day).

Although less common than stationary traps, fly rounds are also used in tsetse surveys (Ford *et al.*, 1959). This method of data collection is mostly used in countries of southern Africa such as Zambia (Muyobela *et al.*, 2023) and Zimbabwe (Shereni *et al.*, 2016), and it is particularly suited to certain species of the *morsitans* group (e.g. *Glossina morsitans*). For mobile fly rounds, in our database we recorded the number of transects, their total length and the duration.

Whenever the source papers reported tsetse data disaggregated by species, we recorded separately (i.e. in separate rows) the results for the different fly species and subspecies. Otherwise, results were captured at the genus level (i.e. "genus *Glossina*"). Two codes were used in the tsetse distribution table: one for the survey (i.e. a trapping event in a given place and time) and one for the separate species detected in that survey/trapping event. As more than one species can be detected in the same survey, the survey code can be repeated in different rows (i.e. it is not unique), while the unique identifier of the row is the one referring to the specific tsetse species detected in the survey.

Chapter 3
Results

GENUS *GLOSSINA*

Based on the papers listed in Annex 1 and summarized in Table 1, the occurrence of *Glossina* species was confirmed in 34 countries: Angola, Benin, Botswana, Burkina Faso, Cameroon, the Central African Republic, Chad, the Congo, Côte d'Ivoire, the Democratic Republic of the Congo, Equatorial Guinea, Eswatini, Ethiopia, Gabon, the Gambia, Ghana, Guinea, Kenya, Malawi, Mali, Mozambique, Namibia, the Niger, Nigeria, Rwanda, Senegal, South Africa, South Sudan, the Sudan, Togo, Uganda, the United Republic of Tanzania, Zambia and Zimbabwe.

No scientific publications were identified for five additional countries of sub-Saharan Africa that were historically, and can still be considered, affected by tsetse flies. These countries are Burundi (Perich, 1982), Guinea-Bissau (Jaenson, Dos Santos and Hall, 1991; de Carvalho, 2011), Liberia (Garms, Mehlitz and Zillmann, 1987), Sierra Leone (Nash, 1948) and Somalia (ICRC, 2017; Hassan-Kadle *et al.*, 2020). Countries in northern Africa that have been historically free of tsetse flies were not considered in the atlas, even though, for a few of them, entomological surveys corroborating the absence of *Glossina* species could be identified (e.g. in Mauritania [Dia *et al.*, 1997)].

A total of 7 386 sites were included in the atlas in relation to the mapping of tsetse distribution. Figure 3 summarizes these results, with black dots indicating locations where tsetse flies were detected (i.e. "presence" points), and white dots representing the lack of detection ("absence" points). Evidently, the "absence" of detection in a location does not necessarily imply the absence of tsetse flies. Country-level maps, both at the genus and species levels, are in Annex 4.

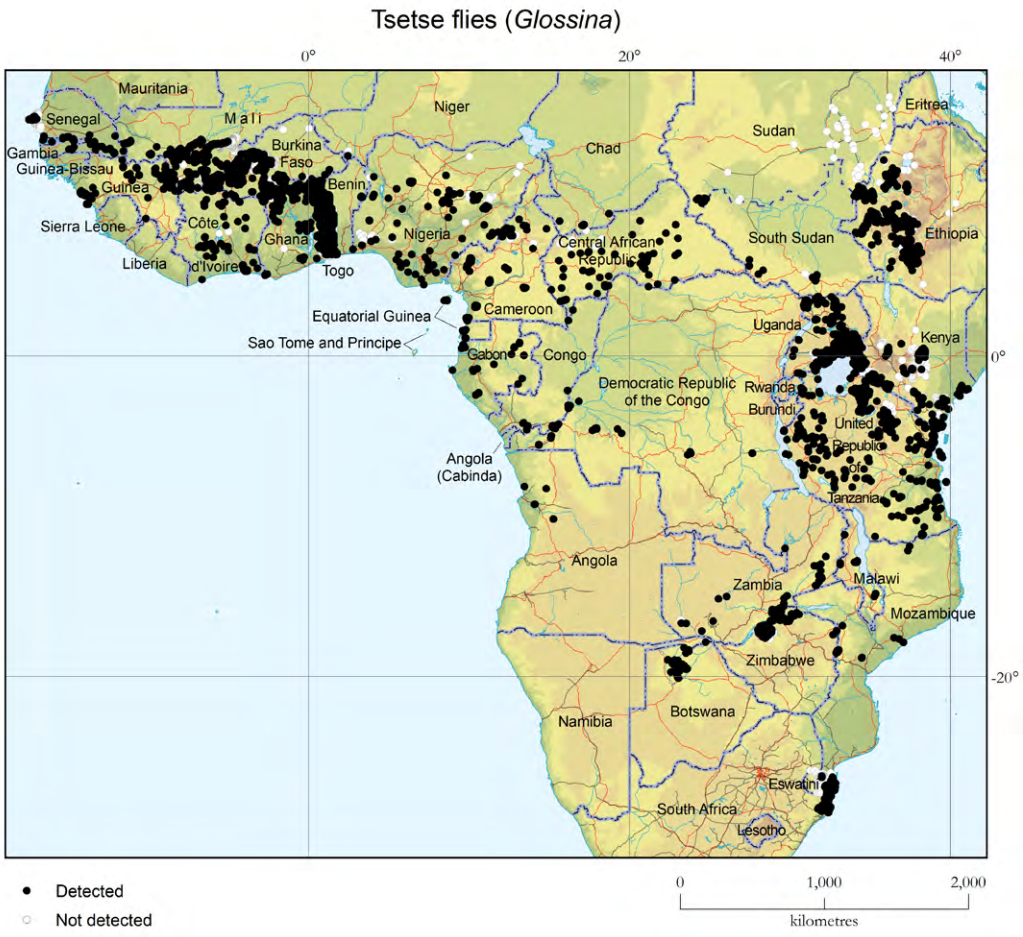
In all maps of this publication where a coloured background is used for landmasses, colours were based on elevation data provided by the Shuttle Radar Topography Mission (van Zyl, 2001), and the legend for the different ranges of elevation is in Figure 4.

Figure 3 shows that, over our 31-year study period, tsetse flies were detected from a maximum latitude of 15° north in Senegal (Niayes Region) to a minimum of 28.5° south in South Africa (KwaZulu-Natal Province). Data coverage is uneven, with large gaps in central Africa in general, and in the Democratic Republic of the Congo in particular.

For correct interpretation of Figure 3, it is important to note that presence points are overlaid onto absence points, even when absence points may be more recent. As a result, the tsetse distribution in Figure 3 should be considered the cumulative or overall distribution for 1990–2020, rather than the most recent one. This means that a few of the points showing tsetse presence in Figure 3 are, to the best of our knowledge, presently free of tsetse; this may be the result of natural or human-made changes in habitat and climate, deliberate elimination efforts or a combination thereof. As regards deliberate elimination efforts, examples of the creation of tsetse-free areas come from the Unguja island, Zanzibar Archipelago, the United Republic of Tanzania (Vreysen *et al.*, 2000), the Okavango Delta in Botswana (Kgori, Modo and Torr, 2006), and the Kwando-Linyanti river system at the border between Botswana and Namibia (Kgori and Modo, 2009), as well as areas of Kenya (Ngari *et al.*, 2020) and Zimbabwe (Shereni *et al.*, 2021).

As regards the different tsetse species, our review found data for a total of 19 out of the 23 recognized species (31 species, if subspecies are also considered). Relatively abundant data were identified for the species of major veterinary and public health importance, especially of the riverine (*palpalis*) and savannah (*morsitans*) groups. Conversely, limited information was found for several species of the forest (*fusca*) group. A summary of the number of species reported at the country level, both within our study period and historically, is shown in Table 2. More details at the group, species and subspecies levels are provided in the following sections.

FIGURE 3
Geographic distribution of tsetse flies (genus *Glossina*) in Africa as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

https://doi.org/10.4060/cd2022en-fig03

FIGURE 4
Colours used for the different ranges of elevation in all maps of this publication where a coloured background is used for landmasses

Source: Authors' own elaboration.

TABLE 2
Country summary of (a) tsetse species reported (publication period: 1990–2020) and (b) tsetse species historically reported or suggested and likely to still be present

Country	Species reported (publication period: 1990–2020) (No.)				Species historically reported or suggested (No.)			
	Palpalis	*Morsitans*	*Fusca*	Total	*Palpalis*	*Morsitans*	*Fusca*	Total
Angola	1	1	0	**2**	3	1	4	**8**
Benin	1	0	0	**1**	2	2	2	**6**
Botswana	0	1	0	**1**	0	1	0	**1**
Burkina Faso	2	1	1	**4**	2	2	1	**5**
Burundi	0	0	0	**0**	1	1	1	**3**
Cameroon	5	1	3	**9**	5	2	7	**14**
Central African Republic	3	1	2	**6**	5	1	8	**14**
Chad	2	1	0	**3**	2	1	0	**3**
Congo	2	0	0	**2**	4	0	7	**11**
Côte d'Ivoire	3	1	2	**6**	3	2	4	**9**
Democratic Republic of the Congo	2	1	1	**4**	3	3	12	**18**
Equatorial Guinea	2	0	1	**3**	2	0	3	**5**
Eswatini	0	1	0	**1**	0	2	0	**2**
Ethiopia	2	2	0	**4**	2	2	2	**6**
Gabon	5	0	4	**9**	5	0	7	**12**
Gambia	1	1	0	**2**	1	2	0	**3**
Ghana	2	1	0	**3**	4	2	4	**10**
Guinea	1	1	0	**2**	3	2	4	**9**
Guinea-Bissau	0	0	0	**0**	1	2	1	**4**
Kenya	1	3	3	**7**	1	4	3	**8**
Liberia	0	0	0	**0**	2	0	3	**5**
Malawi	0	2	0	**2**	0	2	1	**3**
Mali	2	1	0	**3**	2	2	0	**4**
Mozambique	0	3	1	**4**	0	3	1	**4**
Namibia	0	1	0	**1**	0	1	0	**1**
Niger	1	0	0	**1**	1	1	0	**2**
Nigeria	4	1	2	**7**	4	2	5	**11**
Rwanda	0	2	1	**3**	0	2	1	**3**
Senegal	1	1	0	**2**	1	2	0	**3**
Sierra Leone	0	0	0	**0**	2	2	3	**7**
Somalia	0	0	0	**0**	0	2	2	**4**
South Africa	0	1	1	**2**	0	1	1	**2**
South Sudan	1	0	0	**1**	2	2	3	**7**
Sudan	1	1	0	**2**	2	1	0	**3**
Togo	2	2	2	**6**	2	2	2	**6**
Uganda	1	2	0	**3**	1	2	6	**9**
United Republic of Tanzania	1	4	2	**7**	1	4	3	**8**
Zambia	0	2	1	**3**	1	2	1	**4**
Zimbabwe	0	3	0	**3**	0	3	1	**4**
Total	**5**	**5**	**9**	**19**	**5**	**5**	**13**	**23**

We note that among the tsetse species historically reported or suggested in a given country, we only considered those that are expected to, or may, still be present today. We excluded the species that have been reliably reported to have disappeared or to have been eliminated (e.g. *Glossina morsitans morsitans* and *Glossina pallidipes* in South Africa [Du Toit, 1954]).

The maps at the species and subspecies levels are presented in the following sections. Their geographical extents were chosen to envelop the entire historical distribution of each species and subspecies.

RIVERINE *(PALPALIS)* GROUP (SUBGENUS *NEMORHINA*)

Tsetse flies of the riverine (palpalis) group are major vectors of both AAT and HAT, and in particular of gambiense HAT (WHO, 2013), and therefore they were the object of numerous publications in our study period. Table 3 provides the list of the species and subspecies belonging to this group. Occurrence data could be identified for all of them.

The geographic distribution of the palpalis group is provided in Figure 5, while Figure 6 provides the distribution of the different species. A summary of the species reported in the different countries is shown in Table 4.

TABLE 3
Tsetse species and subspecies of the *palpalis* group

Riverine (*palpalis*) group (subgenus *Nemorhina*)	
G. caliginea	Austen, 1911
G. fuscipes fuscipes	Newstead, 1910
G. fuscipes martinii	Zumpt, 1935
G. fuscipes quanzensis	Pires, 1948
G. pallicera newsteadi	Austen, 1929
G. pallicera pallicera	Bigot, 1891
G. palpalis gambiensis	Vanderplank, 1949
G. palpalis palpalis	Robineau-Desvoidy, 1830
G. tachinoides	Westwood, 1850

TABLE 4
***Glossina* species of the *palpalis* group reported in scientific papers (publication period: 1990–2020) by country**

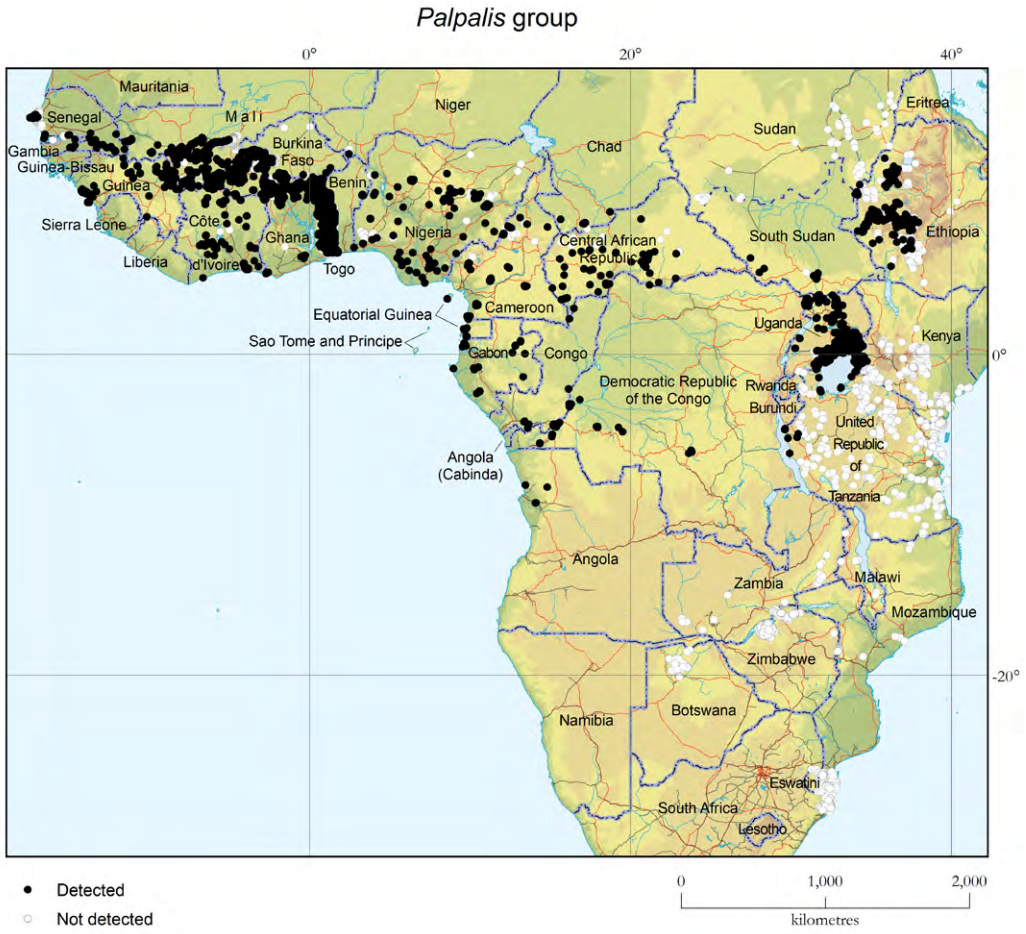
Country	Tsetse species or subspecies (*palpalis* group)											
	G. caliginea	*G. fuscipes*	*G. fuscipes fuscipes*	*G. fuscipes martinii*	*G. fuscipes quanzensis*	*G. pallicera*	*G. pallicera newsteadi*	*G. pallicera pallicera*	*G. palpalis*	*G. palpalis gambiensis*	*G. palpalis palpalis*	*G. tachinoides*
Angola		○			○	○	○		●		●	
Benin									○		○	●
Burkina Faso									●	●		●
Burundi		○		○								
Cameroon	●	●	●			●	○	●	●		●	●
Central African Republic	○	●	●			○	○		●		●	●
Chad		●	●									●
Congo	○	●	●		●	○	○		●		●	
Côte d'Ivoire						●		●	●	●	●	●
Democratic Republic of the Congo		●	○	○	●	○	○		●		●	
Equatorial Guinea	●								●		●	
Ethiopia		●	●									●
Gabon	●	●	●			●	●		●		●	●
Gambia									●	●		
Ghana	○					○		○	●	●	●	●
Guinea						○		○	●	●	○	●
Guinea-Bissau									○	○		
Kenya		●	●									
Liberia						○		○	○	○	○	
Mali									●	●		●
Niger												●
Nigeria	●					●		●	●	**x**	●	●
Rwanda		○		○								
Senegal									●			
Sierra Leone						○		○	○	○	○	
South Sudan		●	●									○
Sudan		●	●									○
Togo									●	○	●	●
Uganda		●	●									
United Republic of Tanzania		●	●	●								
Zambia		○	○	○								

● Species or subspecies reported in scientific papers (publication period: 1990–2020)

○ Species or subspecies reported or suggested in previous periods (<1990) or reviews, and which could, or are likely to, still be present.

x Subspecies reported outside its historical distribution.

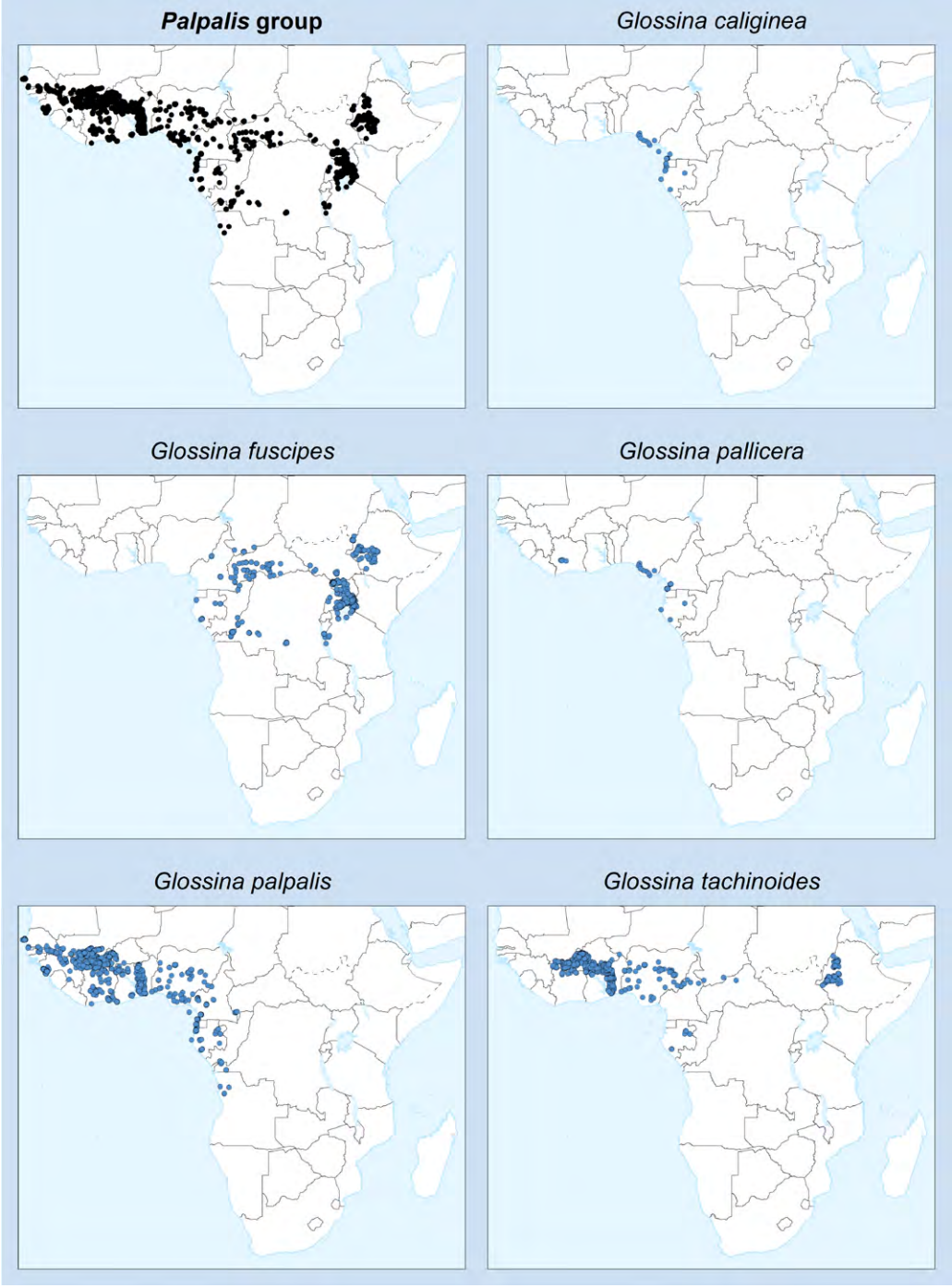
FIGURE 5
Geographic distribution of *palpalis* group (subgenus *Nemorhina*) as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

FIGURE 6
Geographic distribution of the *Glossina* species of the *palpalis* group reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

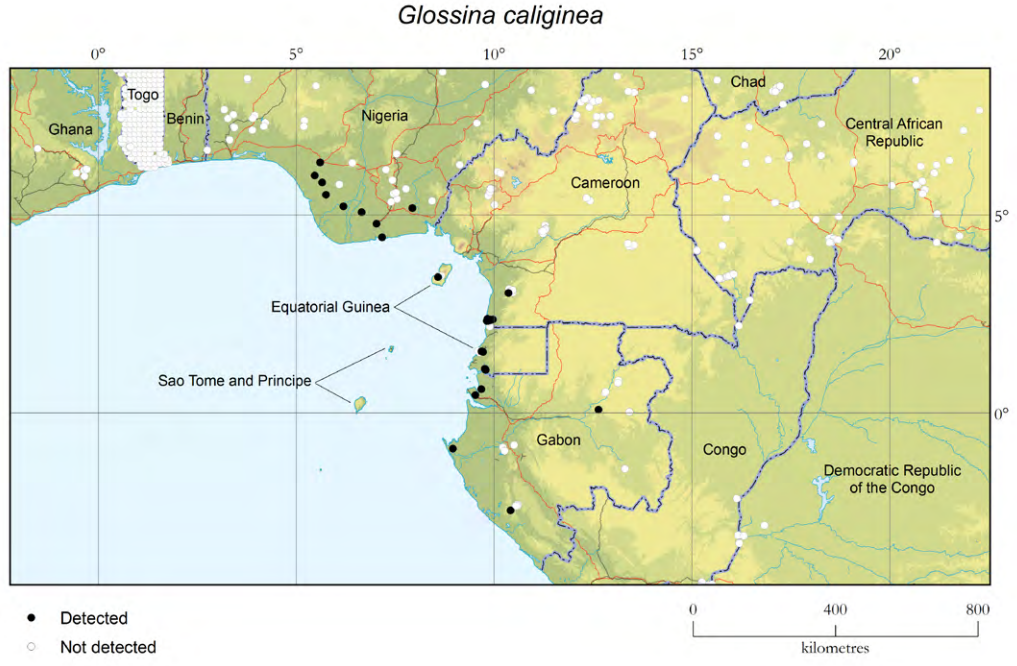
Glossina caliginea

Figure 7 shows the distribution of *Glossina caliginea* as reported in scientific publications for the period 1990–2020, while Table 5 provides the corresponding list of papers we used as sources for the presence points.

The species was detected in the four contiguous countries in central and western Africa, stretching from Gabon to Nigeria. As compared to previous continental maps or reviews (Ford and Katondo, 1977b; Moloo, 1993), we note the addition of Equatorial Guinea to the list of countries where *G. caliginea* was reported. Specifically, in this country, the species was detected in sympatry with other species of the palpalis and *fusca* groups, and in particular with the more abundant and widely distributed *Glossina palpalis palpalis* (Cano *et al.*, 2007a; Cano *et al.*, 2007b; Dyer *et al.*, 2009). All the studies that reported the presence of *G. caliginea* in Equatorial Guinea were carried out in sleeping sickness foci, i.e. Campo, Mbini and Kogo (Simarro *et al.*, 2010). *G. caliginea* was also detected in more areas of Gabon than previously reported, including the provinces of Ogooué-Lolo and Nyanga in the central and southern part of the country. In Nigeria, the species was reported from a single study in the Niger Delta Region (Ogedegbe and Rotimi, 2006). By contrast, the lack of surveys in the western part of the coastal region of Nigeria, as well as along most of the coast of Cameroon, did not allow to confirm the presence of the species in these areas. Within the limits of our review, the highest apparent densities of *G. caliginea* were reported from the HAT focus of Campo in Cameroon (0.59 flies/trap/day [Morlais *et al.*, 1998]) and the Moukalaba-Doudou National Park in Gabon (0.56 flies/trap/day [Essono *et al.*, 2015]).

Previous reports or suggestions of *G. caliginea* occurrence in the Central African Republic (Ford and Katondo, 1977b), the Congo (Gouteux *et al.*, 1987) and Ghana (Offori, 1964) were not confirmed during our study period.

FIGURE 7
Geographic distribution of *Glossina caliginea* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

https://doi.org/10.4060/cd2022en-fig07

TABLE 5
Scientific papers used as sources to map the occurrence of *Glossina caliginea* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Cameroon	10	69, 70, 72, 73, 78, 89, 91, 97, 99, 103
Equatorial Guinea	5	171–175
Gabon	5	306, 308–311
Nigeria	1	483
Total	**21**	

* The numbered list of scientific publications used as sources is in Annex 1.

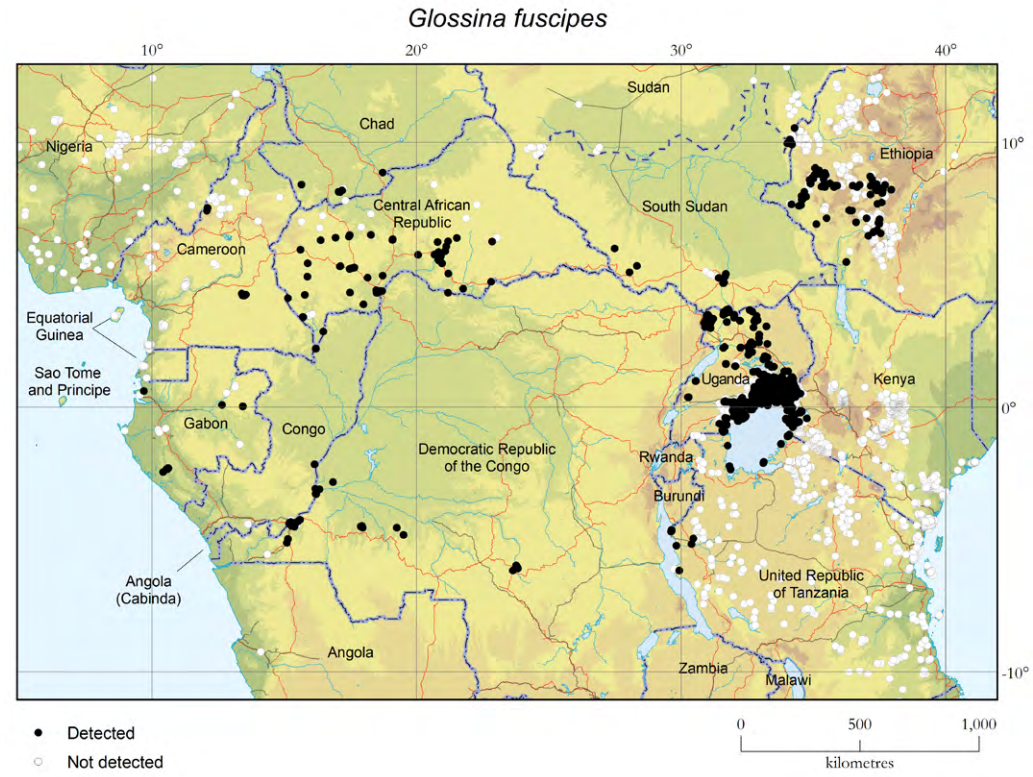
Glossina fuscipes

The species ranges across a vast region in central and eastern Africa, spanning from Cameroon and Gabon in the west to Kenya and Ethiopia in the east, and from Chad and Sudan in the north to Angola, the Democratic Republic of the Congo and the United Republic of Tanzania in the south. Figure 8 shows the distribution of *Glossina fuscipes* as reported in scientific publications for the period 1990–2020 (sources for presence points are shown in Table 7). In total, 12 countries were reported to host the species (i.e. Cameroon, the Central African Republic, Chad, the Congo, the Democratic Republic of the Congo, Ethiopia, Gabon, Kenya, South Sudan, the Sudan, Uganda and the United Republic of Tanzania).

Three subspecies of *G. fuscipes* are recognized: *Glossina fuscipes fuscipes*, *Glossina fuscipes martinii* and *Glossina fuscipes quanzensis* (Machado, 1954). In addition to transmitting animal trypanosomosis, *G. fuscipes fuscipes* and *G. fuscipes quanzensis* are also considered as major vectors of sleeping sickness (WHO, 2013). The subspecies can be distinguished by small differences in morphological features, especially genitalia (FAO, 1982a; Jordan, 1993), although morphological traits are subject to variation and require experience for correct identification. The three subspecies are believed to have limited or no overlap (Ford and Katondo, 1977b; Dyer *et al.*, 2011) and therefore distribution maps are frequently used instead of morphology to determine the subspecies. However, this approach to subspecies determination has limitations in those areas where the boundaries between the subspecies are not well known, or where small overlaps may occur. In recent years, molecular tools have started being used to support subspecies determination and to characterize the relationships between the taxa (Dyer *et al.*, 2011; Mayoke *et al.*, 2020b).

The reported distribution of the three subspecies of *G. fuscipes* is provided separately in the following sections. These distributions are presented as reported by the authors of the source publications, and they include geographical, morphological, and molecular approaches to subspecies identification, and combinations thereof.

FIGURE 8
Geographic distribution of *Glossina fuscipes* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

https://doi.org/10.4060/cd2022en-fig08

TABLE 6
Scientific papers used as sources to map the occurrence of *Glossina fuscipes* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Cameroon	3	77, 79, 86
Central African Republic	11	104, 106, 107, 109–113, 115, 116, 118
Chad	3	119–121
Congo	3	122, 125, 126
Democratic Republic of the Congo	13	32, 122, 145, 157–160, 163, 165, 166, 168–170
Ethiopia	42	145, 158, 178, 182, 190, 191, 195, 197, 203–205, 208, 210, 211, 213, 224, 228, 230, 232, 238, 239, 241, 243–245, 252, 254, 255, 260–262, 266, 268, 270, 276, 280, 282, 283, 286, 291, 295, 296
Gabon	8	306–308, 311, 315, 316, 319, 320
Kenya	30	32, 158, 164, 165, 270, 348, 358, 367–369, 374, 378–380, 387, 388, 391–393, 395, 400–402, 404, 409, 413, 423, 427, 428, 430
South Sudan	5	522, 524–527
Sudan	5	270, 358, 529–531
Uganda	37	122, 158, 164, 358, 374, 427, 522, 536–539, 541–562, 564–567
United Republic of Tanzania	6	32, 158, 572, 584, 585, 591
Total	**148**	

*The numbered list of scientific publications used as sources is in Annex 1.

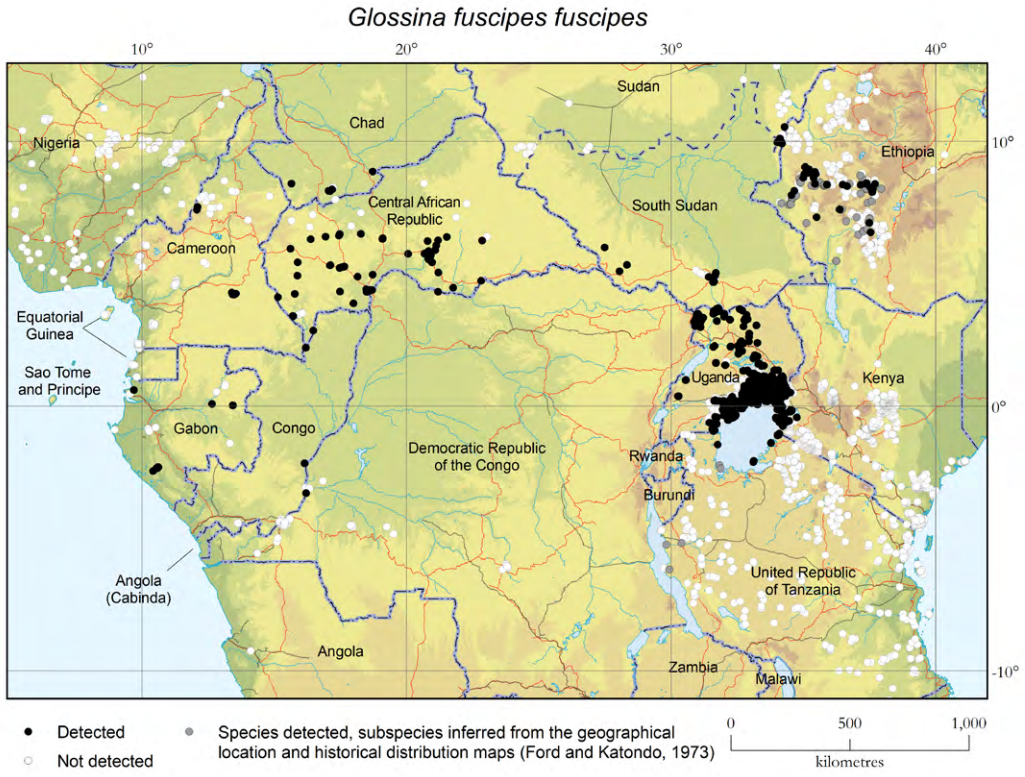
Glossina fuscipes fuscipes

Glossina fuscipes fuscipes inhabits the most humid and more densely forested parts of the species range. Figure 9 shows its distribution as reported in scientific publications for the period 1990–2020, and Table 7 lists the papers that provided the presence points.

The subspecies was reported in 11 countries, with the westernmost records in Gabon and the easternmost in Ethiopia. All these countries were previously known to be infested by *G. fuscipes fuscipes* (Ford and Katondo, 1977b; Moloo, 1993). A total of 139 papers were used to map the presence of this subspecies, of which 114 (i.e. 82 percent) explicitly indicated *G. fuscipes fuscipes*, while 25 (i.e. 18 percent) only reported the species, and we assumed the subspecies based on historical maps (Ford and Katondo, 1977b). According to the data in our database, *G. fuscipes fuscipes* is the main tsetse species in Chad, the Central African Republic, South Sudan and Uganda; for example, in Uganda the species accounts for 96 percent of the total tsetse catches. *G. fuscipes fuscipes* is also more broadly distributed in Gabon than indicated by previous continental maps, having also been detected along the Atlantic coast (Kohagne Tongué *et al.*, 2010; Dibakou *et al.*, 2015) and accounting for a quarter of all tsetse catches at the country level. Even in Ethiopia, where *G. fuscipes fuscipes* is only the fourth tsetse species in terms of abundance and where it accounts for only 6 percent of the catches in our database, the species has a fairly broad distribution centred in the Baro-Akobo and Omo-Gibe river basins (Gebre *et al.*, 2022).

By far the largest geographical gap in our record is in the Democratic Republic of the Congo, where *G. fuscipes fuscipes* is known to be widely distributed

FIGURE 9
Geographic distribution of *Glossina fuscipes fuscipes* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

in the northern part of the country. However, no published survey could be identified for our study period in this part of the country. Another sizeable gap is also apparent in the northern part of the Congo.

TABLE 7
Scientific papers used as sources to map the occurrence of *Glossina fuscipes fuscipes* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Cameroon	3	77, 79, 86
Central African Republic	11	104, 106, 107, 109–113, 115, 116, 118
Chad	3	119–121
Congo	2	125, 126
Ethiopia	42	145, 158, 178, 182, 190, 191, 195, 197, 203–205, 208, 210, 211, 213, 224, 228, 230, 232, 238, 239, 241, 243–245, 252, 254, 255, 260–262, 266, 268, 270, 276, 280, 282, 283, 286, 291, 295, 296
Gabon	8	306–308, 311, 315, 316, 319, 320
Kenya	30	32, 158, 164, 165, 270, 348, 358, 367–369, 374, 378–380, 387, 388, 391–393, 395, 400–402, 404, 409, 413, 423, 427, 428, 430
South Sudan	5	522, 524–527
Sudan	5	270, 358, 529–531
Uganda	37	122, 158, 164, 358, 374, 427, 522, 536–539, 541–562, 564–567
United Republic of Tanzania	3	572, 585, 591
Total	**139**	

*The numbered list of scientific publications used as sources is in Annex 1.

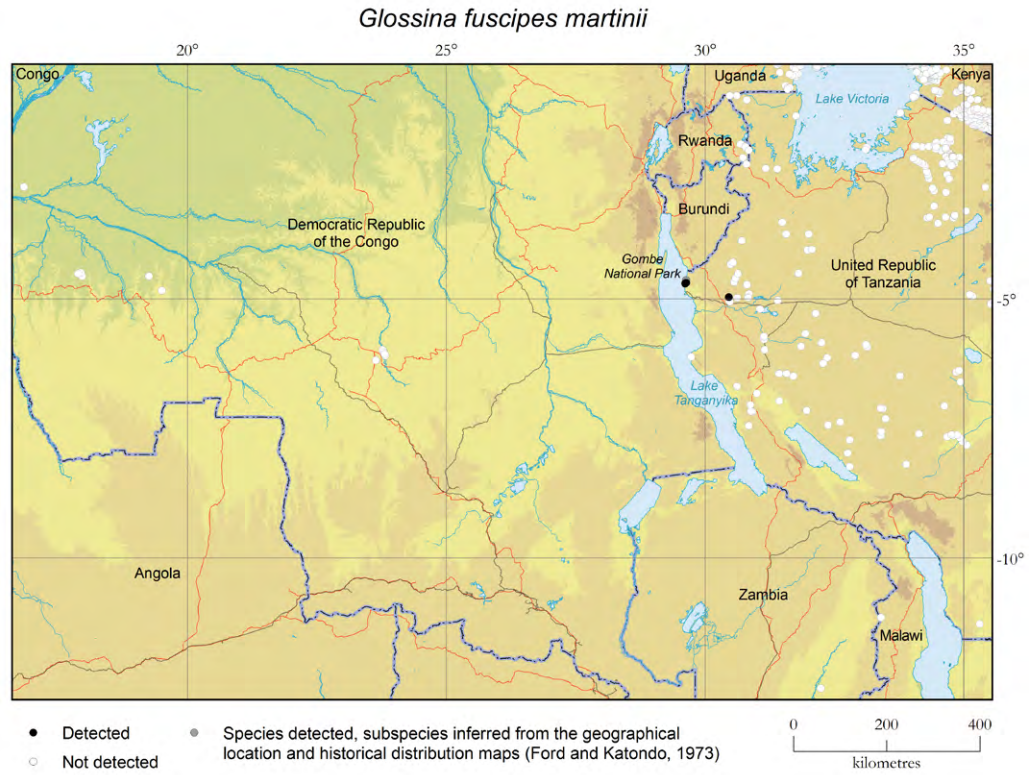
Glossina fuscipes martinii

Glossina fuscipes martinii inhabits the southeastern, driest part of the species range, and its main area of occurrence is in the southeastern part of the Democratic Republic of the Congo, broadly corresponding to today's provinces of Haut-Lomami, Haut-Katanga and Tanganyika.

Figure 10 shows the distribution of *G. fuscipes martinii* as reported in scientific publications for the period 1990–2020. Only three studies reported explicitly its occurrence: two from the Gombe National Park on the shores of Lake Tanganyika in the United Republic of Tanzania (Dyer *et al.*, 2011; Esterhuizen *et al.*, 2011), and one from a less accurately described nearby location (i.e. "western part of the country, along the lake shores of Lake Tanganyika and along the rivers draining into Lake Tanganyika" [Malele *et al.*, 2016]). A fourth study reported *G. fuscipes* from the Gombe National Park (Daffa *et al.*, 2013), and based on historical maps and other reports from the same area, we assumed it to be *G. fuscipes martinii*.

In addition to the Democratic Republic of the Congo and the shores of Lake Tanganyika in the United Republic of Tanzania, the subspecies was also historically reported from small areas in Burundi, Rwanda and Zambia, all bordering the Democratic Republic of the Congo (Ford and Katondo, 1977b; Moloo, 1993). However, in none of these areas were studies on *G. fuscipes* or *G. fuscipes martinii* published during our study period.

FIGURE 10
Geographic distribution of *Glossina fuscipes martinii* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

TABLE 8
Scientific papers used as sources to map the occurrence of *Glossina fuscipes martinii* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
United Republic of Tanzania	4	32, 158, 572, 584
Total	**4**	

*The numbered list of scientific publications used as sources of the atlas is in Annex 1.

Glossina fuscipes quanzensis

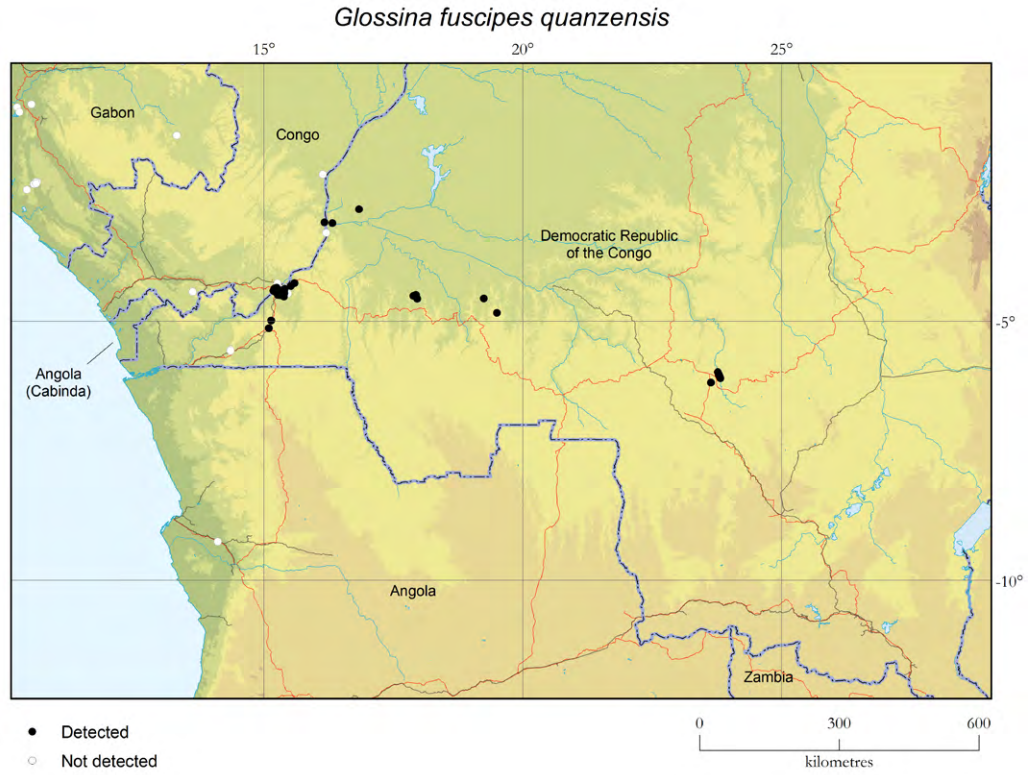
Glossina fuscipes quanzensis inhabits the southwestern part of the species range and, as compared to the other two subspecies of *G. fuscipes*, it is believed to have intermediate climatic and habitat requirements. Figure 11 shows its distribution as reported in scientific publications for the period 1990–2020, with the sources for the presence points in Table 9. The subspecies was explicitly indicated in all 13 publications that reported the occurrence of *G. fuscipes quanzensis*.

The presence of *G. fuscipes quanzensis* was confirmed in a few locations in the southwestern part of the Democratic Republic of the Congo, including the provinces of Kasaï-Oriental, Kinshasa, Kongo Central, Kwilu and Mai-Ndombe. It is noteworthy that the southwestern part of the country continues to report the majority of sleeping sickness cases, both at the national and continental levels (Franco *et al.*, 2022a). In the Congo, the distribution of *G. fuscipes quanzensis* was known to extend along the Congo River, and especially in

the departments of Pool and Plateaux. Within our review, only one paper confirmed the occurrence of the subspecies in this area, specifically in Ngabé/Mboka-Léfini (Alibu *et al.*, 2015). However, both *G. fuscipes quanzensis* and *G. fuscipes fuscipes* were historically reported in this area straddling the Congo River (Ford and Katondo, 1977b), and Alibu *et al.* (2015) do not clarify whether the subspecies was determined from morphological features or geographic location.

Historical records also indicate that *G. fuscipes quanzensis* occurs in northern Angola (Moloo, 1993) (Ford and Katondo, 1977b), but no survey from that area was published during our study period.

FIGURE 11
Geographic distribution of *Glossina fuscipes quanzensis* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

TABLE 9
Scientific papers used as sources to map the occurrence of *Glossina fuscipes quanzensis* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Congo	1	122
Democratic Republic of the Congo	13	32, 122, 145, 157–160, 163, 165, 166, 168–170
Total	**13**	

*The numbered list of scientific publications used as sources of the atlas is in Annex 1.

Glossina pallicera

Figure 12 shows the distribution of *Glossina pallicera* as reported in scientific publications for the period 1990–2020, while Table 10 provides the corresponding list of papers we used as sources for the presence points. Overall, the occurrence of *G. pallicera* was reported in only four countries of western and central Africa: Cameroon, Côte d'Ivoire, Gabon and Nigeria. Historical records indicate that the species also occurs in several other countries in the region: Ghana, Guinea, Liberia and Sierra Leone in western Africa and Angola, the Central African Republic, the Congo and the Democratic Republic of the Congo in central Africa (Ford and Katondo, 1977b; Moloo, 1993). However, in none of these countries was any record of *G. pallicera* published during our study period.

Two subspecies of *G. pallicera* are recognized: *Glossina pallicera newsteadi* and *Glossina pallicera pallicera*. The latter occupies the western part of the species distribution, from Sierra Leone to western Cameroon, while the former is found in the eastern part of the distribution, from eastern Cameroon and Gabon to Angola and the Democratic Republic of the Congo. In the following sections, we separately present the reported occurrence of the subspecies. Considering that the two are believed to be geographically separated, where the source study did not indicate explicitly the subspecies, we assumed it based on the study location and historical distribution maps. This was the case in ten out of 21 publications.

FIGURE 12
Geographic distribution of *Glossina pallicera* as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

https://doi.org/10.4060/cd2022en-fig12

TABLE 10
Scientific papers used as sources to map the occurrence of *Glossina pallicera* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Cameroon	13	69, 70, 72–74, 78, 85, 89, 91, 97, 99, 102, 103
Côte d'Ivoire	4	134, 139, 146, 147
Gabon	3	306, 308, 310
Nigeria	1	483
Total	**21**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina pallicera newsteadi

Figure 13 shows the distribution of *G. pallicera newsteadi* as reported in scientific publications for 1990–2020 (sources for the presence points in Table 11). The subspecies was only reported in three locations in Gabon; these are two national parks (i.e. Ivindo in the east central part of the country and Moukalaba-Doudou in the south [Essono *et al.*, 2015]) and on the Atlantic coast in the *Canton Océan* (Kohagne Tongué *et al.*, 2011). From the three locations in Gabon where *G. pallicera newsteadi* was detected, an average apparent density of 0.3 flies/trap/days was reported for the subspecies.

Very limited studies were carried out in the other areas and countries where the subspecies was known to occur (i.e. Angola, Cameroon, the Central African Republic, the Congo and the Democratic Republic of the Congo), with no report of *G. pallicera newsteadi* or *G. pallicera*.

FIGURE 13
Geographic distribution of *Glossina pallicera newsteadi* as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

TABLE 11
Scientific papers used as sources to map the occurrence of *Glossina pallicera newsteadi* (publication period: 1990–2020)

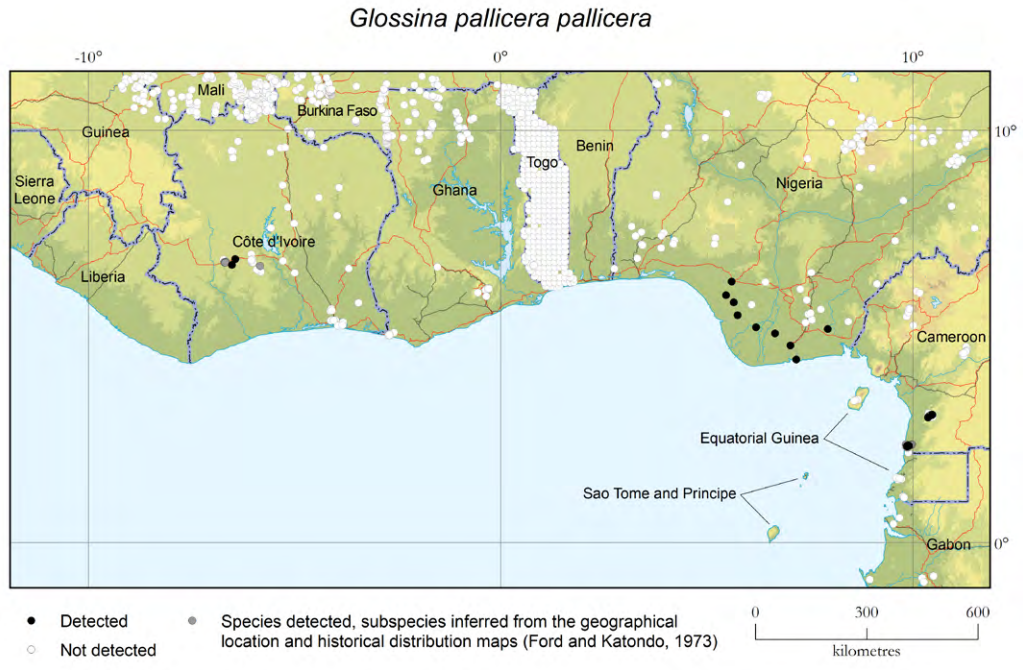
Country	Papers (No.)	Papers (list*)
Gabon	3	306, 308, 310
Total	**3**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina pallicera pallicera

Figure 14 shows the distribution of *G. pallicera pallicera* as reported in scientific publications for the period 1990–2020 (sources for the presence points in Table 12). In Côte d'Ivoire, *G. pallicera pallicera* was explicitly reported at the subspecies level by two studies from the area of Daloa (McNamara, Laveissière and Masiga, 1995; Fournet, Traoré and Hervouët, 1999), and at the species level by another study from the same area (Dagnogo, Lohuirignonm and Traore, 1997). A fourth study reported it at the species level from the HAT focus of Sinfra (Masiga *et al.*, 1996). In Cameroon, *G. pallicera pallicera* was reported from several studies in the HAT foci of Campo and Bipindi (13 publications), with most papers reporting it at the species level (8 publications) and a few at the subspecies level (5 publications). The highest densities of *G. pallicera pallicera* were reported in the HAT focus of Campo in Cameroon, namely 0.46 flies/trap/day (Morlais *et al.*, 1998). In Nigeria, only one study on the occurrence of *G. pallicera pallicera* was available, but it included reports from five different states in the Niger Delta Region, i.e. Akwa Ibom, Bayelsa, Delta, Edo and Rivers (Ogedegbe and Rotimi, 2006). No record of occurrence was available for our study period from Ghana, Guinea, Liberia or Sierra Leone.

FIGURE 14
Geographic distribution of *Glossina pallicera pallicera* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. New York, USA, UN. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

TABLE 12
Scientific papers used as sources to map the occurrence of *Glossina pallicera pallicera* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Cameroon	13	69, 70, 72–74, 78, 85, 89, 91, 97, 99, 102, 103
Côte d'Ivoire	4	134, 139, 146, 147
Nigeria	1	483
Total	**18**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina palpalis

Figure 15 shows the distribution of *Glossina palpalis* as reported in scientific publications for the period 1990–2020. The occurrence of the species was reported in 16 countries of western and central Africa, stretching from Senegal to Angola, for a total of 203 publications (see Table 13). In four additional countries where the species is known to occur (i.e. Benin, Guinea-Bissau, Liberia and Sierra Leone) (Ford and Katondo, 1977b; Moloo, 1993), no published record was identified for the period 1990–2020.

Two subspecies of *G. palpalis* are recognized, i.e. Glossina palpalis gambiensis and *G. palpalis palpalis*. In addition to transmitting animal trypanosomosis, they are both considered major vectors of sleeping sickness (WHO, 2013). The subspecies are believed to have been geographically separated during the last glacial period approximately 12 000 years ago (Challier, Gouteux and Coosemans, 1983; de Meeûs *et al.*, 2014). To date, with the exception of a narrow zone of contact where hybridization can occur, the two subspecies are still believed to be geographically separated (Challier, Gouteux and Coosemans, 1983). Hybridization between the subspecies has been shown to reduce fertility in females and to induce sterility in males (Gooding, 1988), thus contributing to maintaining the geographic separation.

Morphologically, *G. palpalis gambiensis* and *G. palpalis palpalis* are difficult to distinguish, although, in males, differences in genitalia can be useful (Machado, 1954). Because of the geographic differentiation and the difficult identification by morphology, the subspecies is normally determined from the location where the specimens were collected. In a few cases, molecular tools are also used to explore taxonomic relationships and help classification (Dyer *et al.*, 2008).

In the following sections, we present separately the distribution of the two subspecies as reported by the authors of the publications. When the study authors did not explicitly indicate the subspecies, we inferred it from the study location and historical distribution maps (Challier, Gouteux and Coosemans, 1983).

FIGURE 15
Geographic distribution of *Glossina palpalis* as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

https://doi.org/10.4060/cd2022en-fig15

TABLE 13
Scientific papers used as sources to map the occurrence of *Glossina palpalis* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Angola	4	2–5
Burkina Faso	45	13, 14, 16–28, 30–33, 35, 36, 38, 40–46, 48–54, 56–63, 65
Cameroon	29	4, 68–76, 78, 85, 87–103
Central African Republic	2	113, 117
Congo	3	105, 124, 126
Côte d'Ivoire	35	4, 25, 26, 51, 52, 101, 105, 127–153, 156
Democratic Republic of the Congo	5	4, 88, 101, 164, 167
Equatorial Guinea	6	171–176
Gabon	16	145, 306–320
Gambia	3	25, 321, 323
Ghana	9	327–331, 333–336
Guinea	12	25, 38, 42, 339–347
Mali	14	25, 42, 342, 436–442, 444–447
Nigeria	32	93, 457–460, 462, 464–467, 471–473, 477, 478, 480–492, 494–496, 499
Senegal	12	14, 25, 42, 43, 61, 342, 445, 501–505
Togo	3	533–535
Total	**203**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina palpalis gambiensis

Glossina palpalis gambiensis was reported from eight countries (see Figure 16 and Table 14). From West to East, these are Senegal, the Gambia, Guinea, Mali, Côte d'Ivoire, Burkina Faso, Ghana and Nigeria.

In Côte d'Ivoire, *G. palpalis gambiensis* occurs in the northern part of the country, and most of the studies from this area explicitly reported the subspecies. In a few studies, and especially near the transition zone with *G. palpalis palpalis*, the subspecies attribution is less clear (Acapovi-Yao, Lendzele and Cissé, 2017), and when reports were at the species level, we inferred the subspecies from historical distribution maps (Challier, Gouteux and Coosemans, 1983). In Ghana, findings of *G. palpalis* in the northern regions were often explicitly reported as *G. palpalis gambiensis* (e.g. [Adam *et al.*, 2012] and [Mahama *et al.*, 2004]), while those further south and closer to the transition zone with *G. palpalis palpalis* (e.g. the area of the Mole National Park [Dankwa, Oddoye and Mzambo, 2000; Ebhodaghe, Gomez and Isaac, 2016]) were generically reported as *G. palpalis*; in these cases we inferred the subspecies from historical distribution maps (Challier, Gouteux and Coosemans, 1983).

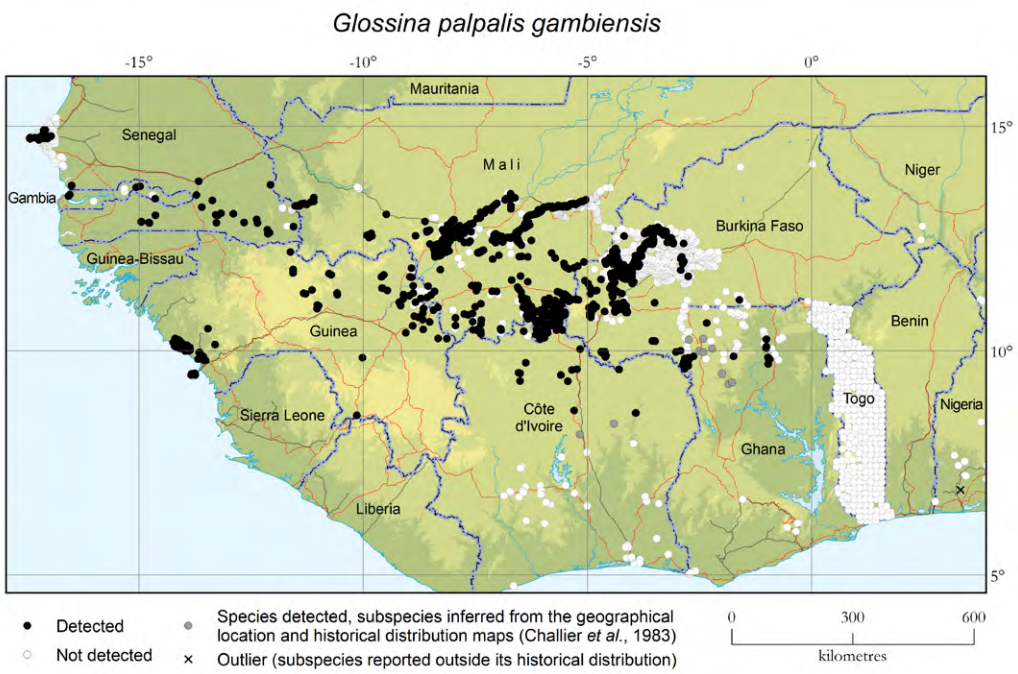
According to the data in our atlas, within its geographical distribution, *G. palpalis gambiensis* is the dominant tsetse species in Guinea, Mali (Diarra *et al.*, 2019), and possibly Senegal. It is also the second main species in Burkina Faso (Percoma *et al.*, 2022). In Senegal, an elimination campaign including a sterile insect technique component is reaching its final stages of implementation at the northernmost limit of the species distribution, in the Niayes Region (Vreysen *et al.*, 2021).

As shown in Figure 16 and Table 14, the occurrence of G. palpalis gambiensis was also reported from southwestern Nigeria (Odeniran *et al.*, 2020). However, no previous record of the subspecies is available for this country, and the study was conducted at over 500 km from the closest record of *G. palpalis gambiensis*; furthermore, subspecies determination solely relied on molecular techniques without morphological confirmation. Because of these limitations, this report of *G. palpalis gambiensis* occurrence in Nigeria would

need corroboration and it is shown in Figure 16 as an "outlier".

In addition to the eight countries in Table 14, *G. palpalis gambiensis* was also previously reported from Guinea-Bissau, Liberia, Sierra Leone and Togo. In particular, a detailed identification and mapping of the distribution of *G. palpalis gambiensis* and *G. palpalis palpalis* in Liberia based on morphological features was provided in 1987 (Garms, Mehlitz and Zillmann, 1987). However, because of the year of publication, we could not include this study in our review. In this study published in 1987, *G. palpalis palpalis* was found to be the dominant subspecies in Liberia, with *G. palpalis gambiensis* only detected in the northernmost tip of the country in the immediate proximity of the border with Guinea and Sierra Leone. These findings are consistent with a later report of *G. palpalis gambiensis* from Guékédou in Guinea, at only 5 km from the border with Liberia (de Meeûs *et al.*, 2015). In Togo, *G. palpalis gambiensis* used to be reported in the northernmost part of the country (i.e. Savanes Region [Itard, 1969; Challier, Gouteux and Coosemans, 1983]). However, surveys in the same region in the past 30 years failed to detect the subspecies (Hendrickx *et al.*, 1999; Dao *et al.*, 2008).

FIGURE 16
Geographic distribution of *Glossina palpalis gambiensis* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

TABLE 14
Scientific papers used as sources to map the occurrence of *Glossina palpalis gambiensis* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Burkina Faso	45	13, 14, 16–28, 30–33, 35, 36, 38, 40–46, 48–54, 56–63, 65
Côte d'Ivoire	7	26, 127, 136, 137, 141, 145, 150
Gambia	3	25, 321, 323
Ghana	7	327, 328, 331, 333–336
Guinea	12	25, 38, 42, 339–347
Mali	14	25, 42, 342, 436–442, 444–447
Nigeria	1	478
Senegal	12	14, 25, 42, 43, 61, 342, 445, 501–505
Total	**86**	

*The numbered list of scientific publications used as sources is in Annex 1.

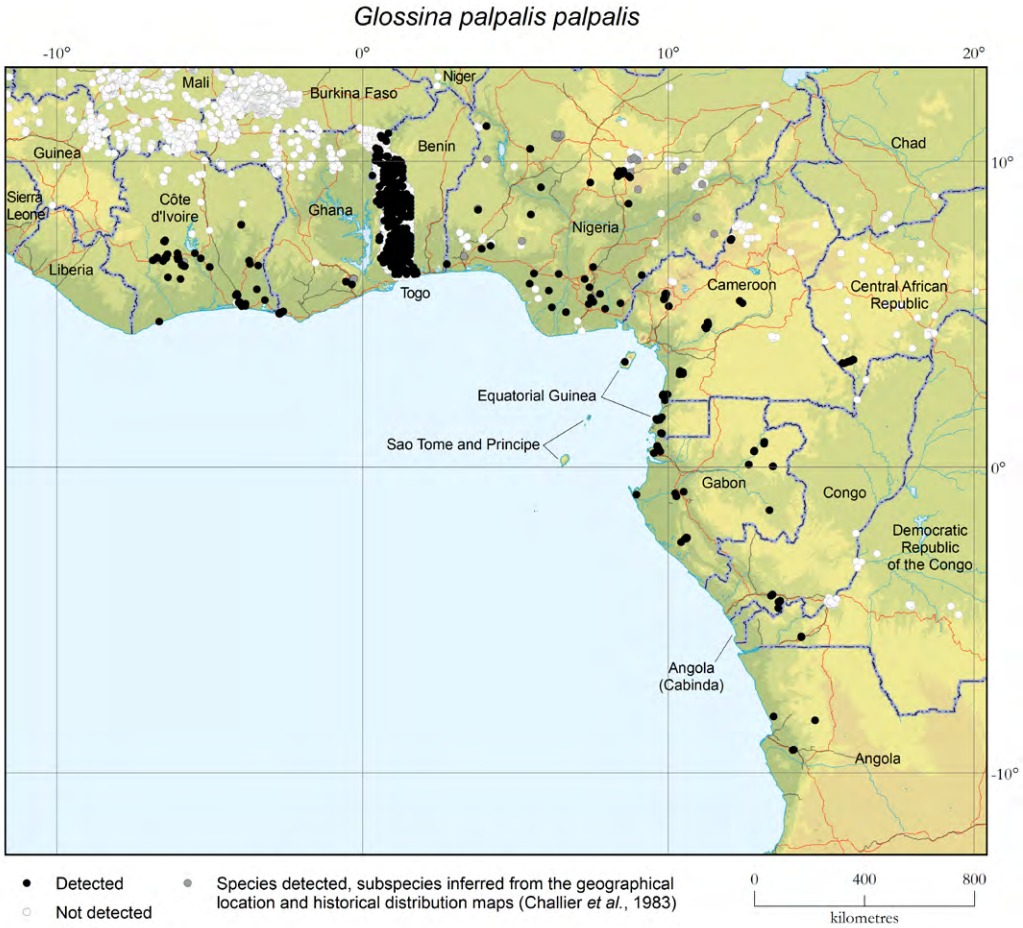
Glossina palpalis palpalis

The reported distribution of *G. palpalis palpalis* from scientific publications for the period 1990–2020 is shown in Figure 17 (sources for the presence points in Table 15). The subspecies is believed to occur from Sierra Leone to Angola, but the westernmost published data at our disposal are from Côte d'Ivoire, and no record is available for Sierra Leone, Guinea and Liberia.

In Côte d'Ivoire *G. palpalis palpalis* occurs in the southern part of the country, with most papers being explicit in reporting the subspecies (i.e. 30 out of 32 papers). In Ghana, the subspecies is known to occur in the central and southern parts of the country, but relatively few data are available for our study period (i.e. only three papers). In Togo, *G. palpalis palpalis* has a broad distribution from the north (Savanes Region) to the south (Plateaux Region) (Hendrickx *et al.*, 1999). The same is thought to be the case in Benin, where *G. palpalis palpalis* is believed to be the only subspecies of *G. palpalis* present in the country (Challier, Gouteux and Coosemans, 1983); however, no published records were identified in Benin for our reporting period. In Nigeria, *G. palpalis palpalis* occurs in the central and southern parts of the country, with some studies explicitly reporting the subspecies and others referring generically to *G. palpalis*. The species is, together with *Glossina tachinoides*, the dominant tsetse species in Nigeria, respectively accounting for 49 and 45 percent of all tsetse catches recorded in our atlas.

From Cameroon to Angola, all studies are explicit in reporting *G. palpalis palpalis* at the subspecies level. The species is the dominant one in Cameroon and Equatorial Guinea, accounting for 80 percent of the catches recorded in these two countries. The species is also the dominant one in Gabon (39 percent of the catches), while data from other countries are too scanty to make comparisons with other species.

FIGURE 17
Geographic distribution of *Glossina palpalis palpalis* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

TABLE 15
Scientific papers used as sources to map the occurrence of *Glossina palpalis palpalis* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Angola	4	2–5
Cameroon	29	4, 68–76, 78, 85, 87–103
Central African Republic	2	113, 117
Congo	3	105, 124, 126
Côte d'Ivoire	32	4, 25, 26, 51, 52, 101, 105, 127–140, 142–144, 146–149, 151–153, 156
Democratic Republic of the Congo	5	4, 88, 101, 164, 167
Equatorial Guinea	6	171–176
Gabon	16	145, 306–320
Ghana	3	329, 330, 333
Nigeria	32	93, 457–460, 462, 464–467, 471–473, 477, 478, 480–492, 494–496, 499
Togo	3	533–535
Total	**127**	

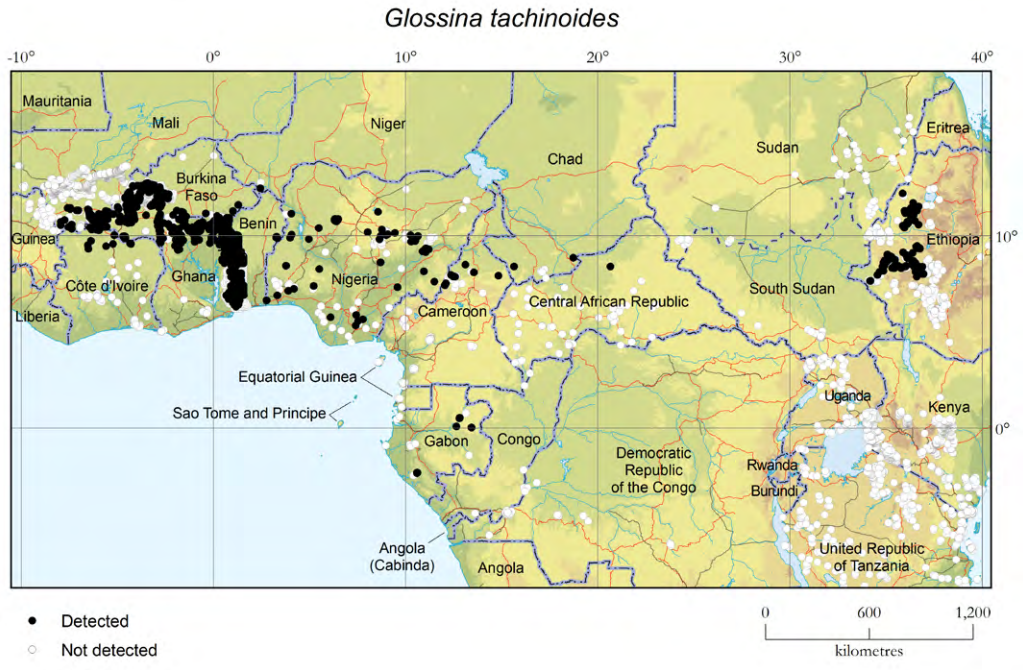
*The numbered list of scientific publications used as sources is in Annex 1.

Glossina tachinoides

Like many species of the *palpalis* group, *G. tachinoides* favours gallery forests. However, compared to other riverine species, it can withstand relatively drier climatic conditions. Because of this, in certain countries in western and central Africa, *G. tachinoides* can stretch further north than other species of the same group (e.g. in Ghana [Adam *et al.*, 2012] , Niger [Rouamba *et al.*, 2019] and Nigeria [Kalu and Lawani, 1996]).

Figure 18 shows the distribution of *G. tachinoides* as reported in scientific publications for the period 1990–2020, while Table 16 provides the corresponding sources for the presence points. The species was reported in a relatively contiguous belt from Mali to the West and Chad and the Central African Republic to the East, while no record was identified from eastern Guinea, the species' historical western limit (Ford and Katondo, 1977b). In the western region, *G. tachinoides* was reported to be the most abundant and widely distributed species in Burkina Faso; in this country, *G. tachinoides* accounts for two thirds of the tsetse flies catches included in our database, which is in line with the estimates from the national atlas (Percoma *et al.*, 2022). The species is also widely distributed in Togo and Nigeria, and therefore also conceivably in Benin, even though data from the latter country are very limited. At a distance of over 1 000 km from the western and central Africa belt lies the *G. tachinoides* belt of western Ethiopia; in this country the species is, after *G. pallidipes*, the second most widespread and abundant tsetse species, occurring in the regions of Amhara, Benishangul-Gumuz, Gambela and Oromia (Gebre *et al.*, 2022)]. The G. tachinoides belt in Ethiopia was historically reported to extend to the Sudan (Ford and Katondo, 1977b); however, after the separation of South Sudan and the Sudan, there is no published report of *G. tachinoides* in present-day Sudan (Ahmed *et al.*, 2016), and very little data are available from South Sudan.

FIGURE 18
Geographic distribution of *Glossina tachinoides* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

https://doi.org/10.4060/cd2022en-fig18

As compared to historical distribution maps (Ford and Katondo, 1977b), we found a few papers reporting a southward shift of the distribution limit of *G. tachinoides* in western Africa, including in Togo (Hendrickx *et al.*, 1999), and possibly in Nigeria (Isaac, Igbinosa and Nmorsi, 2011; Odeniran *et al.*, 2020). Finally, at variance with historical records, our review also identified seven publications reporting *G. tachinoides* from Gabon. These reports originate from different sites, mostly located within or in proximity to national parks (i.e. Moukalaba-Doudou [Dibakou *et al.*, 2015; Mounioko *et al.*, 2015] and Ivindo [Mbang Nguema *et al.*, 2016; Zinga Koumba *et al.*, 2014]).

TABLE 16
Scientific papers used as sources to map the occurrence of *Glossina tachinoides* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Benin	1	6
Burkina Faso	45	10–17, 19, 20, 22–24, 28, 30–42, 44–59, 62, 63
Cameroon	7	67, 77, 81–84, 90
Central African Republic	1	112
Chad	1	121
Côte d'Ivoire	6	127, 136, 145, 150, 154, 155
Ethiopia	44	183, 189, 190, 198–200, 204, 205, 208, 209, 211, 213, 214, 216, 218, 219, 223, 226, 228–230, 232–234, 238–240, 250, 251, 256, 258–260, 262, 264, 267, 270, 272, 285, 287, 290, 293–295
Gabon	7	307, 313, 314, 316–318, 320
Ghana	9	42, 326–328, 331, 333–336
Mali	7	436, 437, 439, 440, 444, 446, 447
Niger	1	455
Nigeria	31	93, 456, 459–463, 465, 466, 469–473, 477, 478, 480–482, 484–493, 496, 499
Togo	3	533–535
Total	**162**	

*The numbered list of scientific publications used as sources is in Annex 1.

SAVANNAH (*MORSITANS*) GROUP (SUBGENUS *GLOSSINA* S.S.)

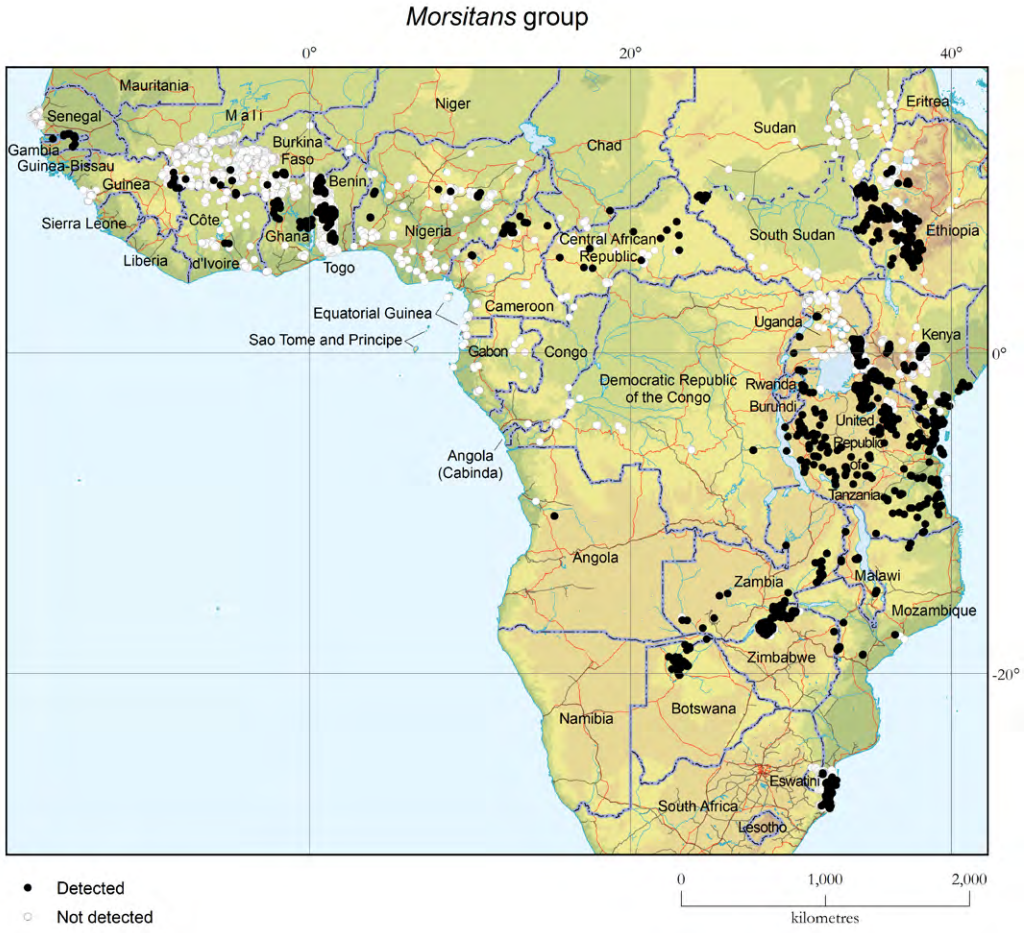
Like the *palpalis* group, the savannah (*morsitans*) group also includes major vectors of both AAT and HAT, and in particular of rhodesiense HAT (WHO, 2013). Table 17 provides the list of all the species and subspecies belonging to this group; for all of them, data could be identified for the study period 1990–2020.

The geographic distribution of the *morsitans* group is provided in Figure 19, while Figure 20 provides the distribution of the different species. A summary of the species and subspecies reported in the different countries is shown in Table 18.

TABLE 17
Tsetse species and subspecies of the *morsitans* group

Savannah (*morsitans*) group (subgenus *Glossina* s.s.)	
G. austeni	Newstead, 1912
G. longipalpis	Wiedemann, 1830
G. morsitans centralis	Machado, 1970
G. morsitans morsitans	Westwood, 1850
G. morsitans submorsitans	Newstead, 1910
G. pallidipes	Austen, 1903
G. swynnertoni	Austen, 1923

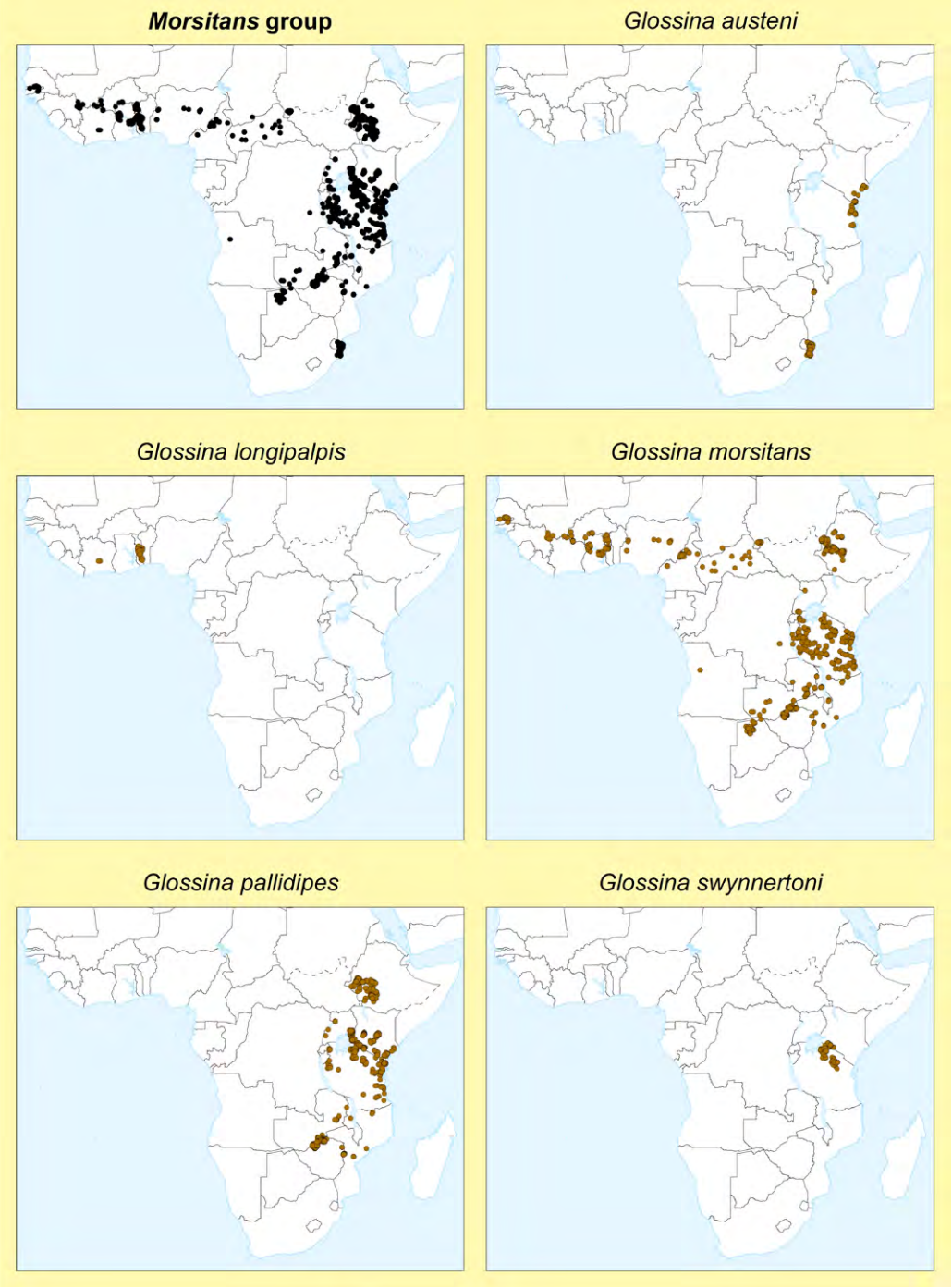
FIGURE 19
Geographic distribution of the *morsitans* group (subgenus *Glossina* s.s.) as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

FIGURE 20
Geographic distribution of *Glossina* species of the *morsitans* group reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

TABLE 18
***Glossina* species of the *morsitans* group reported in scientific papers (publication period: 1990–2020) by country**

Country	Tsetse species and subspecies (*morsitans* group)							
	G. austeni	*G. longipalpis*	*G. morsitans*	*G. morsitans centralis*	*G. morsitans morsitans*	*G. morsitans submorsitans*	*G. pallidipes*	*G. swynnertoni*
Angola			●	●				
Benin		○	○			○		
Botswana			●	●				
Burkina Faso		○	●			●		
Burundi			○	○				
Cameroon		○	●			●		
Central African Republic			●			●		
Chad			●			●		
Côte d'Ivoire		●	○			○		
Democratic Republic of the Congo		○	●	●		○	○	
Eswatini	●						○	
Ethiopia			●			●	●	
Gambia		○	●			●		
Ghana		○	●			●		
Guinea		○	●			●		
Guinea-Bissau		○	○			○		
Kenya	●		○			○	●	●
Malawi			●		●		●	
Mali		○	●			●		
Mozambique	●		●		●		●	
Namibia			●	●				
Niger			○			○		
Nigeria		○	●			●		
Rwanda			●	●			●	
Senegal		○	●			●		
Sierra Leone		○	○			○		
Somalia	○						○	
South Africa	●							
South Sudan			○			○	○	
Sudan			●			●		
Togo		●	●			●		
Uganda			●	○		●	●	
United Republic of Tanzania	●		●	●	●		●	●
Zambia			●	●	●		●	
Zimbabwe	●		●		●		●	

● Species or subspecies reported in scientific papers (publication period: 1990–2020).

● Subspecies inferred to be present based on the reported presence of the corresponding species and the known historical distribution of the subspecies (publication period: 1990–2020).

○ Species or subspecies reported or suggested in previous periods (<1990) or reviews, and which could, or are likely to, still be present.

Glossina austeni

Figure 21 shows the distribution of *Glossina austeni* as reported in scientific publications for the period 1990–2020, while Table 19 provides the list of papers we used as sources for the presence points. The species is shown to occur along the coast of eastern Africa from KwaZulu-Natal in northeastern South Africa (de Beer *et al.*, 2016) to Kenya (Ngari e*t al.*, 2020). One scientific paper (de Beer *et al.*, 2019), using data from an earlier survey commissioned by WHO (Saini and Simarro, 2008), reported the presence of *G. austeni* in Eswatini. One paper from the early 1990s also reported the occurrence of *G. austeni* in Zimbabwe, along the border with Mozambique (Thakersi, 1992), although more recent surveys in that area failed to detect tsetse flies (Shereni *et al.*, 2021). Finally, *G. austeni* was known to occur in southern Somalia (FAO, 1982a; Ford and Katondo, 1977b; Moloo, 1993), but published data from this country are lacking for our study period.

The main habitat of *G. austeni* is evergreen thicket, even though the species can also be found in dense secondary forests (FAO, 1982b). The species was believed to occur as far from the coast as 200 km and at altitudes of up to 900 m above sea level (FAO, 1982b). The current data broadly confirm this and, excepting the report from Zimbabwe, all records of *G. austeni* documented in our atlas

FIGURE 21
Geographic distribution of *Glossina austeni* as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

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originate within 100 km of the coast of the Indian Ocean and at altitudes of less than 400 m.

The distribution of *G. austeni* is known to be patchy and its behaviour elusive. The difficulty of capturing *G. austeni* with conventional tsetse traps must be taken into consideration when interpreting the results of standard surveys (Vreysen, Khamis and van der Vloedt, 1996). Furthermore, the elimination campaign with a sterile insect technique component carried out at the end of the 1990s on the island of Unguja (Zanzibar Archipelago) has to be considered when interpreting Figure 21, as the map shows the pre-elimination captures of *G. austeni* on top of the later absence points. Figure 21 also shows the dearth of information in Mozambique, a country which has one of the longest coastlines along the Indian Ocean and is historically known to host numerous pockets of *G. austeni*.

TABLE 19
Scientific papers used as sources to map the occurrence of *Glossina austeni* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Eswatini	1	177
Kenya	12	362, 364, 370, 375, 381, 382, 390, 395, 409, 414, 421, 429
Mozambique	2	177, 453
South Africa	18	164, 177, 429, 506–520
United Republic of Tanzania	11	164, 572, 577, 579, 585, 586, 604–608
Zimbabwe	1	650
Total	**41**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina longipalpis

Glossina longipalpis was known to occur in western and central Africa from Senegal to the Democratic Republic of the Congo, where it was generally found to the south of, but with some overlap with, *Glossina morsitans submorsitans*. The species' favoured habitat is the woodland savannah lying immediately north of the rainforest, but it also occurs more to the north, especially in riverine vegetation. Its distribution was reported to be relatively contiguous from Senegal to central Nigeria but was more markedly patchy and fragmented from eastern Nigeria to north-western Democratic Republic of the Congo.

Figure 22 shows the distribution of *G. longipalpis* as reported in scientific publications for the period 1990–2020, with the sources of presence points in Table 20. Our review identified only three scientific papers, all dating back to the 1990s, reporting the occurrence of the species in two countries, i.e. Côte d'Ivoire (Solano *et al.*, 1995; Späth, 1997), and Togo (Hendrickx *et al.*, 1999). A recent study published in 2022, and therefore outside our review, confirmed the persistence of *G. longipalpis* in central Togo (Soudah *et al.*, 2022). Furthermore, a paper published in the proceedings of a workshop, and therefore not eligible for inclusion in our atlas database, reported the capture of *G. longipalpis* in Nigeria (Ajayi *et al.*, 1997).

Other countries historically reporting *G. longipalpis* included Benin, Burkina Faso, Cameroon, the Democratic Republic of the Congo, the Gambia, Ghana, Guinea, Guinea-Bissau, Mali, Senegal and Sierra Leone. Regarding Mali and Burkina Faso, it is worth noting that the species used to be reported from very small border areas, and that recently published national atlases of tsetse flies failed to confirm the persistence of this species in these two countries (Diarra *et al.*, 2019; Percoma *et al.*, 2022).

FIGURE 22
Geographic distribution of *Glossina longipalpis* as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

https://doi.org/10.4060/cd2022en-fig22

TABLE 20
Scientific papers used as sources to map the occurrence of *Glossina longipalpis* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Côte d'Ivoire	2	153, 154
Togo	1	534
Total	**3**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina morsitans

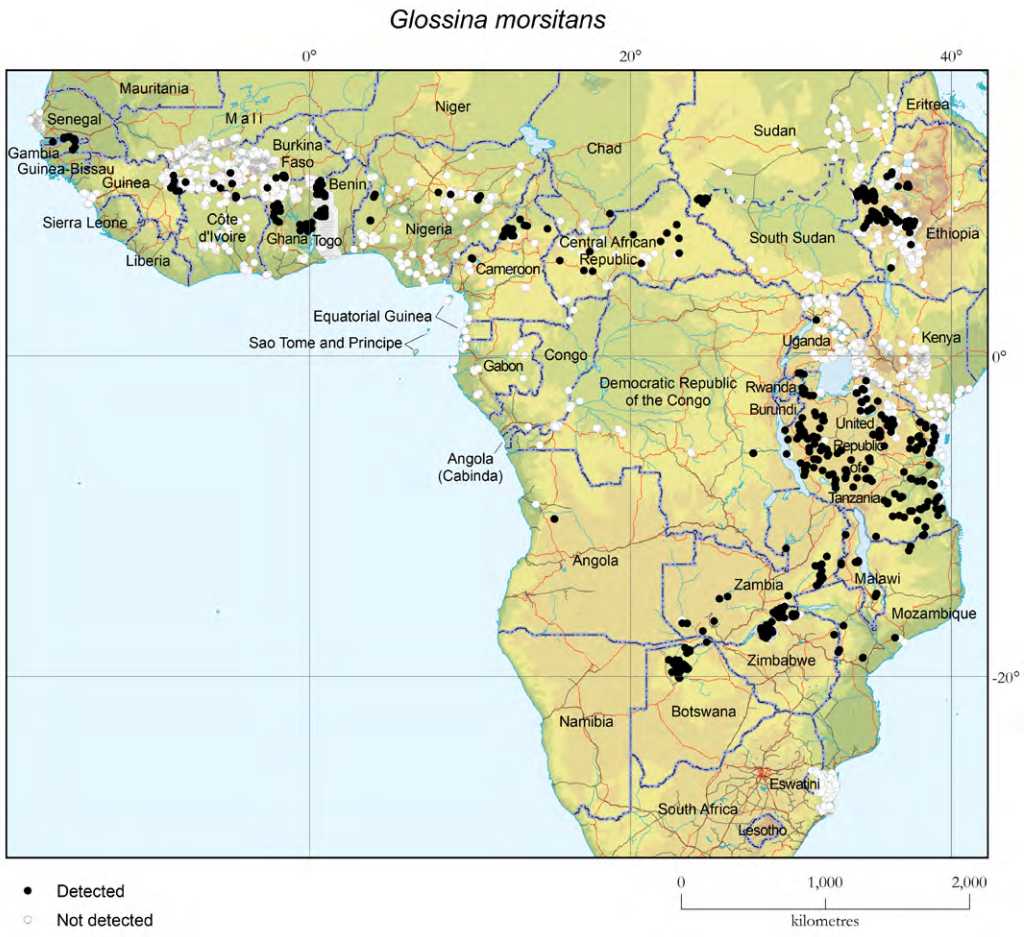
Glossina morsitans is a major vector of animal trypanosomosis, and it is also involved in the transmission of HAT (WHO, 2013). Its typical habitats are open woodland and woodland savannah, and its geographic distribution is very broad, spanning up to Senegal in the north-west, Ethiopia in the northeast, Angola in the southwest and Mozambique in the southeast. However, as the species relies mainly on wildlife for blood meal and is sensitive to human-induced habitat disturbance, its areas of occurrence have been progressively shrinking, most notably in western Africa, and in many countries *G. morsitans* is now mostly confined to national parks or other protected areas (de Gier *et al.*, 2020; Gashururu *et al.*, 2021; Percoma *et al.*, 2022).

Figure 23 shows the distribution of *G. morsitans* as reported in scientific publications for the period 1990–2020. Overall, 24 countries reported the occurrence of *G. morsitans* (see Table 21), which is the highest number of countries for any tsetse species in our review. No published record of *G. morsitans* was identified for our study period from Benin, Burundi, Côte d'Ivoire, Guinea-Bissau, Kenya, Niger, Sierra Leone or South Sudan,

which historically hosted the species (Jaenson, Dos Santos and Hall, 1991; Späth, 2000).

Three subspecies of *G. morsitans* are recognized: *Glossina morsitans centralis*, *G. morsitans morsitans* and *G. morsitans submorsitans*. They are believed to be geographically distinct (allopatric) (Ford and Katondo, 1977b), with genetic evidence suggesting longstanding and complete reproductive isolation in nature (Krafsur and Endsley, 2006). The three subspecies are presented separately in the following sections.

FIGURE 23
Geographic distribution of *Glossina morsitans* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

https://doi.org/10.4060/cd2022en-fig23

TABLE 21
Scientific papers used as sources to map the occurrence of *Glossina morsitans* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Angola	1	1
Botswana	3	7–9
Burkina Faso	17	10, 12, 14–16, 30, 34, 39, 42, 44, 48–50, 53, 54, 57, 59
Cameroon	10	66, 67, 77, 79–84, 90
Central African Republic	2	104, 112
Chad	1	121
Democratic Republic of the Congo	1	1
Ethiopia	59	145, 179, 180, 182, 184, 186, 189, 190, 193, 194, 198, 199, 201, 203, 204, 206, 208, 210, 211, 213, 214, 217, 219, 223, 227, 230, 232, 233, 235, 238–240, 242–246, 250, 252, 254–256, 261, 262, 267–269, 272, 273, 276–280, 291, 293, 295, 298, 299
Gambia	6	242, 321–325
Ghana	3	331, 333, 336
Guinea	1	339
Malawi	6	122, 431–435
Mali	2	439, 440
Mozambique	5	275, 449–452
Namibia	1	9
Nigeria	8	93, 456, 460, 463–465, 491, 493
Rwanda	1	500
Senegal	1	504
Sudan	2	529, 531
Togo	2	533, 534
Uganda	1	537
United Republic of Tanzania	17	164, 452, 572, 573, 577, 582, 584–588, 593, 595–599
Zambia	22	9, 145, 164, 433, 452, 521, 609–613, 615–617, 620–626, 628
Zimbabwe	34	164, 452, 454, 630–634, 636, 637, 640, 641, 643, 644, 646–658, 660–666
Total	**195**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina morsitans centralis

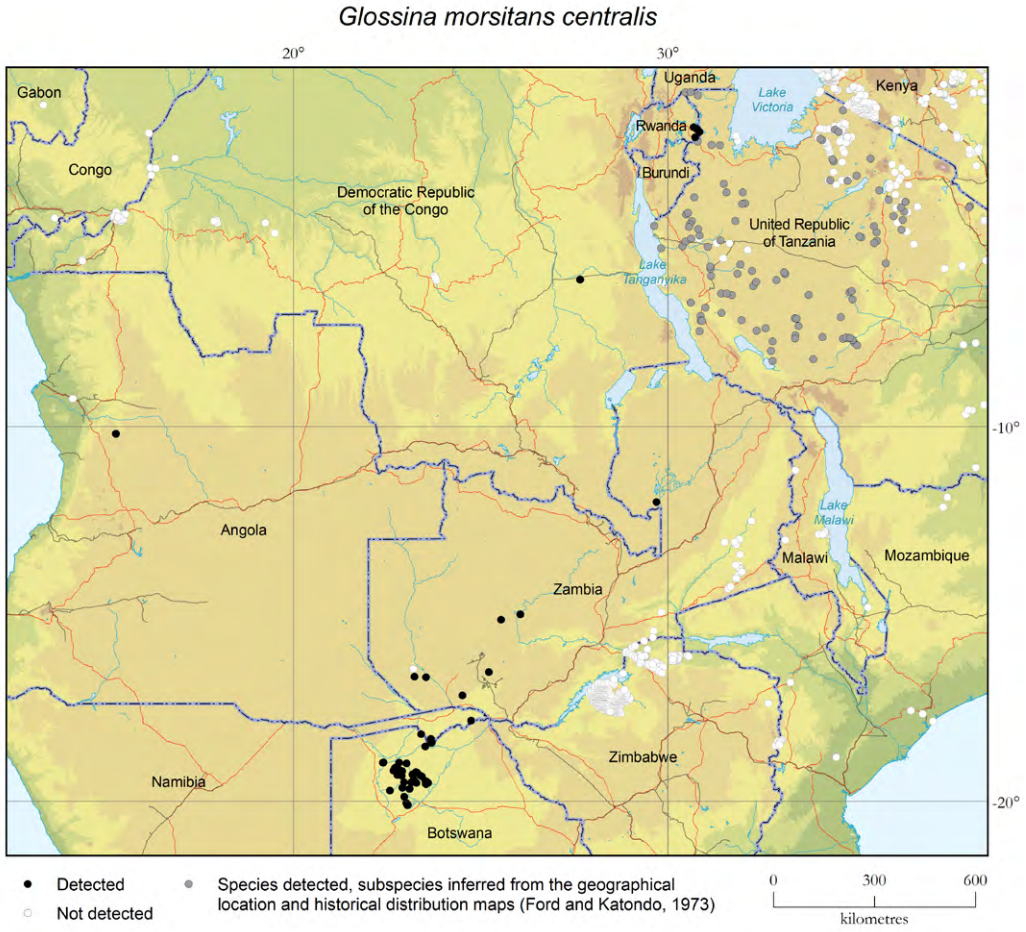
Figure 24 shows the reported distribution of *G. morsitans centralis*, with Table 22 providing the list of papers we used as sources for the presence points.

During our study period (1990–2020), the subspecies was explicitly reported from six countries: Angola, Botswana, the Democratic Republic of the Congo, Namibia, Rwanda and Zambia. In the United Republic of Tanzania, no explicit report of *G. morsitans centralis* was identified. However, a national-level tsetse mapping exercise provided abundant information on G. *morsitans* (Daffa *et al.*, 2013), which we used in combination with the historical separation line between *G. morsitans centralis* and *G. morsitans morsitans* (Ford and Katondo, 1977b) tentatively to map the subspecies. Two further studies from the Maasai steppe in the north of the country, adjacent to the Tarangire National Park, also reported *G. morsitans* (Ngonyoka *et al.*, 2017a; Ngonyoka *et al.*, 2017b), which we also assumed to be *G. morsitans centralis* based on historical information. However, given the close proximity of this latter study area to the historical separation line, and considering that some authors reported *G. morsitans morsitans* from the same area (Malele *et al.*, 2003; Nnko *et al.*, 2017), our assumption would need confirmation. No published report

was available for two additional countries that were known to host the subspecies (i.e. Burundi and Uganda).

When looking at Figure 24, it must be stressed again that in these maps, presence points are always overlaid onto absence points, irrespective of the date of the survey. As a result, presence points are still visible in some areas that, to the best of our knowledge, have been sustainably cleared of *G. morsitans centralis* through aerial spraying (the sequential aerosol technique). These areas include the inland delta of the Okavango river in Botswana (Kgori, Modo and Torr, 2006), the border area between Botswana and Namibia (Linyanti River) (Kgori and Modo, 2009), and some areas in southwestern Zambia (in and around Sesheke District).

FIGURE 24
Geographic distribution of *Glossina morsitans centralis* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

TABLE 22
Scientific papers used as sources to map the occurrence of *Glossina morsitans centralis* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Angola	1	1
Botswana	3	7–9
Democratic Republic of the Congo	1	1
Namibia	1	9
Rwanda	1	500
United Republic of Tanzania	3	572, 595, 596
Zambia	4	9, 612, 613, 617
Total	**11**	

*The numbered list of scientific publications used as sources is in Annex 1.

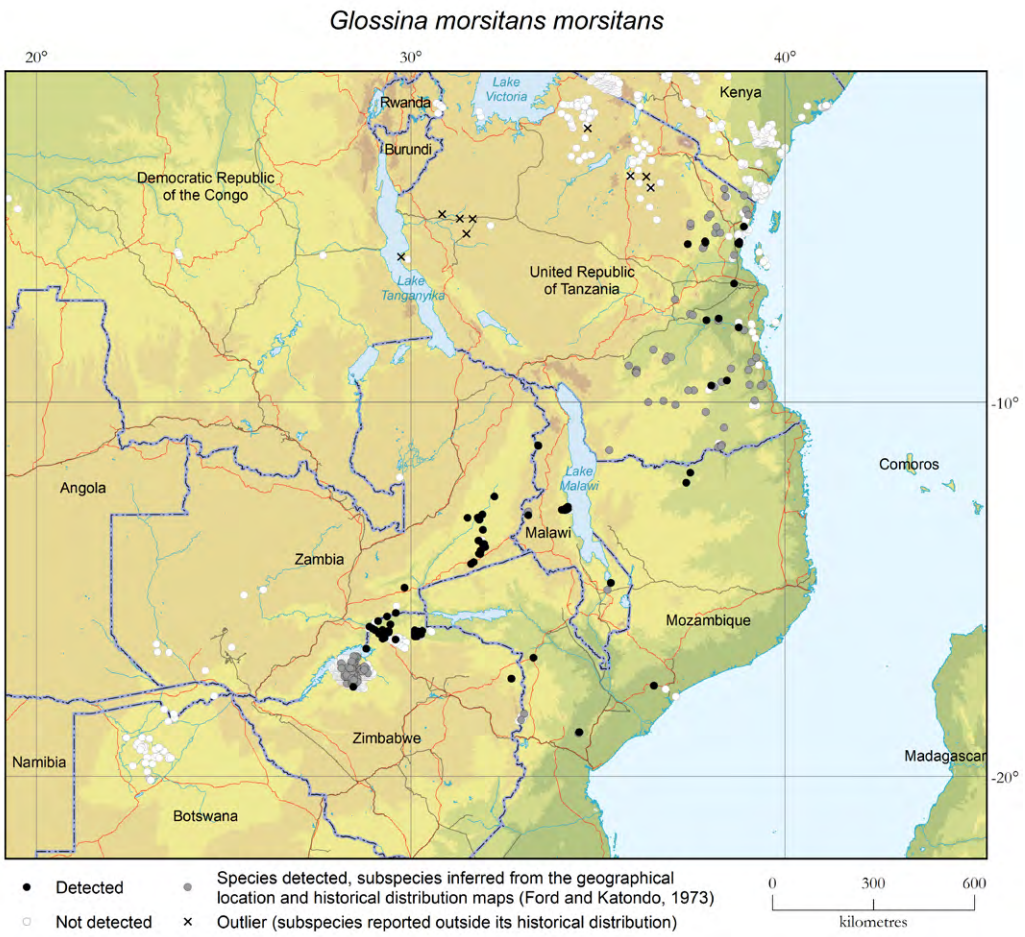
Glossina morsitans morsitans

Figure 25 shows the distribution of *G. morsitans morsitans* as reported in scientific publications for the period 1990–2020, with Table 23 providing the sources for the presence points. In line with the historical record, during our study period the subspecies was reported in five countries: Malawi, Mozambique, the United Republic of Tanzania, Zambia and Zimbabwe.

Most of the studies (i.e. 63 out of 72 [88 percent]) explicitly reported the subspecies, while a few (9 [13 percent]) reported *G. morsitans* at the species level, and we assumed the subspecies based on the survey location and historical distribution maps (Ford and Katondo, 1977b). Also, seven studies from the United Republic of Tanzania reported *G. morsitans morsitans* from areas that were historically known to host *G. morsitans centralis*. Some of these studies were conducted relatively close to the *G. morsitans centralis*/*G. morsitans morsitans* separation line (Malele *et al.*, 2003; Salekwa *et al.*, 2014; Nnko *et al.*, 2017), while others were in the western part of the country (Sasaki and Nishida, 1999; Ouma, Marquez and Krafsur, 2007) or in the Serengeti ecosystem (Malele *et al.*, 2007), deep into what was known to be *G. morsitans centralis* area (Malele *et al.*, 2016). These results are presented in Figure 25 as "outliers" that would need verification, also considering that these studies did not provide details on how the subspecies was determined.

As regards Zimbabwe, a more detailed delineation of the occurrence of *G. morsitans morsitans*, including its temporal dynamics in the period 2000–2019, is available from the national atlas (Shereni *et al.*, 2021). As the latter was published in 2021, it was not considered for the present edition of the continental atlas.

FIGURE 25
Geographic distribution of *Glossina morsitans morsitans* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

TABLE 23
Scientific papers used as sources to map the occurrence of *Glossina morsitans morsitans* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Malawi	6	122, 431–435
Mozambique	5	275, 449–452
United Republic of Tanzania	15	164, 452, 572, 573, 577, 582, 584–588, 593, 597–599
Zambia	18	145, 164, 433, 452, 521, 609–611, 615, 616, 620–626, 628
Zimbabwe	34	164, 452, 454, 630–634, 636, 637, 640, 641, 643, 644, 646–658, 660–666
Total	**72**	

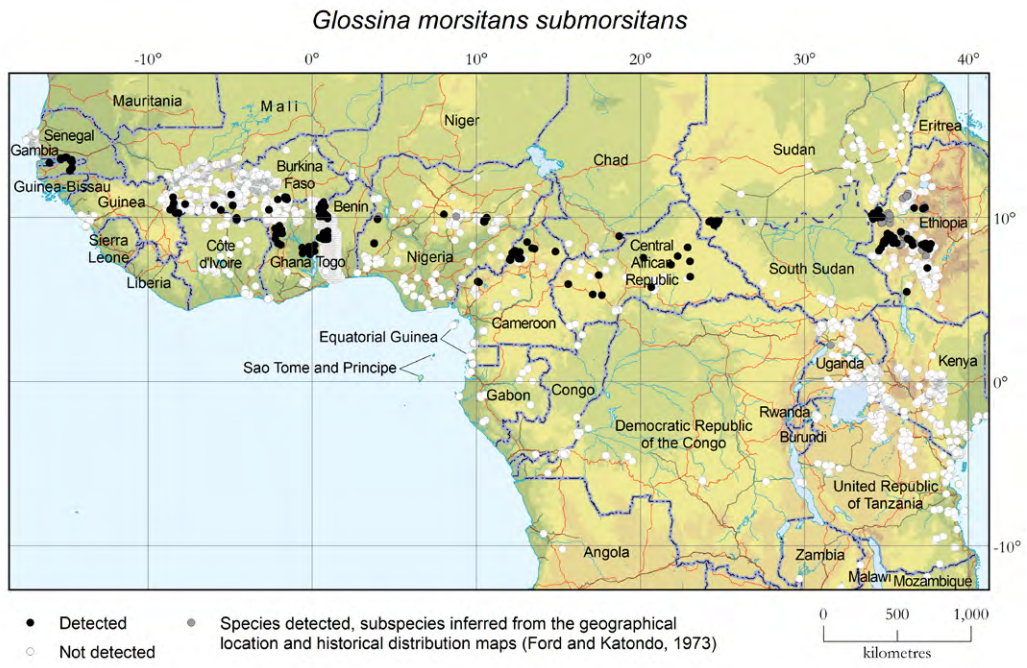
*The numbered list of scientific publications used as sources is in Annex 1.

Glossina morsitans submorsitans

Figure 26 shows the distribution of *G. morsitans submorsitans* as reported in scientific publications during 1990–2020. The subspecies can be found in a relatively narrow and fragmented belt from Senegal to Ethiopia, and in our study period its occurrence was confirmed in 14 countries (see Table 24). A total of 114 papers reported *G. morsitans submorsitans*, of which 91 (i.e. 80 percent) explicitly reported the subspecies. In 22 papers (18 for Ethiopia and four for Nigeria), the species *G. morsitans* was reported, and we assumed the subspecies based on the survey location and historical distribution maps (Ford and Katondo, 1977b). One study from Uganda reported on *G. morsitans morsitans* from the Murchison Falls National Park (Aksoy *et al.*, 2014); however, following consultations with the authors, we assumed these captures to be *G. morsitans submorsitans*. This is because the samples were not characterized at the subspecies level, and the study area belongs to the historical distribution of *G. morsitans submorsitans*.

In addition to the 14 countries in Table 24, *G. morsitans submorsitans* was also historically reported from Benin, Côte d'Ivoire, the Democratic Republic of the Congo, Guinea-Bissau, Kenya, Niger, Sierra Leone and South Sudan.

FIGURE 26
Geographic distribution of *Glossina morsitans submorsitans* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

TABLE 24
Scientific papers used as sources to map the occurrence of *Glossina morsitans submorsitans* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Burkina Faso	17	10, 12, 14–16, 30, 34, 39, 42, 44, 48–50, 53, 54, 57, 59
Cameroon	10	66, 67, 77, 79–84, 90
Central African Republic	2	104, 112
Chad	1	121
Ethiopia	59	145, 179, 180, 182, 184, 186, 189, 190, 193, 194, 198, 199, 201, 203, 204, 206, 208, 210, 211, 213, 214, 217, 219, 223, 227, 230, 232, 233, 235, 238–240, 242–246, 250, 252, 254–256, 261, 262, 267–269, 272, 273, 276–280, 291, 293, 295, 298, 299
Gambia	6	242, 321–325
Ghana	3	331, 333, 336
Guinea	1	339
Mali	2	439, 440
Nigeria	8	93, 456, 460, 463–465, 491, 493
Senegal	1	504
Sudan	2	529, 531
Togo	2	533, 534
Uganda	1	537
Total	**114**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina pallidipes

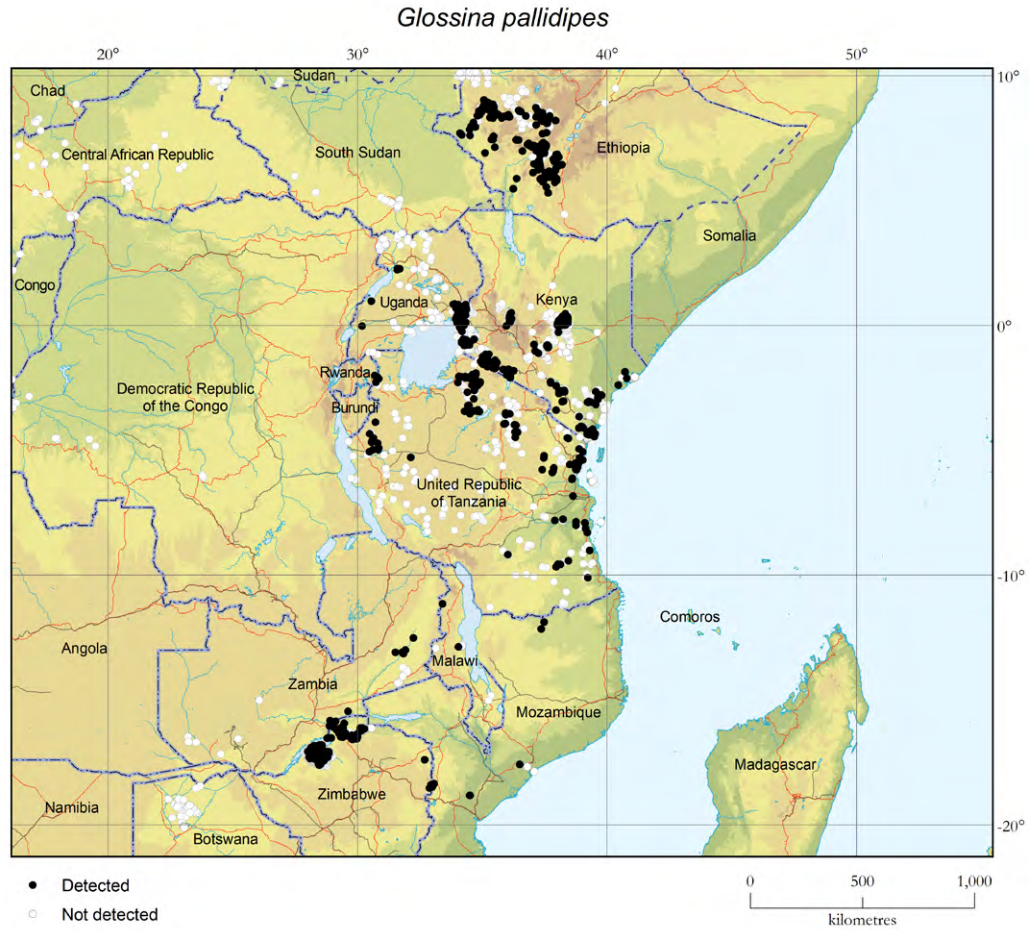
Glossina pallidipes is a major vector of AAT and HAT (WHO, 2013), and it is patchily distributed across eastern Africa, from Ethiopia to Mozambique. Figure 27 shows its distribution as reported in 219 scientific publications for the period 1990–2020. The very high number of papers that looked at *G. pallidipes*, which is the highest for any single species in our atlas, attests to the veterinary and medical importance of the species.

Nine countries reported *G. pallidipes* in our study period: Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Uganda, the United Republic of Tanzania, Zambia and Zimbabwe (see Table 25). In Ethiopia, the species occurs in the southwestern regions and it is the most abundant and broadly distributed in the country, where it accounts for two thirds of all the tsetse catches in our database; these findings are in line with the recently published national atlas for Ethiopia (Gebre *et al.,* 2022). *Glossina pallidipes* is also by far the most abundant and widely distributed species in Kenya, where it accounts for 87 percent of the tsetse flies included in our atlas, and where it occurs in all the tsetse-infested regions (Western, Rift Valley, Central and Coast [Ngari *et al*., 2020]). By contrast, in Uganda the species has a relatively limited distribution, and it was reported only from the southeastern regions bordering Kenya and in the west near Lake Albert and Lake Edward. In Rwanda, only one paper reporting *G. pallidipes was* available for our review (Mihok, Otieno and Tarimo, 1992), but more recent surveys at the wildlife-human-livestock interface of the Akagera National Park confirmed the presence of the species in the eastern part of the country (Gashururu *et al.*, 2021). In the United Republic of Tanzania, *G. pallidipes* is less widely distributed than *G. morsitans*, but it still occurs in several regions including the coast, Arusha, Manyara, Kigoma and the Serengeti-Mara ecosystem. In Malawi, Mozambique, Zambia and Zimbabwe, *G. pallidipes* often co-occurs with *G. morsitans*, especially within or close to protected areas.

In addition to the nine countries shown in Table 25, according to historical records, the species was also known to occur in the Demo-

cratic Republic of the Congo, Eswatini, Somalia and South Sudan. However, relatively recent surveys failed to detect *G. pallidipes* in Eswatini (Saini and Simarro, 2008). The species also used to occur in South Africa in the KwaZulu-Natal Province, but it was eliminated from that area several decades ago by means of persistent chemicals (Du Toit, 1954).

FIGURE 27
Geographic distribution of *Glossina pallidipes* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

https://doi.org/10.4060/cd2022en-fig27

TABLE 25
Scientific papers used as sources to map the occurrence of *Glossina pallidipes* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Ethiopia	80	145, 178, 185, 187, 188, 190–192, 195–197, 202–205, 207, 208, 210–213, 215, 217, 221–225, 228, 230–233, 236, 238–241, 243–245, 247, 248, 252, 254, 255, 257, 261–263, 266, 268, 271–274, 276–283, 286, 288, 289, 291, 293–297, 299–305
Kenya	56	164, 236, 271, 348–351, 353–357, 359–366, 368–370, 372, 375, 377, 381–383, 389, 390, 394–397, 399, 405–407, 409–412, 414–420, 422, 424–426, 429, 430
Malawi	1	432
Mozambique	3	275, 450, 451
Rwanda	1	500
Uganda	11	122, 369, 405, 418, 449, 537, 551, 552, 555, 557, 567
United Republic of Tanzania	33	1, 122, 236, 271, 349, 403, 419, 568–573, 576–588, 590, 593, 595–598, 601
Zambia	11	145, 236, 271, 521, 610, 614, 616, 618, 627, 628, 668
Zimbabwe	40	236, 271, 365, 629, 631–640, 642–644, 646–666, 668, 669
Total	**219**	

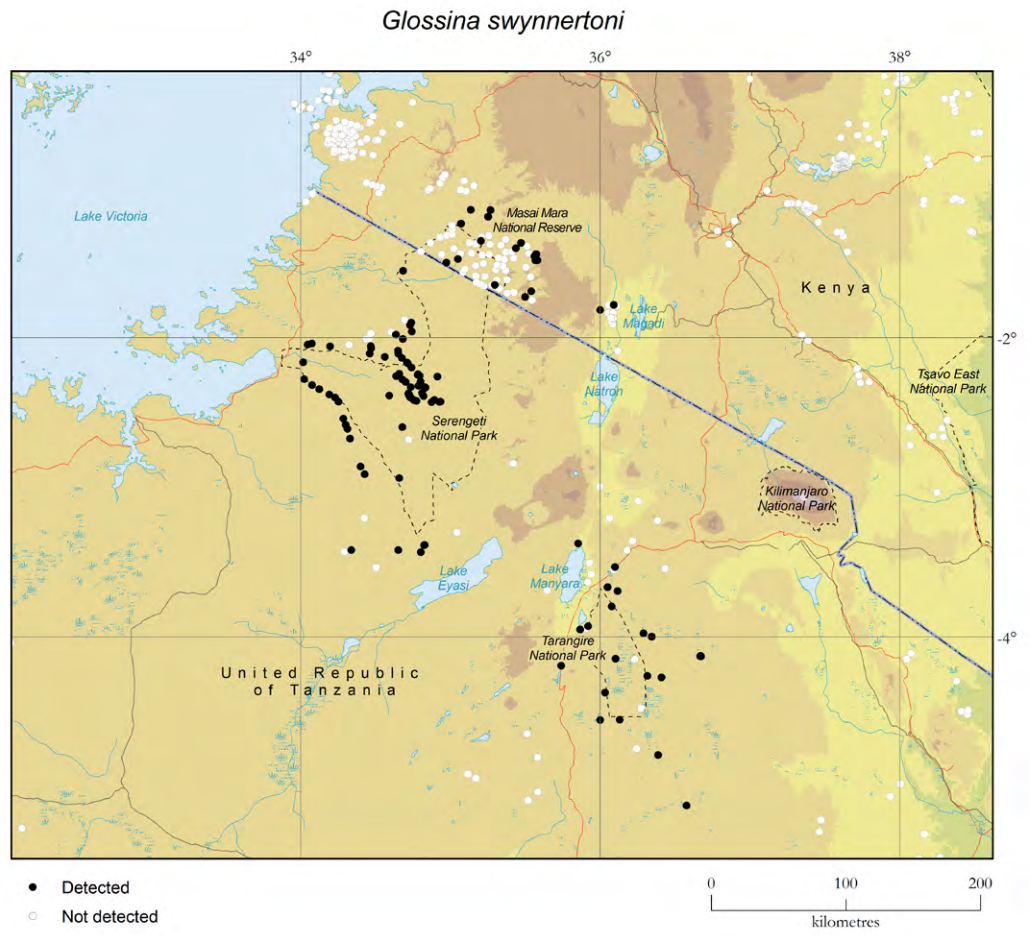
*The numbered list of scientific publications used as sources is in Annex 1.

Glossina swynnertoni

Glossina swynnertoni is a species closely resembling *G. morsitans* that occurs in a relatively small area straddling northern United Republic of Tanzania and southwestern Kenya. In these areas, the *G. swynnertoni* co-exists mainly with *G. pallidipes*, where it contributes to the transmission of both AAT and HAT (WHO, 2013).

Figure 28 shows the distribution of *G. swynnertoni* as reported in scientific publications (1990–2020); the source papers for presence points are shown in Table 26. Most of the areas where *G. swynnertoni* occurs are found in or around national parks or other conservancies. The main clusters of reported occurrence are associated with the Serengeti and Tarangire national parks in the United Republic of Tanzania (Ngonyoka *et al.*, 2017b; Lord *et al.*, 2018) and the Masai Mara National Reserve in Kenya (Ngari *et al.*, 2020). In Kenya, the species was also reported from the Nguruman Escarpment, west of Lake Magadi, in a survey carried out in 1992 (Stiles *et al.*, 1994); however, no later study from the area reported *G. swynnertoni* (e.g. [Ouma *et al.*, 2000; Bett *et al.*, 2008; Channumsin *et al.*, 2018]).

FIGURE 28
Geographic distribution of *Glossina swynnertoni* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

https://doi.org/10.4060/cd2022en-fig28

TABLE 26
Scientific papers used as sources to map the occurrence of *Glossina swynnertoni* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Kenya	7	360, 362, 403, 407–409, 426
United Republic of Tanzania	26	1, 122, 164, 403, 405, 408, 568–572, 574, 576, 580, 581, 584, 585, 587, 588, 592, 594–598, 601
Total	**31**	

*The numbered list of scientific publications used as sources is in Annex 1.

FOREST (*FUSCA*) GROUP (SUBGENUS *AUSTENINA*)

As compared to the *palpalis* and *morsitans* groups, the tsetse species of the *fusca* group is much less studied. This is because of its lesser medical and veterinary importance, more limited geographical distribution and habitat that is generally more difficult to access. In fact, most species of the *fusca* group are associated with rainforests, and in particular with closed, relatively undisturbed vegetation (Cecchi *et al.*, 2008). Overall, 15 species and subspecies are recognized in this group (see Table 27).

The characterization of the *fusca* group as rainforest-associated species having negligible economic importance needs some nuancing. In fact, such characterization fits better some of the species in the group (e.g. *Glossina tabaniformis*, *Glossina haningtoni*, *Glossina nashi*, *Glossina severini*, *Glossina vanhoofi*), and less so other species (e.g. *Glossina fusca*, *Glossina nigrofusca*, *Glossina fuscipleuris*, *Glossina medicorum* and *Glossina schwetzi*) which inhabit more transitional zones between true rainforest and savannah woodland (Ford, 1963; Jordan, 1961). *Glossina longipennis* is even more of an exception, as it inhabits very dry areas (FAO, 1982b).

In our review for the period 1990–2020, we were able to find data for ten species and subspecies of the *fusca* group. The five for which no data could be found are *G. haningtoni*, *Glossina nigrofusca hopkinsi*, *G. schwetzi*, *G. severini* and *G. vanhoofi*. Of these five, two species (i.e. *G. haningtoni* and *G. schwetzi*), were historically reported from relatively large areas along the Atlantic coast of central Africa, while *G. nigrofusca hopkinsi*, *G. severini* and *G. vanhoofi* were reported only from very small areas in the east of the Democratic Republic of the Congo.

The geographic distribution of the *fusca* group as derived from our 31-year review is provided in Figure 29, while Figure 30 and Figure 31 provide the distribution of the nine species for which spatially explicit field data could be found (subspecies are not shown in Figure 30 and Figure 31). A summary of the species and subspecies reported in the different countries is shown in Table 28.

TABLE 27
Tsetse species and subspecies of the *fusca* group (subgenus *Austenina*)

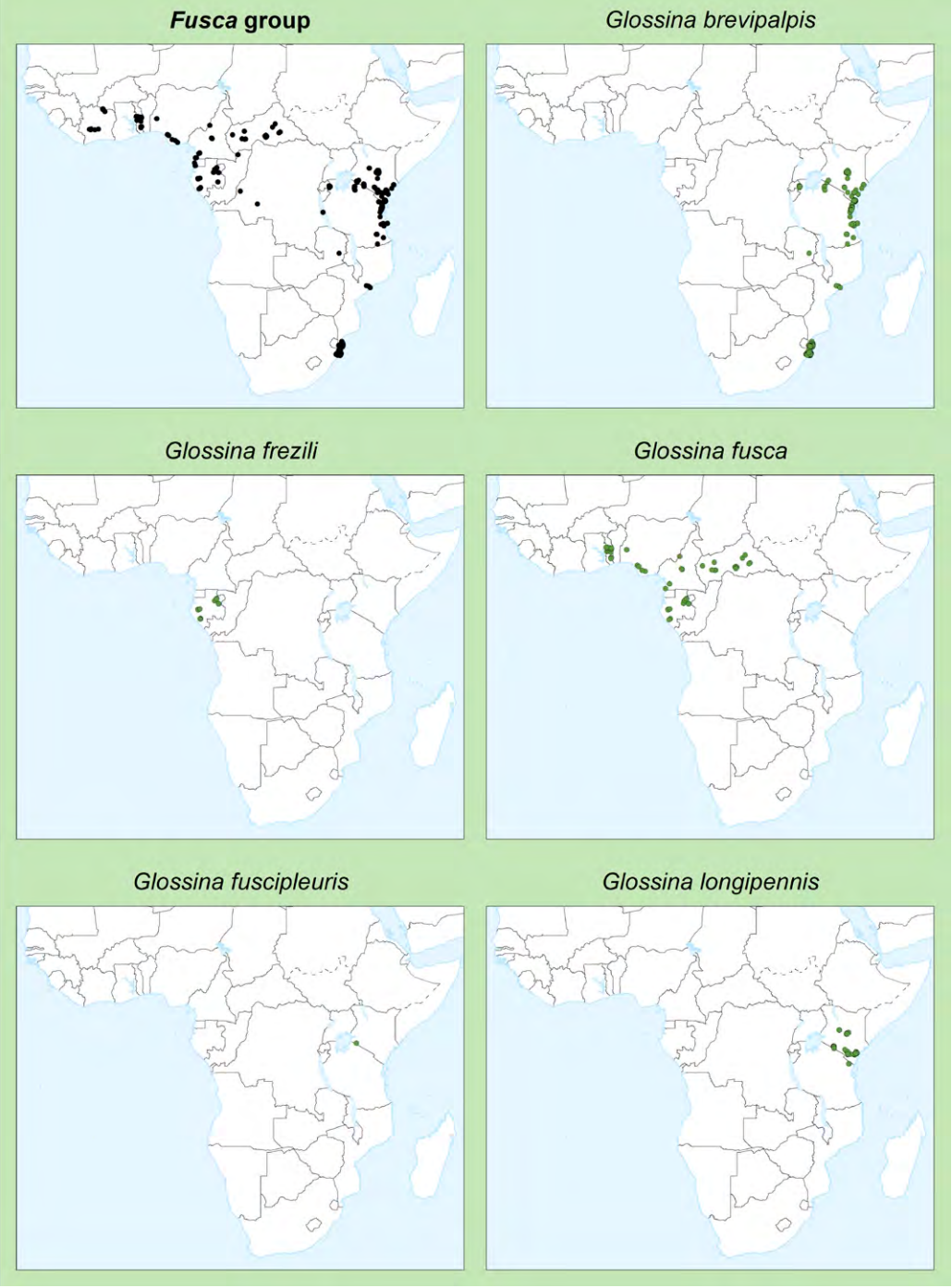
Forest (*fusca*) group (subgenus *Austenina*)	
G. brevipalpis	Newstead, 1910
G. frezili	Gouteux, 1987
G. fusca congolensis	Newstead and Evans, 1921
G. fusca fusca	Walker, 1849
G. fuscipleuris	Austen, 1911
G. haningtoni	Newstead and Evans, 1922
G. longipennis	Corti, 1895
G. medicorum	Austen, 1911
G. nashi	Potts, 1955
G. nigrofusca hopkinsi	van Emden, 1944
G. nigrofusca nigrofusca	Newstead, 1910
G. schwetzi	Newstead and Evans, 1921
G. severini	Newstead, 1913
G. tabaniformis	Westwood, 1850
G. vanhoofi	Henrad, 1952

FIGURE 29
Geographic distribution of the *fusca* group (subgenus *Austenina*) as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

FIGURE 30
Geographic distribution of the *Glossina* species of the *fusca* group reported in scientific papers – Part 1 (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

FIGURE 31
Geographic distribution of the *Glossina* species of the *fusca* group reported in scientific papers – Part 2 (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

TABLE 28
***Glossina* species of the *fusca* group reported in scientific papers (publication period: 1990–2020) by country**

Country	Tsetse species and subspecies (*fusca* group)																
	G. brevipalpis	*G. frezili*	*G. fusca*	*G. fusca congolensis*	*G. fusca fusca*	*G. fuscipleuris*	*G. haningtoni*	*G. longipennis*	*G. medicorum*	*G. nashi*	*G. nigrofusca*	*G. nigrofusca hopkinsi*	*G. nigrofusca nigrofusca*	*G. schwetzi*	*G. severini*	*G. tabaniformis*	*G. vanhoofi*
Angola							○			○				○		○	
Benin			○	○					○								
Burkina Faso									●								
Burundi	○																
Cameroon			●	●	●	○	○			○	●		●	○		●	
Central African Republic		○	●	●		○	○		○	○	○	○	○			●	
Congo		○	○	○			○		○	○				○		○	
Côte d'Ivoire			○		○				●		●		●			○	
Democratic Republic of the Congo	○	○	○	○		○	○		○	○	○	○	○	○	○	●	○
Equatorial Guinea			○	○			○									●	
Ethiopia	○							○									
Gabon		●	●	●			○		○	●				○		●	
Ghana			○	○	○				○		○		○			○	
Guinea			○		○				○		○		○			○	
Guinea-Bissau			○		○												
Kenya	●					●		●									
Liberia			○		○				○		○		○				
Malawi	○																
Mozambique	●																
Nigeria			●	●			○		○		●		●			○	
Rwanda	●																
Sierra Leone			○		○				○		○		○				
Somalia	○							○									
South Africa	●																
South Sudan			○	○		○		○									
Togo			●		●				●								
Uganda	○		○	○		○		○	○		○	○					
United Republic of Tanzania	●					○		●									
Zambia	●																
Zimbabwe	○																

● Species or subspecies reported in scientific papers (publication period: 1990–2020).

○ Species or subspecies reported or suggested in previous periods (<1990) or reviews, and which could, or are likely to, still be present.

Glossina brevipalpis

Glossina brevipalpis is distributed fairly widely in eastern and southern Africa, and its favoured habitat is waterside evergreen thicket and forest islands in savannah (FAO, 1982b). Figure 32 shows its geographic distribution as reported in scientific publications (1990–2020); the corresponding list of papers for the presence points is in Table 29.

We found reports of *G. brevipalpis* in four countries along the coast of the Indian Ocean, from South Africa (de Beer *et al.*, 2016) to Kenya (Ngari *et al.*, 2020), as well as in two landlocked countries, i.e. Rwanda (Mihok, Otieno and Tarimo, 1992) and Zambia (Dennis *et al.*, 2014). In both Kenya and the United Republic of Tanzania, *G. brevipalpis* is mainly reported from within 200 km of the coast, but also further inland, such as from the Serengeti-Mara ecosystem (Lord *et al.*, 2020) and central Kenya (Ngari *et al.*, 2020). The species is also reported from within 100 km of the coast in South Africa (KwaZulu-Natal Province) and Mozambique (Matutuíne District at the border with South Africa [Sigauque *et al.*, 2000], and Nicoadala District in the central province [Mulandane *et al.*, 2020]). However, while the available data provide a good coverage of the small area of occurrence of *G. brevipalpis* in South Africa, large gaps affect our knowledge of *G. brevipalpis* distribution in Mozambique. In South Africa's KwaZulu-Natal Province, *G. brevipalpis* is the most collected of two tsetse species, the other being *G. austeni*; in our database, and in line with previous estimates (de Beer *et al.*, 2016), *G. brevipalpis* accounts for 90 percent of the total catches from South Africa. In South Africa we also found the highest apparent densities of *G. brevipalpis*, with over 10 flies/trap/day reported from the Hluhluwe–iMfolozi Park (de Beer *et al.*, 2016). In Rwanda, *G. brevipalpis* was known to occur in the southeastern part of the country (Mihok, Otieno and Tarimo, 1992), although a recent survey focusing on part of its historical area of occurrence (i.e. the Akagera National Park) failed to detect it (Gashururu *et al.*, 2021). In Zambia, the species was reported from one site only: Luambe National Park in Eastern Province (Dennis *et al.*, 2014).

Historical reports also indicated fairly large areas of occurrence of *G. brevipalpis* in the eastern Democratic Republic of the Congo, and smaller ones in Burundi, Ethiopia, Malawi, Somalia, Uganda and Zimbabwe (Ford and Katondo, 1977b). However, very little data were collected in the eastern Democratic Republic of the Congo during our study period, and a similar dearth of information affects the small historical pockets of *G. brevipalpis* in Burundi, Ethiopia (Gebre *et al.*, 2022), Malawi, Somalia, Uganda and Zimbabwe (Shereni *et al.*, 2021).

FIGURE 32
Geographic distribution of *Glossina brevipalpis* as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

https://doi.org/10.4060/cd2022en-fig32

TABLE 29
Scientific papers used as sources to map the occurrence of *Glossina brevipalpis* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Kenya	17	362, 364, 369, 370, 375, 381, 382, 389, 390, 395–397, 399, 407, 409, 414, 429
Mozambique	3	177, 451, 453
Rwanda	1	500
South Africa	17	164, 177, 506–520
United Republic of Tanzania	16	569, 570, 572, 573, 575, 577, 579–582, 584–588, 593
Zambia	1	610
Total	**54**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina frezili

Glossina frezili was the latest species of tsetse fly to be identified. Morphologically, it is close to *G. medicorum*, and it was first described in the Congo, where it was collected in the mangroves at the estuary of the Kouilou-Niari river (Gouteux *et al.*, 1987; Gouteux, Sinda and de Foresta, 1991). Earlier findings of the species from a similar habitat in Gabon had been identified as *G. medicorum* (Maillot, 1956). In addition to the Congo and Gabon, the possible presence of *G. frezili* was also suggested in the Central African Republic and the Democratic Republic of the Congo (Moloo, 1993).

Figure 33 shows the distribution of *G. frezili* as reported in scientific publications for the period 1990–2020. The publications that provided the presence points are in Table 30. The species was only detected in four areas in Gabon. These areas include two national parks (i.e. Ivindo [Mbang Nguema *et al.*, 2016] and Moukalaba-Doudou [Dibakou *et al.*, 2015; Mounioko *et al.*, 2018]), and other forested or wetland areas (i.e. the Bas Ogooué wetland [Mbang Nguema *et al.*, 2019], the *baï* (swampy forest clearing) of Momba [Zinga Koumba *et al.*, 2013] and the Zadié Forest [Zinga Koumba *et al.*, 2016], the latter two respectively located to the east and the northeast of Ivindo National Park). In the studies we reviewed, apparent densities of up to 1.4 flies/trap/day were reported for *G. frezili* (Mounioko *et al.*, 2018); however, the species was normally detected at lower densities, with an average of 0.3 flies/trap/day in the 16 surveys where full information on the number of traps, days and flies was available. Also, when caught, *G. frezili* was always detected in association with several other tsetse species, and especially the much more abundant *G. fuscipes*.

No report on *G. frezili* from either Congo or the Democratic Republic of the Congo was found for our study period. However, it should be noted that, as shown in Figure 33, no survey was carried out in the coastal area of Congo where *G. frezili* was first described, an area that today falls within the wetland of international importance "Bas-Kouilou-Yombo".

FIGURE 33
Geographic distribution of *Glossina frezili* as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

https://doi.org/10.4060/cd2022en-fig33

TABLE 30
Scientific papers used as sources to map the occurrence of *Glossina frezili* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Gabon	8	307, 312, 314–317, 319, 320
Total	**8**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina fusca

The main habitat of *G. fusca* is the edge of the rainforest, but it can also be found well within the rainforest, as well as in riverine vegetation and isolated forest patches within the savannah (FAO, 1982b). The species was historically known to occur in a relatively broad and contiguous belt from Guinea-Bissau to Uganda, including a total of 17 countries (see Table 28). However, in the scientific literature from 1990–2020, we only found confirmation of *G. fusca* occurrence in five countries: Cameroon, the Central African Republic, Gabon, Nigeria and Togo (see Figure 34 and Table 31). In both Gabon and Togo, the species seems to be more widely distributed than suggested by historical records (Ford and Katondo, 1977b).

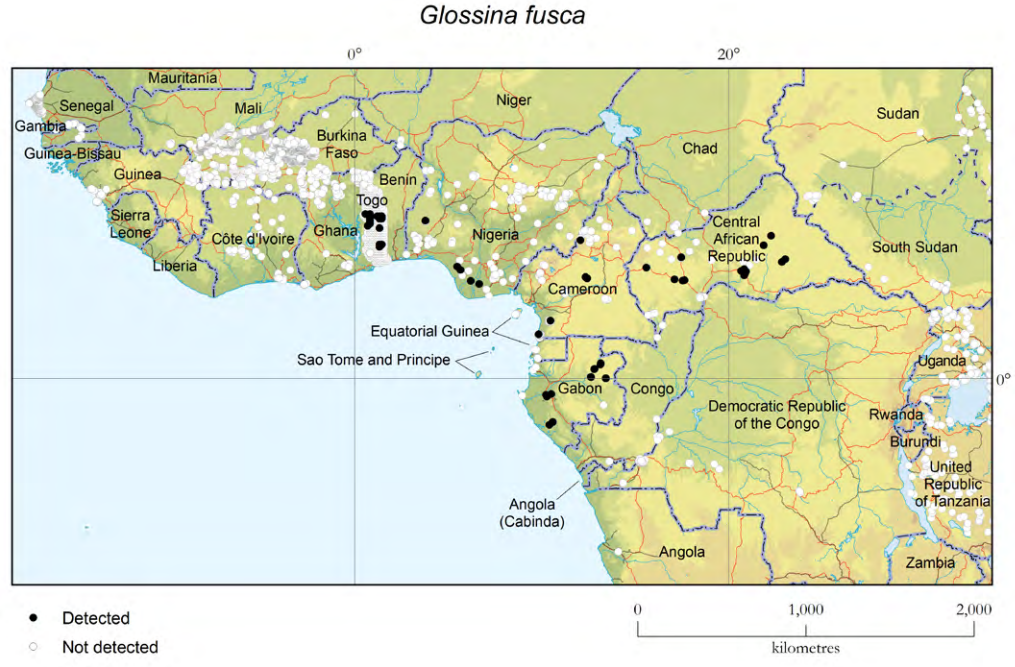
Large data gaps can be observed in western Africa from Guinea-Bissau to Ghana and in the north and east of the Democratic Republic of the Congo.

Two subspecies of *G. fusca* are recognized: *Glossina fusca congolensis* and *Glossina fusca fusca*. The subspecies differ morphologically, and can be distinguished by identification keys (Leak *et al.*, 2008). Regarding their geographical distribution, most authors concur in indicating that *G. fusca fusca* occurs in the western part of the species range, with *G. fusca congolensis* occupying the eastern part (Leak *et al.*, 2008; Moloo, 1993; Rogers and Robinson, 2004). However, the area of transition between the two subspecies, being generally placed between Ghana, Togo and Benin, appears less clearly identified. Furthermore, the occurrence of *G. fusca fusca* alongside *G. fusca congolensis* in Cameroon, already reported in the 1950s (Rageau and Adam, 1953) and recently confirmed (Grébaut *et al.*, 2004; Simo *et al.*, 2020), seems to have been overlooked at times.

In our review for the period 1990–2000, most publications (i.e. 20 out of 22) reported their findings on the detection of *G. fusca* at the subspecies level (i.e. *G. fusca congolensis* or *G. fusca fusca*), with only two studies reporting it at the species level (one from Nigeria [Omonona *et al.*, 2020] and one from Cameroon [Morlais *et al.*, 1998]). Based on the papers reporting *G. fusca congolensis* and *G. fusca fusca* at the subspecies level, separate maps are presented below. Because of the possible co-occurrence of the two subspecies in the same location, the two studies reporting *G. fusca* at the species level were not apportioned to a subspecies based on geography. As a result, they were only included in the species-level map (see Figure 34), but not in the subspecies-level ones (see Figure 35 and Figure 36).

When looking at the maps at the subspecies level, it should be noted again that authors and papers very rarely describe the methodology used for the subspecies determination, and it is likely that in some instances the subspecies of *G. fusca* may have been inferred from the geographical location rather than from morphological characterization.

FIGURE 34
Geographic distribution of *Glossina fusca* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

https://doi.org/10.4060/cd2022en-fig34

TABLE 31
Scientific papers used as sources to map the occurrence of *Glossina fusca* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Cameroon	4	74, 79, 89, 94
Central African Republic	6	104, 106, 110, 112, 115, 116
Gabon	10	306–308, 312–314, 317–320
Nigeria	2	483, 491
Togo	1	534
Total	**23**	

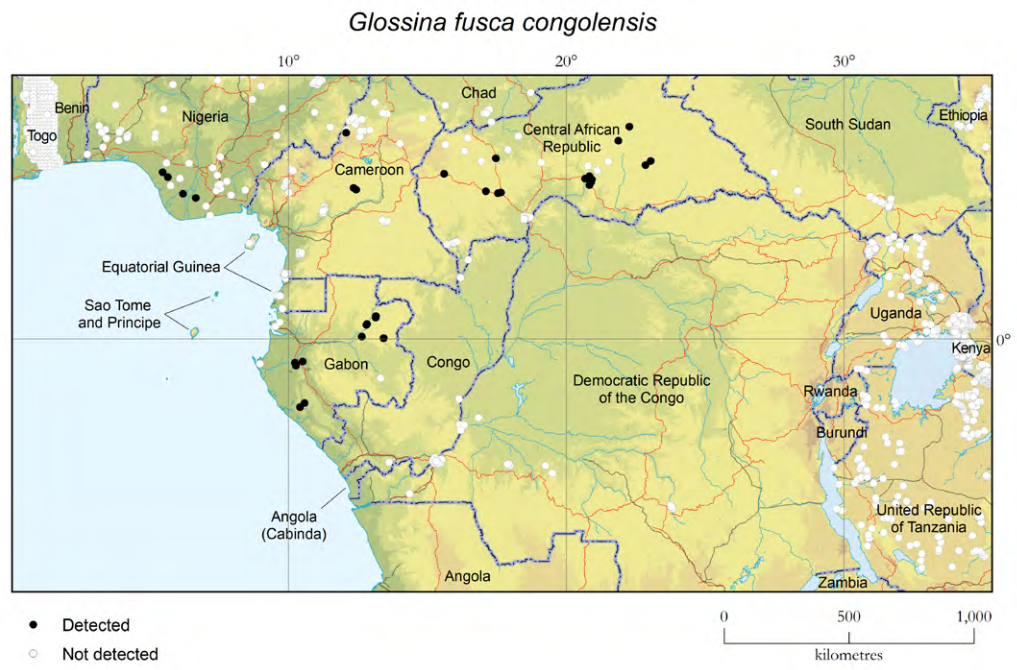
*The numbered list of scientific publications used as sources is in Annex 1.

Glossina fusca congolensis

The reported detections of *G. fusca congolensis* in 1990–2020 are shown in Figure 35, with papers providing the presence points in Table 32. With the exception of the major gap in the northern and eastern regions of the Democratic Republic of the Congo, Figure 35 is broadly in line with the known geographic distribution of the subspecies (Ford and Katondo, 1977b; Moloo, 1993). The main novelty in terms of reported occurrence seems to be the detection of *G. fusca congolensis* in northeastern Gabon; in particular, the subspecies was detected by several studies in and around the Ivindo National Park (Essono *et al.*, 2015; Mbang Nguema *et al.*, 2015; Mbang Nguema *et al.*, 2016; Zinga Koumba *et al.*, 2014; Zinga Koumba *et al.*, 2016). The subspecies was also detected in the Niger Delta Region of Nigeria, in Cameroon and in several prefectures of the Central African Republic.

Apparent densities of up to 4 flies/trap/day were reported for *G. fusca congolensis* in certain locations in the Central African Republic (Acapovi-Yao *et al.*, 2019) and Gabon (Mbang Nguema *et al.*, 2019). However, when detected, the subspecies is normally reported at lower densities; specifically, we calculated an average apparent density of 0.31 flies/trap/day from the 23 locations and surveys in our database that reported full information on the number of traps, days and *G. fusca congolensis* detected.

FIGURE 35
Geographic distribution of *Glossina fusca congolensis* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

TABLE 32
Scientific papers used as sources to map the occurrence of *Glossina fusca congolensis* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Cameroon	2	79, 94
Central African Republic	6	104, 106, 110, 112, 115, 116
Gabon	10	306–308, 312–314, 317–320
Nigeria	1	483
Total	**19**	

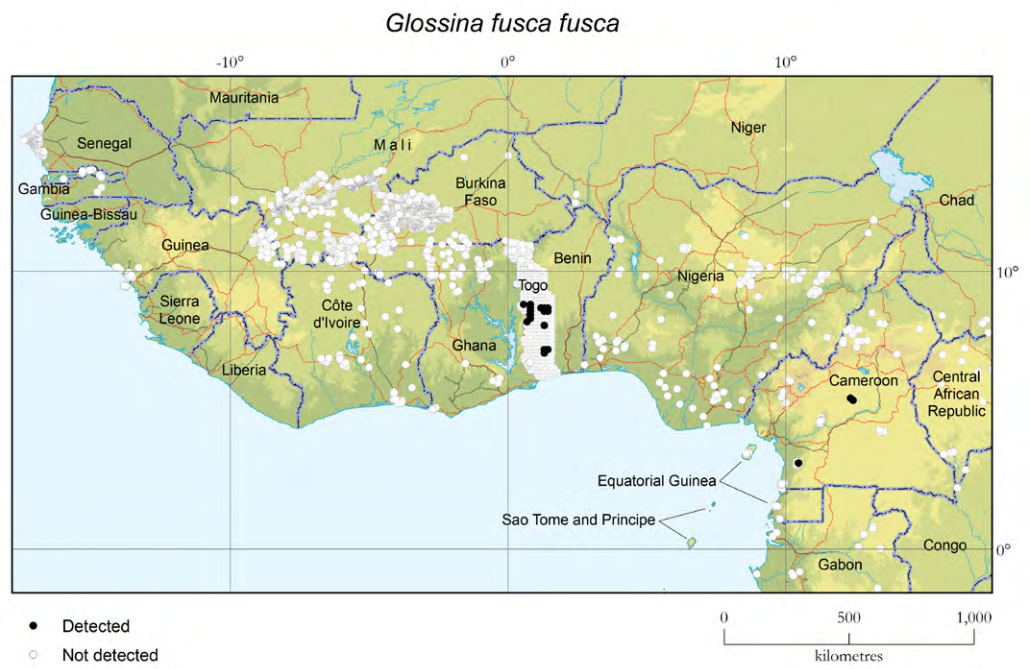
*The numbered list of scientific publications used as sources is in Annex 1.

Glossina fusca fusca

Figure 36 shows the distribution of *G. fusca fusca* as reported in scientific publications for the period 1990–2020, and the list of papers that provided the presence points is in Table 33.

From all the western African countries that are believed to host *G. fusca fusca*, the species was only reported from one study from the early 1990s in Togo (Hendrickx *et al.*, 1999). In central Africa, and more specifically in Cameroon, the capture of one *G. fusca fusca* in the HAT focus of Bipindi was reported (Grébaut *et al.*, 2004), thus confirming earlier reports (Rageau and Adam, 1953). Indeed, in the 1950s the occurrence of *G. fusca fusca* had been reported from several regions in Cameroon, including Yoko in the Centre Region, where the sympatric occurrence of *G. fusca fusca* and *G. fusca congolensis* was recently confirmed (Simo *et al.*, 2020).

FIGURE 36
Geographic distribution of *Glossina fusca fusca* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

TABLE 33
Scientific papers used as sources to map the occurrence of *Glossina fusca fusca* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Cameroon	2	74, 94
Togo	1	534
Total	**3**	

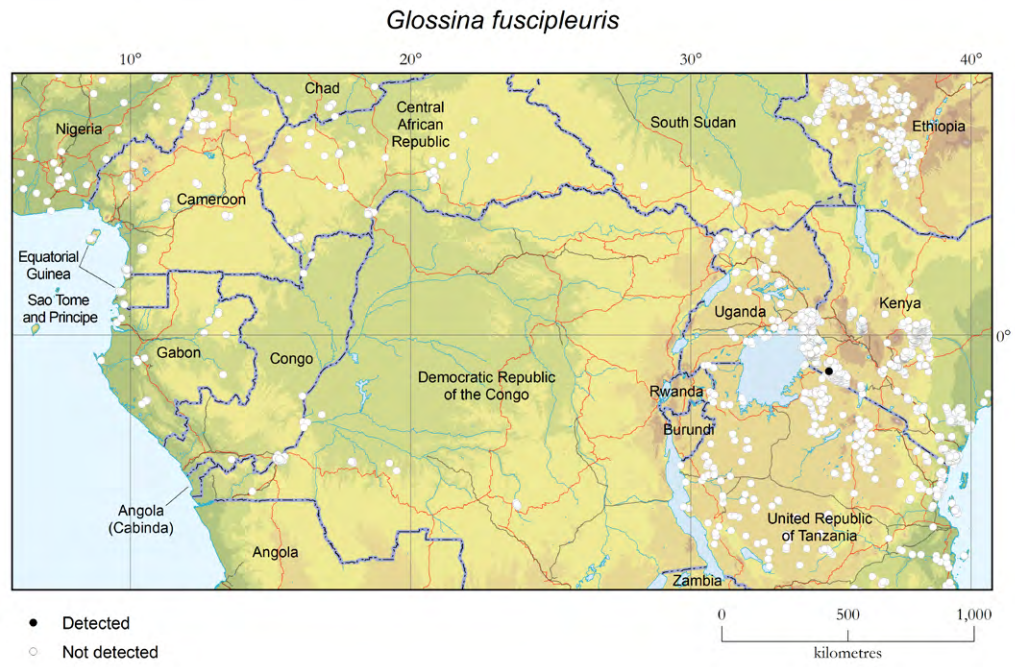
*The numbered list of scientific publications used as sources is in Annex 1.

Glossina fuscipleuris

Relatively little is known about *G. fuscipleuris*, but historical distribution records reported the species from fragmented belts in central Africa. Its preferred habitat is remnant forest patches surrounded by savannah, and particularly those located at the northern and eastern fringes of the Congo basin. Countries where *G. fuscipleuris* was historically recorded included Cameroon, the Central African Republic, the Democratic Republic of the Congo, Kenya, South Sudan, Uganda and the United Republic of Tanzania (see Table 28) (Ford and Katondo, 1977b; Moloo, 1993).

During our study period, only one scientific publication reported field captures of *G. fuscipleuris* (Griffith *et al.*, 2018) (see Table 34). The species was captured in 2013 in the Trans Mara Region of southwestern Kenya (see Figure 37), the only area where the species had been historically detected in the country (Ford and Katondo, 1977b; Lewis, 1939). No additional record of *G. fuscipleuris* emerged from recent and extensive surveys in other regions of Kenya (Ngari *et al.*, 2020).

FIGURE 37
Geographic distribution of *Glossina fuscipleuris* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

https://doi.org/10.4060/cd2022en-fig37

TABLE 34
Scientific papers used as sources to map the occurrence of *Glossina fuscipleuris* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Kenya	1	369
Total	**1**	

* The numbered list of scientific publications used as sources is in Annex 1.

Glossina longipennis

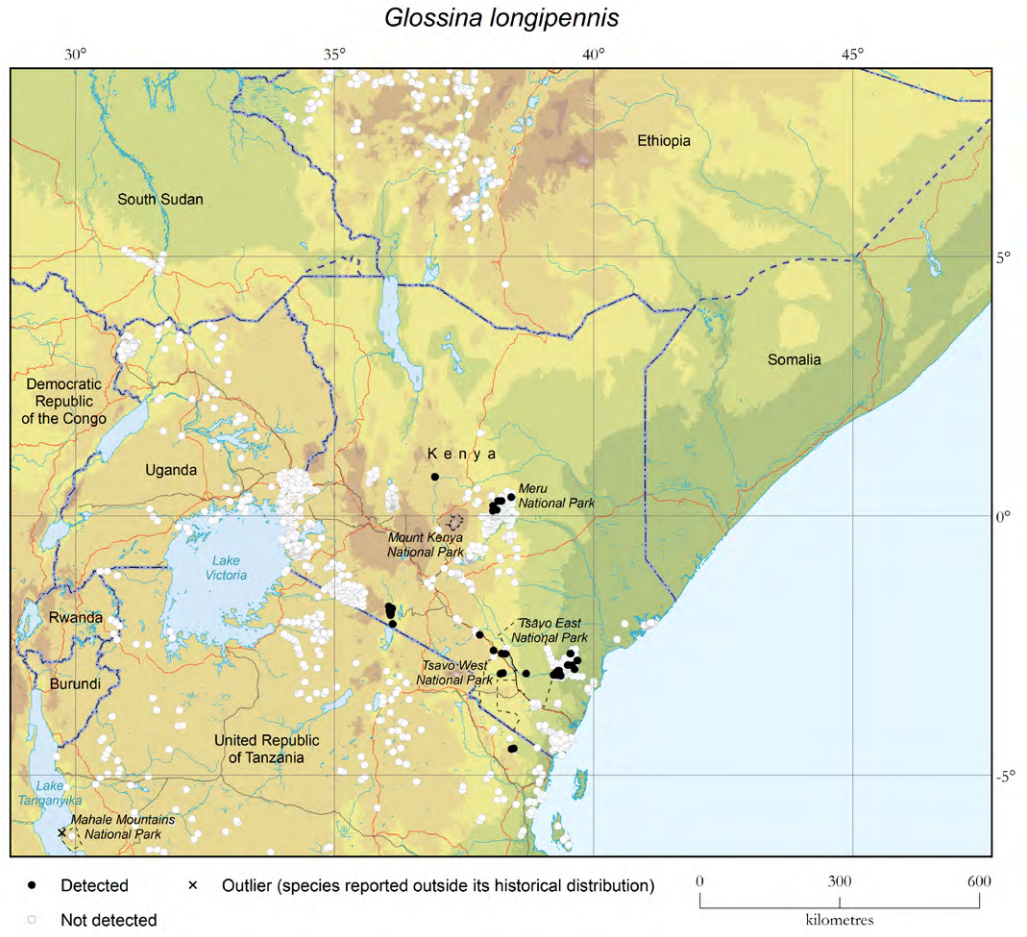
Glossina longipennis is peculiar among the species of the *fusca* group in that it inhabits very dry areas and even semi-deserts (FAO, 1982b). Its preferred habitat is dry thorn bush, but it can be found also in riverine thicket. Kenya is at the centre of its geographic distribution, although the species is also found in northern Tanzania and it was known to occur in relatively small pockets in Ethiopia, Somalia, South Sudan and Uganda (Ford and Katondo, 1977b).

In our review, we identified records of *G. longipennis* only from Kenya and the United Republic of Tanzania (see Figure 38 and Table 35). In particular, 19 different papers reported the occurrence of the species from four areas in Kenya: (1) the Nguruman Escarpment in the south/southwestern part of the country near the border with the United Republic of Tanzania; (2) the national parks of Tsavo East and Tsavo West, and their neighbouring areas in the southern part of Kenya; (3) the area of the Meru National Park in central Kenya (Ngari *et al.*, 2020), and (4) the Ewaso Ng'iro river valley northwest of Mount Kenya (Mihok, 2002). Apparent densities of more than ten and up to 30 flies/trap/day were reported from two studies in the 1990s in the Nguruman Escarpment (Mihok *et al.*, 1996) and the Galana Ranch in costal Kenya (Makumi, Stevenson and Green, 2000); however, more recent and extensive

surveys across the country estimated the overall apparent density of *G. longipennis* in Kenya at 0.03 flies/trap/day (Ngari *et al.*, 2020).

In the United Republic of Tanzania, *G. longipennis* was reported from two regions: Tanga, in the northeastern part of the country (Daffa *et al.*, 2013), and Kigoma, in the Mahale Mountains National Park on the shores of Lake Tanganyika (Sasaki and Nishida, 1999). However, the latter report is from an area that historically lay outside the distribution of *G. longipennis*, and it is therefore marked as an outlier in need of confirmation in Figure 38. Outside our study period, i.e. in 2022, the capture of one specimen of *G. longipennis* dating back to 2017 was published from Ethiopia, in the Gibe River basin (Gebre *et al.*, 2022).

FIGURE 38
Geographic distribution of *Glossina longipennis* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

https://doi.org/10.4060/cd2022en-fig38

TABLE 35
Scientific papers used as sources to map the occurrence of *Glossina longipennis* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Kenya	26	350, 351, 355, 360, 361, 363, 364, 370, 376, 382, 384–386, 389, 395–397, 399, 406, 409–412, 417, 420, 425
Tanzania	2	572, 599
Total	**28**	

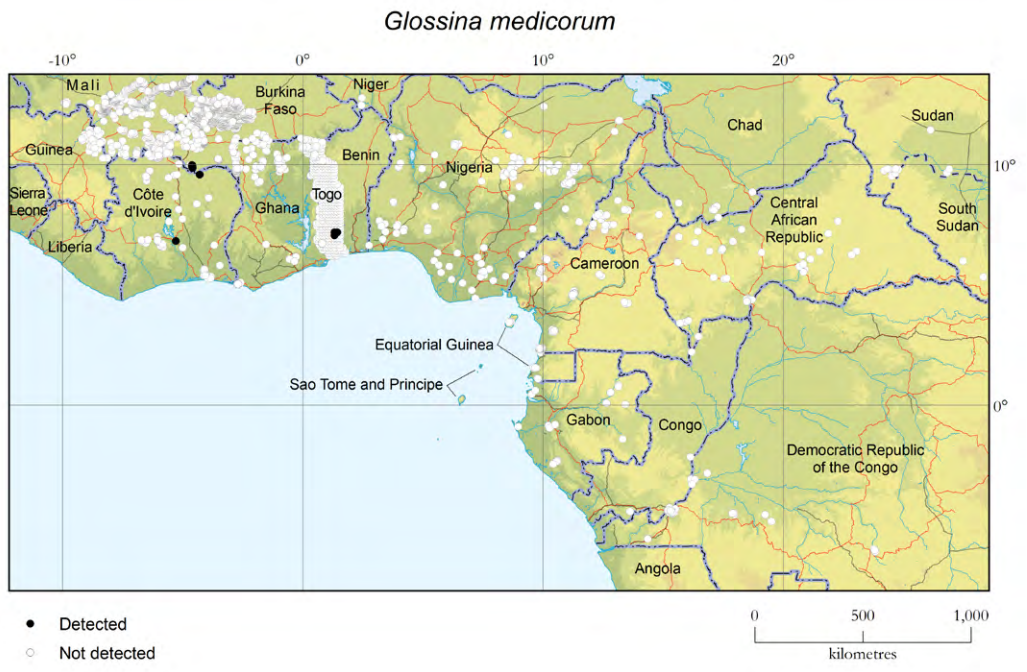
*The numbered list of scientific publications used as sources is in Annex 1.

Glossina medicorum

Glossina medicorum is a species of the *fusca* group that inhabits relatively dry forest, mosaic forest/savannah, forest islands and riverine vegetation (FAO, 1982b). Its main area of occurrence was known to be in western Africa, from Liberia to Nigeria (Ford and Katondo, 1977b), but the species was also reported or suggested from other countries, including the Central African Republic, the Congo, the Democratic Republic of the Congo, Gabon, Sierra Leone and Uganda (FAO, 1982a; Jordan and Okoth, 1990; Moloo, 1993).

In our review, we identified published records of *G. medicorum* from only three countries: Burkina Faso, Côte d'Ivoire and Togo (see Figure 39 and Table 36). In Burkina Faso, the species was found in several studies carried out in the southwestern part of the country near the border with Côte d'Ivoire, and more specifically in the classified forest and partial faunal reserve of Comoé-Léraba (Rayaisse *et al.*, 2009). In Côte d'Ivoire, the species was known to be broadly distributed (Ford and Katondo, 1977b), but we found records of its occurrence only in two areas, namely at the border with Burkina Faso, in connection with the already mentioned Comoé-Léraba reserve (Djohan *et al.*, 2015), and in the centre of the country, near the capital city Yamoussoukro (Solano *et al.*, 1995). In Togo, the only reports of *G. medicorum* in our review dated back to the early 1990s and they were from the southern part of the country (Tchiela Monata forest [Hendrickx *et al.*, 1999]), which is in line with historical reports (Ford and Katondo, 1977b). In the sites where *G. medicorum* was captured, apparent densities of up to 1.4 flies/trap/day were reported (Rayaisse *et al.*, 2009), with an average of 0.41 flies/trap/day from the four studies that allowed this metric to be estimated (Djohan *et al.*, 2015; Pagabeleguem *et al.*, 2012; Rayaisse *et al.*, 2009; Rayaisse *et al.*, 2015).

FIGURE 39
Geographic distribution of *Glossina medicorum* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

https://doi.org/10.4060/cd2022en-fig39

TABLE 36
Scientific papers used as sources to map the occurrence of *Glossina medicorum* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Burkina Faso	8	14, 30, 42, 44, 48, 49, 53, 59
Côte d'Ivoire	2	136, 153
Togo	1	534
Total	**11**	

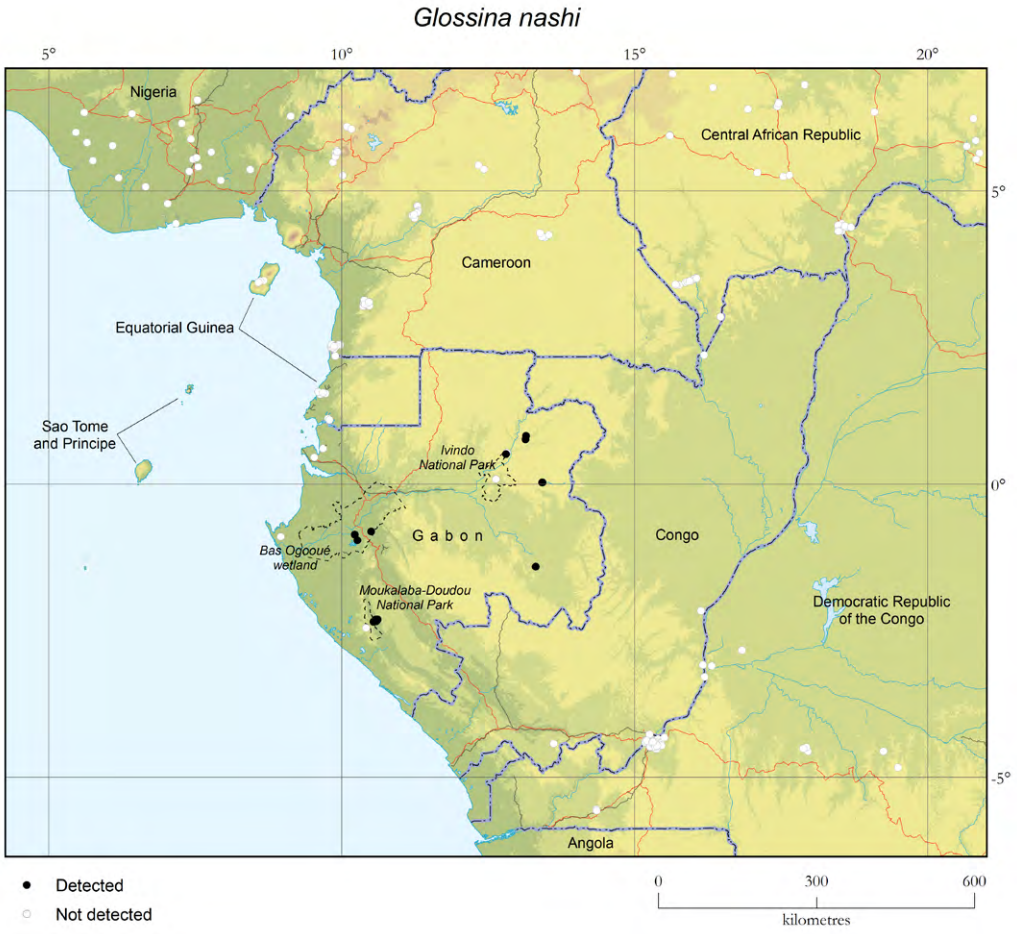
*The numbered list of scientific publications used as sources is in Annex 1.

Glossina nashi

Glossina nashi is a rare and little-known species of the *fusca* group that is believed to occur especially in dense rainforest and hilly country (FAO, 1982b). Historically, *G. nashi* was reported from a few countries in central Africa, namely Angola, Cameroon, the Central African Republic, Congo, and Gabon (FAO, 1982a; Ford and Katondo, 1977b; Moloo, 1993). Some authors also report it from the Democratic Republic of the Congo (Rogers and Robinson, 2004), while others do not (FAO, 1982a; Leak *et al.*, 2008; Moloo, 1993).

In our review, the species was confirmed only in one country, Gabon, where it was reported by several studies in different locations (see Figure 40 and Table 37). Most of these locations are linked to national parks or other protected areas, where *G. nashi* occurs in sympatry with several other tsetse species of the fusca and palpalis groups, in particular *G. fuscipes fuscipes* and *G. palpalis palpalis*. In the studies we reviewed, apparent densities of up to 2 flies/trap/day were reported for *G. nashi* from the *baï* of Momba (Zinga Koumba *et al.*, 2013), with an average of 0.56 flies/trap/day in the all sites of the country where it was detected.

FIGURE 40
Geographic distribution of *Glossina nashi* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

https://doi.org/10.4060/cd2022en-fig40

TABLE 37
Scientific papers used as sources to map the occurrence of *Glossina nashi* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Gabon	9	145, 307, 312, 314–317, 319, 320
Total	**9**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina nigrofusca

The main habitat of *G. nigrofusca* is believed to be the rainforest and its edges, including forest islands beyond the limits of the rainforest (FAO, 1982b). The species was historically reported in a narrow and fragmented belt from Sierra Leone to Uganda.

In our review, we found records of *G. nigrofusca* occurrence in three countries: Côte d'Ivoire, Cameroon and Nigeria (see Figure 41 and Table 38). Most of the studies reporting this species are from Cameroon (11), but they all originate from two locations that are well known as foci of sleeping sickness: Campo, at the border with Equatorial Guinea, and Bipindi, also located in the southwestern part of the country (Simarro *et al.*, 2010). In these areas, G. *nigrofusca* was detected together with several other tsetse species, and in particular with the much more abundant *G. palpalis palpalis*. In the studies we reviewed for Cameroon, the apparent density of *G. nigrofusca* never exceeded 0.03 flies/trap/day (Grébaut *et al.*, 2016), and in the locations where it was captured, *G. nigrofusca* represented only 3 percent of the total tsetse catches, with *G. palpalis palpalis* accounting for approximately 84 percent.

In both Côte d'Ivoire and Nigeria, reports of *G. nigrofusca* date back to the 1990s, and they only concern two areas, namely the Sassandra-Marahoué District in central Côte d'Ivoire (Fournet, Traoré and Hervouët, 1999; Masiga *et al.*, 1996), and the Niger Delta Region (Rivers State) in southern Nigeria (Ogedegbe and Rotimi, 2006).

Two subspecies of *G. nigrofusca* are recognized, *Glossina nigrofusca nigrofusca* and *G. nigrofusca hopkinsi*, and they are generally believed to be geographically separated. The former is reported in the western part of the species distribution, from Sierra Leone to the Central African Republic and western Democratic Republic of the Congo, while the latter is found in the eastern part of the species distribution, in eastern Democratic Republic of the Congo and Uganda (Leak *et al.*, 2008; Rogers

FIGURE 41
Geographic distribution of *Glossina nigrofusca* as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

https://doi.org/10.4060/cd2022en-fig41

and Robinson, 2004). However, one author appears to have placed the separation between the subspecies further to the west, and he indicated that the subspecies occurring in the Central African Republic and the only subspecies in the Democratic Republic of the Congo would be *G. nigrofusca hopkinsi* (Moloo, 1993). This discrepancy did not pose a challenge to the present version of the continental atlas, as no *G. nigrofusca* was reported from that region.

TABLE 38
Scientific papers used as sources to map the occurrence of *Glossina nigrofusca* (publication period: 1990–2020)

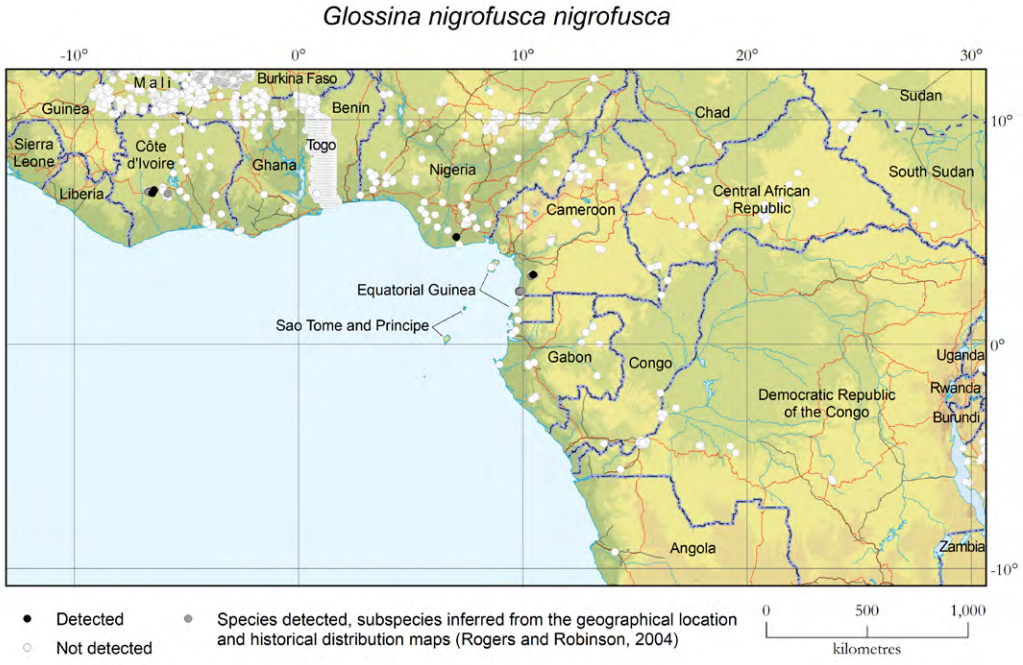
Country	Papers (No.)	Papers (list*)
Cameroon	11	69, 70, 72–74, 85, 91, 97, 99, 102, 103
Côte d'Ivoire	4	134, 139, 146, 147
Nigeria	1	483
Total	**16**	

*The numbered list of scientific publications used as sources is in Annex 1.

Glossina nigrofusca nigrofusca

Four studies explicitly reported *G. nigrofusca nigrofusca* as a subspecies, while 12 reported it as G. nigrofusca (Figure 42). In the latter cases, *G. nigrofusca nigrofusca* was assumed because of the geographical location of the reports (i.e. Côte d'Ivoire and Cameroon) and the historical reported occurrence of the subspecies in these countries (Leak *et al.*, 2008; Moloo, 1993; Rogers and Robinson, 2004). Figure 42 distinguishes reports at the subspecies level (in black) from those at the species level (in grey). The source papers for the presence points in Figure 42 are the same as for the species-level map in Figure 41 (see Table 38).

FIGURE 42
Geographic distribution of *Glossina nigrofusca nigrofusca* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

Glossina nigrofusca hopkinsi

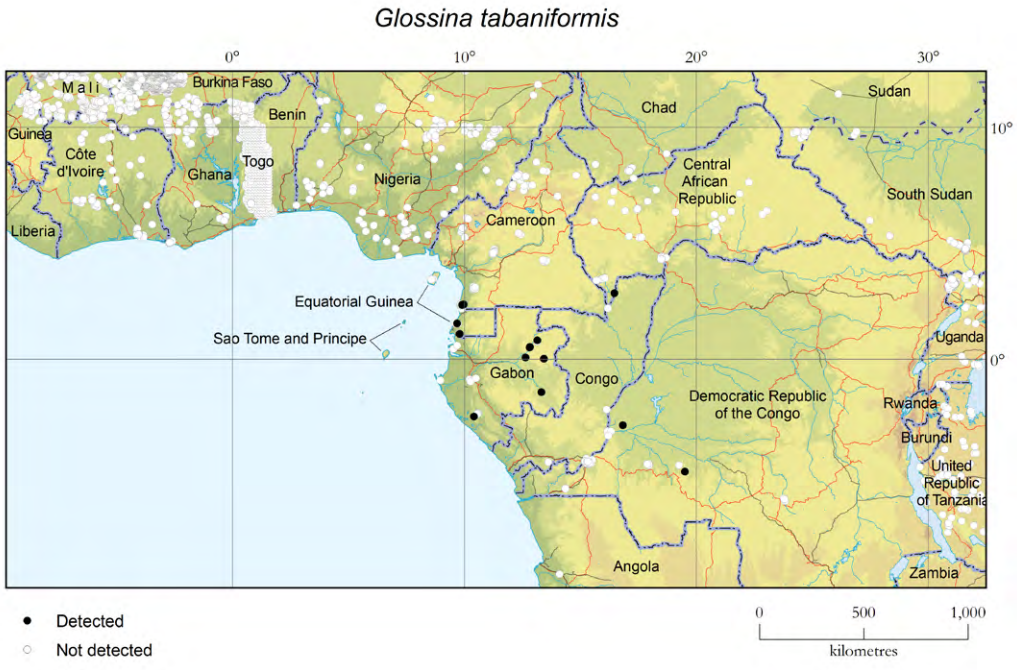
Glossina nigrofusca hopkinsi was known to occur in two countries (i.e. the Democratic Republic of the Congo and Uganda) (Leak *et al.*, 2008; Rogers and Robinson, 2004), and possibly in the Central African Republic (Moloo, 1993). However, in our review, we did not find any report of this subspecies, nor any report of *G. nigrofusca* from the areas that were known or that may have been inhabited by this subspecies.

Glossina tabaniformis

Glossina tabaniformis is considered mainly a rainforest species, but it is also found in drier forests. It is historically known to occur mainly in central Africa, but with pockets extending also to western Africa as far as Liberia (FAO, 1982b). As is the case for some other species of the *fusca* group, there is indication that the distribution of *G. tabaniformis* may be shrinking because of factors such as the reduction of wild hosts (Gouteux *et al.*, 1991) and forest habitat.

In our study, we found reports of *G. tabaniformis* from five countries in central Africa: Cameroon, the Central African Republic, the Democratic Republic of the Congo, Equatorial Guinea and Gabon (see Figure 43 and Table 39). In addition, historical records indicate that the species was also present in Angola, the Congo and Nigeria (Ford and Katondo, 1977b; Moloo, 1993), and that it was or could still be present also in Côte d'Ivoire, Ghana and Guinea (Moloo, 1993). When detected, *G. tabaniformis* is normally reported in low numbers, with a maximum apparent density of 0.2 flies/trap/day recorded in the Ivindo National Park in Gabon (Zinga Koumba *et al.*, 2016).

FIGURE 43
Geographic distribution of *Glossina tabaniformis* as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

https://doi.org/10.4060/cd2022en-fig43

TABLE 39
Scientific papers used as sources to map the occurrence of *Glossina tabaniformis* (publication period: 1990–2020)

Country	Papers (No.)	Papers (list*)
Cameroon	3	73, 78, 97
Central African Republic	1	118
Democratic Republic of the Congo	1	145
Equatorial Guinea	2	172, 173
Gabon	7	145, 306, 308, 314, 317, 318, 320
Total	**13**	

*The numbered list of scientific publications used as sources is in Annex 1.

Other species of the *fusca* group

In addition to the subspecies *G. nigrofusca hopkinsi* previously described, our review could find no report of four other species of the *fusca* group: *G. haningtoni*, *G. severini*, *G. schwetzi* and *G. vanhoofi*. For the sake of completeness, we provide here below a short description of their historical areas of reported occurrence.

Glossina haningtoni

Although little is known of this species, *G. haningtoni* is believed to be more restricted to rainforest than some other species of the *fusca* group. The species was historically reported from a relatively large and contiguous belt along the Atlantic coast of central Africa, centred in Gabon. Overall, eight countries were historically reported to host *G. haningtoni*: Angola, Cameroon, the Central African Republic, the Congo, the Democratic Republic of the Congo, Equatorial Guinea, Gabon and Nigeria (FAO, 1982a; Ford and Katondo, 1977b; Moloo, 1993).

The absence of any detection in Gabon over our study period is noteworthy, because the country was historically reported to be fully within the area of distribution of *G. haningtoni*. However, we reviewed 18 publications from Gabon for 1990–2020, which included an overall trapping effort of more than 10 000 trap days in 38 distinct locations and, while nine different tsetse species were detected, no *G. haningtoni* was reported.

Glossina schwetzi

Another little-known species of the *fusca* group, *G. schwetzi* appears to be associated with relic forests and forest islands (FAO, 1982a). Its historical area of occurrence is along the coast of the Atlantic Ocean, including areas in Angola, the Congo, the Democratic Republic of the Congo and Gabon (FAO, 1982a; Ford and Katondo, 1977b). In his 1993 review, Moloo also included it in the species present in Cameroon (Moloo, 1993). In some areas, e.g. Bouenza in the Congo, the species has been reported to be progressively disappearing, and the latest report of G. schwetzi in the Congo would date back to 1971 (Gouteux *et al.*, 1991).
During our study period, few entomological surveys were conducted in the historical areas of occurrence of *G. schwetzi*. However, the few that were conducted in such zones in Angola (Gomes *et al.*, 2009; Truc *et al.*, 2011), the Democratic Republic of the Congo (Simo *et al.*, 2012) and the Congo (Laveissière *et al.*, 1998) (Artzrouni and Gouteux, 2003) failed to detect *G. schwetzi* and they only captured *G. palpalis palpalis.*

Glossina severini

Little is also known about this species, which is believed to favour forest-edge vegetation rather than rainforest (FAO, 1982a). *G. severini* was historically reported from small areas around the mountains of the eastern Democratic Republic of Congo, near the borders with Uganda and Rwanda (FAO, 1982a; Ford and Katondo, 1977b). From these areas *G. fusca*, *G. nigrofusca*, *G. fuscipleuris*, *G. vanhoofi* and *G. tabaniformis* were also reported (Ford, 1963). However, during the period covered

by this atlas, no survey in the historical area of occurrence of *G. severini* was published (Figure 3).

Glossina vanhoofi

Glossina vanhoofi is believed to favour dense forest (FAO, 1982a), and it was reported only from the Democratic Republic of the Congo. More specifically, the species is believed to occur in the northern and eastern parts of the country, from the boundary with the Central African Republic to the Kivu area (FAO, 1982a; Leak *et al.*, 2008). Other authors report a more limited distribution in the eastern part of the Democratic Republic of the Congo (Ford and Katondo, 1977b; Rogers and Robinson, 2004). As is the case for *G. severini*, no entomological survey was conducted in the areas of occurrence of *G. vanhoofi* during the period covered by this continental atlas (see Figure 3).

Chapter 4
Discussion

MAJOR STRENGTHS OF THE ATLAS

Currency

After more than 40 years, that is, after the publication of the Ford and Katondo maps by the Organization of African Unity Scientific and Technical Research Commission (Ford and Katondo, 1977b), the FAO continental atlas of tsetse flies is the first systematic attempt to map the distribution of *Glossina* species in Africa. By covering the 31-year period 1990–2020, the atlas represents a major update as compared to previous continental mapping endeavours, especially when considering that the Ford and Katondo maps, although published in 1977 and dated 1973, were based in many areas on much older records (Ford and Katondo, 1977a). In the light of the major land cover and land-use changes that have occurred in Africa over the past decades, and considering the sensitivity of many tsetse species to habitat modifications, a new appraisal of the reported occurrence of *Glossina* species was long overdue.

Sources

The high number of scientific publications that were used as sources for this publication (i.e. 669) represents another important feature of the atlas. To maximize this number, an inclusive approach was adopted, which also took into consideration peripheral journals that may not be indexed in the leading online databases of scholarly articles. These articles were identified either via more inclusive indexes, and most notably Google Scholar, or via the references cited in the other articles we reviewed. Peripheral journals are increasingly used by many researchers, including African ones, who may find it difficult to publish the results of their studies in higher-profile outlets. Although articles published in these journals may have been subject to a less stringent peer review, we judged that they still added value to the atlas by enabling us to tap into a broader source base. Furthermore, the link that exists in the atlas between sources and mapped data enables future verifications and reappraisals, should they be needed. The broad source base allowed entomological data on tsetse occurrence to be mapped in more than 6 800 distinct locations across Africa. Although the geographical distribution of these locations is uneven, it still allows a broad-brush delineation of the areas of occurrence of the main tsetse species, and especially of those of veterinary and medical importance.

The atlas as a geospatial database

Another major improvement of the atlas as compared to previous tsetse maps for Africa is that it benefits from the recent and very wide adoption of technologies such as the Global Positioning System (GPS), GIS and database management systems. Thanks to these technologies, today it is possible to develop an atlas that, rather than being just a collection of maps, is a database of georeferenced information lending itself to a variety of applications and analyses. The maps presented in this publication are only examples of the outputs that can be generated from the atlas, and each dot on the maps is linked to a string of information items recorded in the database. Crucially, each mapped location is linked to its source publication, thus allowing better informed interpretations and, if needed, future verifications. This is unlike previous continental tsetse maps, for which sources were provided (Ford and Katondo, 1977a), but in which the link between sources and specific details on the maps could not be readily established.

"Absence" points

An important feature of the atlas is that negative results, that is the absence of detection of tsetse flies in a survey, are included alongside positive results. A shorthand for these negative results can be absence points, although it is always worth stressing that the absence of detection in one or more surveys

does not necessarily imply the absence of flies. The inclusion of these negative results in the database and in the maps allows better to distinguish (a) the areas where, despite sampling, a given tsetse species was not found, from (b) the areas where no investigation was carried out (or, more accurately, where no survey was published in scientific journals). Such a distinction can be very relevant in planning future surveys, which may or may not wish to target areas where no previous data are available. Negative results can also be used to estimate through statistical and mathematical methods the probability of a given species being absent or eliminated from an area (Barclay and Hargrove, 2005); this kind of information and analysis can be very relevant both in the context of the progressive control of AAT (Diall *et al.*, 2017) and the elimination of HAT (FAO and WHO, 2022).

Mapping accuracy

Assessing spatial accuracy is an important aspect of any mapping exercise, as it defines up to what scale the data can be meaningfully used, either for purely cartographic purposes or for epidemiological studies. In our atlas, the mapping accuracy of each point was estimated and recorded. Specifically, we recorded the surface area of the survey whenever it was reported by the authors or possible to estimate in an exact manner. However, in most cases, this piece of information was not available in the source articles, nor was it possible for us to estimate it exactly; in these cases, we resorted to an approximate quantification of the surveyed area based on the narrative information available in the paper. Furthermore, in addition to estimating the surface study area, we had to estimate the approximate geographic coordinates of the central point of the study area, which is the point where the results of the surveys are mapped. These two levels of approximation (i.e. surface area and central point) are combined into a single estimation of the accuracy for each mapped location, according to pre-defined categories of accuracy (see "Geographical data" in Chapter 2).

Table 40 summarizes the accuracy of the locations mapped in the atlas by category of accuracy. We note that almost 90 percent of the locations correspond to areas of less than 100 km^2, which in turn roughly corresponds to a linear error or uncertainty of approximately 5 km. Overall, we estimate that the mean linear error is approximately 10 km for the whole tsetse database. We also note that only four locations correspond to areas of more than 100 000 km^2, which correspond to a linear error of approximately 300 km; we considered the mapping accuracy of these four locations as too low to be included in the maps presented in this publication, but we included them in the atlas database to support possible future data analyses. Table 41 provides the number of locations included in the atlas by category of mapping accuracy and by country.

TABLE 40
Number of locations included in the atlas by category of mapping accuracy

Category of mapping accuracy		Mapped locations
Code	**Definition**	**(No.)**
1	≤ 10 km^2	2 294
2	> 10 km^2 and ≤ 25 km^2	2 900
3	> 25 km^2 and ≤ 100 km^2	1 348
4	> 100 km^2 and ≤ 500 km^2	539
5	> 500 km^2 and ≤ 1 000 km^2	92
6	> 1 000 km^2 and ≤ 5 000 km^2	145
7	> 5 000 km^2 and ≤ 10 000 km^2	33
8	> 10 000 km^2 and ≤ 50 000 km^2	26
9	> 50 000 km^2 and ≤ 100 000 km^2	5
10	> 100 000 km^2	4

TABLE 41
Number of locations included in the atlas by category of mapping accuracy and by country

Country	Mapped locations (No.)										
	Category of mapping accuracy (Code*)										
	1	2	3	4	5	6	7	8	9	10	TOT
Angola	3	1	2	1	0	0	0	0	0	0	**7**
Benin	3	0	0	0	0	0	0	0	0	0	**3**
Botswana	44	0	2	0	0	0	1	0	0	0	**47**
Burkina Faso	108	830	31	4	4	10	0	0	0	0	**987**
Cameroon	83	19	19	16	7	3	1	0	0	0	**148**
Central African Republic	26	5	30	7	2	12	2	1	0	1	**86**
Chad	4	0	2	0	0	1	0	0	0	0	**7**
Congo	7	4	3	0	0	0	0	0	0	0	**14**
Côte d'Ivoire	22	17	18	14	6	11	0	0	0	0	**88**
Democratic Republic of the Congo	60	10	7	2	0	4	0	0	0	0	**83**
Equatorial Guinea	12	1	1	2	3	1	1	0	0	0	**21**
Eswatini	18	0	37	0	0	0	0	0	0	0	**55**
Ethiopia	59	58	124	84	28	27	1	2	2	0	**385**
Gabon	17	8	0	2	0	6	4	0	0	1	**38**
Gambia	10	1	3	3	0	1	0	0	0	0	**18**
Ghana	139	2	61	3	1	1	0	0	0	0	**207**
Guinea	130	4	1	2	0	1	8	1	0	0	**147**
Kenya	150	25	661	39	7	7	5	2	0	1	**897**
Malawi	54	0	1	0	2	3	0	0	0	0	**60**
Mali	97	612	12	2	3	1	0	0	0	0	**727**
Mozambique	3	1	9	7	0	2	0	2	0	0	**24**
Namibia	1	1	0	0	0	0	0	0	0	0	**2**
Niger	0	0	0	0	1	1	0	0	0	0	**2**
Nigeria	49	20	20	17	7	15	0	2	3	0	**133**
Rwanda	0	3	1	0	0	0	0	0	0	0	**4**
Senegal	162	0	10	0	1	1	0	0	0	0	**174**
South Africa	187	26	11	2	1	2	0	0	0	0	**229**
South Sudan	23	6	0	1	0	0	1	3	0	0	**34**
Sudan	13	0	48	0	0	0	0	0	0	0	**61**
Togo	2	1	114	283	0	0	0	0	0	0	**400**
Uganda	436	865	63	7	4	15	2	1	0	0	**1 393**
United Republic of Tanzania	187	113	51	23	6	8	5	12	0	1	**406**
Zambia	17	5	3	14	5	4	2	0	0	0	**50**
Zimbabwe	168	262	3	4	4	8	0	0	0	0	**449**
Total	2 294	2 900	1 348	539	92	145	33	26	5	4	**7 386**

*The definitions for the categories of mapping accuracy are given in Table 40.

MAJOR WEAKNESSES OF THE ATLAS

Notwithstanding the strengths previously outlined, the atlas is also affected by many limitations. A thorough appreciation of these weaknesses is crucial to interpret the maps correctly, to use the atlas properly and to guide future improvements.

Sources

By focusing only on papers published in scientific journals, we did not consider other types of publications that otherwise, based on the other criteria for inclusion, would have been eligible. First among these publications are the proceedings of conferences or meetings, but also other possible soft publications such as theses, dissertations and reports. The choice to focus on scientific articles was driven mainly by the need to keep the workload for data extraction within the limits of the available human and financial resources. However, issues of quality, reliability and accessibility were also taken into consideration, as all these attributes are normally considered higher in scientific journals than in other types of publications.

Furthermore, beyond publications lays the often vast amount of unpublished data that exist in many countries. These data can be the product of regular or ad hoc surveillance activities, or they may derive from research activities that did not result in a publication. Unpublished data were not considered for the development of the continental atlas, both for reasons of data ownership (i.e. there is no obligation for enzootic countries to transmit these data to FAO) and for the aforementioned workload challenges inherent in directly managing very large datasets.

Some of the limitations of the FAO continental atlas in terms of data sources could be addressed in future editions or updates of the atlas. For example, in relation to the possible inclusion of conference proceedings or other soft publications, it is believed that the proceedings of the general conferences of the International Scientific Council for Trypanosomiasis Research and Control could be a valuable source of information.

Limitations in the sources used by FAO for the continental atlas are also being addressed in separate but related initiatives at the country level. National atlases are being developed that have the ambition to include all data on animal trypanosomosis and tsetse collected in the respective countries. Some countries such as Sudan (Ahmed *et al.*, 2016), Mali (Diarra *et al.*, 2019) and most notably Burkina Faso (Percoma *et al.*, 2022) have already developed atlases that include both published and unpublished data. Conversely, other countries such as Kenya (Ngari *et al.*, 2020), Zimbabwe (Shereni *et al.*, 2021) and Ethiopia (Gebre *et al.*, 2022) have initially focused on the unpublished data collected for surveillance purposes by national veterinary authorities, and they have postponed the inclusion of published data to a second stage or a second edition of their atlases (Boulangé *et al.*, 2022).

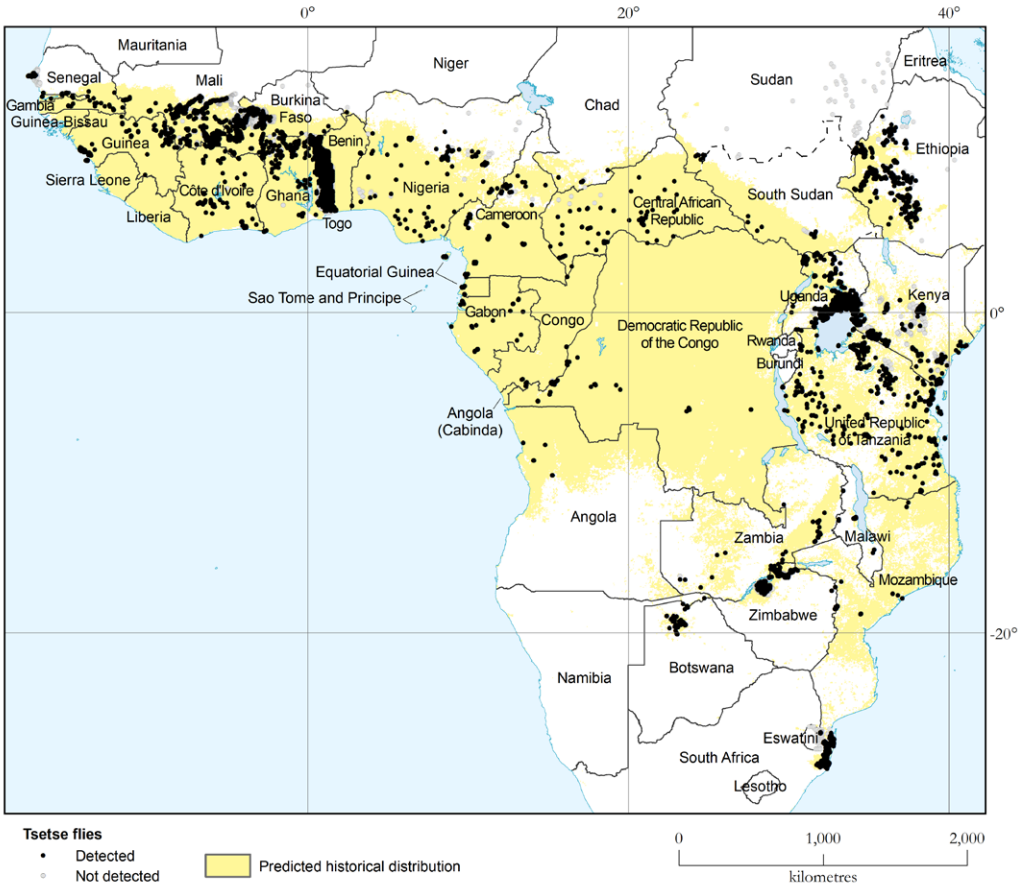
Spatial gaps

Because of our choice to focus only on scientific publications, but also for a genuine lack of field data in several areas and countries, the continental atlas is affected by many geographical gaps. We discuss here the main ones, but readers can better appreciate all the existing gaps by examining the various continental and national maps in this publication.

Figure 44 shows the reported occurrence of tsetse flies from the continental atlas overlaid onto the predicted historical distribution of tsetse flies (Wint and Rogers, 2000). We observe that the main geographical gaps in the atlas are arguably those in the Democratic Republic of the Congo, a country that, despite its vast territory at the heart of the African tsetse belt, has been the target of relatively few published entomological investigations (20 papers). The dearth of information on the Democratic Republic of the Congo greatly limited our ability to generate more complete maps for a few species of the *palpalis* group (e.g. *G. fuscipes* and *G. pallicera*), as well as for several species of the *fusca* group. For example, both *G. severini* and *G. vanhoofi* were historically reported only in the Democratic Republic of the Congo, and no study was carried out over our study period in what was believed to be their area of occurrence.

Large geographical gaps can also be observed in some neighbouring countries of the Democratic Republic of the Congo, such as the Congo, South Sudan and Angola, but also in other countries such as Mozambique and Benin. To fill these gaps,

FIGURE 44
Geographic distribution of tsetse flies as reported in scientific papers (publication period: 1990–2020) and the predicted historical distribution of tsetse flies



Source: Wint and Rogers (2000) and authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

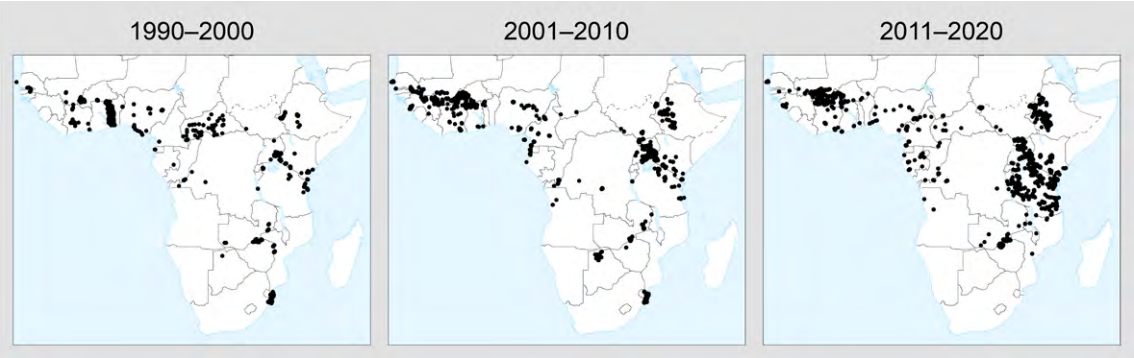
Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

we should add the complete lack of published information in countries such as Liberia, Sierra Leone and Guinea-Bissau, which are known to be well within the area of tsetse infestation, and Burundi and Somalia, whose current levels of infestation are presently difficult to assess.

Temporal gaps

When appraising the atlas's outputs, its shortcomings in terms of temporal coverage should also be considered. This is because the 31-year study period 1990–2020, while long, is nonetheless limiting, especially when it comes to mapping very rare and poorly studied tsetse species. This was well understood by the authors of previous continental maps, who relied on records that were often many decades old to shed light on the most elusive and less known species (Ford and Katondo, 1977a). Also, the synoptic presentation in our maps of 31-years' worth of data should not mislead into believing that these maps represent the current situation; in fact, not only did we not yet include publications from 2021 onwards, but in some areas the most recent data may date back ten or 20, and indeed up to 30 years ago. Considering the profound ecological changes that have been observed on the African continent over this period, it should come as no surprise that the current tsetse distribution may be, in places, significantly different from the one depicted in these maps. Naturally, the atlas database

FIGURE 45
Reported occurrence of tsetse flies from scientific papers in 1990–2000, 2001–2010 and 2011–2020



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

does allow generation of maps focusing on shorter or more recent periods; however, the resulting gain in the currency or temporal resolution of the outputs is partly offset by the more limited number of studies available; this is the main reason why, for the present publication, we chose to focus on synoptic maps for the entire study period.

For the sake of illustration, Figure 45 provides three temporal snapshots from the atlas: 1990–2000, 2001–2010 and 2011–2020. We note that the differences between these three maps are much more closely linked to differences in the coverage of the surveys than to real changes in tsetse distribution.

It is also worth reiterating here that, for the sake of clarity, all maps in this publication display presence points on top of absence points, regardless of the timing of data collection. This presentation allows a better visualization of tsetse detections throughout the study period, but it hides in some areas the impact of tsetse elimination campaigns or the disappearance of the flies because of habitat modifications, the so-called "autonomous tsetse control" (Bourn *et al.*, 2001).

Possible inaccuracies in the data sources

By relying solely on peer-reviewed scientific publications, the accuracy of the sources of the atlas can generally be considered high. However, errors or inaccuracies can also affect scholarly papers, and in the process of developing the atlas, we did occasionally identify errors or inaccuracies in the scientific publications we used as sources. Whenever mistakes could be detected and unequivocally rectified, we imported the corrected data in the database. However, in a few instances, internal inconsistencies within a given paper could not be reconciled just by a careful analysis of the publication; in those instances, we contacted the authors for clarifications; when case feedback was lacking, we either made reasonable assumptions (in the most straightforward cases) or we did not import the data at all (in the most uncertain cases).

The issue of tsetse identification at the species and subspecies levels deserves a brief discussion, because misidentification is not impossible. In this regard, it is important to stress that, unless there was a clearly detectable error in the paper (e.g. an evident typing error), we imported in the atlas the tsetse species and subspecies as reported by the authors. With over 600 papers analysed, we cannot exclude the possibility that a few of them may have contained misidentifications of tsetse species or subspecies. However, we encountered very few doubtful identifications at the species level. In this context, "doubtful" mainly refers to the reported occurrence of a tsetse species outside its known historical distribution (i.e. an "outlier"), especially if at a considerable distance from the historical distribution. Indeed, we only found one such case: the reported occurrence of *G. longipennis* from an

area in the United Republic of Tanzania, the Mahale Mountains National Park, which is more than 500 km from the known distribution of the species (Sasaki and Nishida, 1999). The record was still included in the database and the corresponding species map in Figure 38, but it was flagged as an "outlier".

We found a few more doubtful reports at the subspecies level. This can probably be ascribed to several factors. First, subspecies determination is inherently more challenging, because morphological differences between subspecies are often small and are not routinely investigated; also, molecular techniques are not yet well established or widely adopted, and they may provide results that are inconclusive or difficult to interpret (Mayoke *et al.*, 2020a). Second, historical knowledge of the distributional limits of tsetse subspecies is less accurate than the species level, which creates more uncertainties when using the geographical location of surveys to infer or to support the identification of subspecies. Third, authors reporting the detection of tsetse subspecies rarely provide details of how they determined the subspecies; in many cases, even though authors may not be explicit on the point, we can assume that no morphological or molecular investigation at the subspecies level was carried out, and that the subspecies was merely inferred by matching the geographical location of the samples with historical maps. As already mentioned, in this atlas, we recorded species and subspecies as reported by the authors; however, when a subspecies was reported outside its historical distribution, we flagged it as an "outlier" that may need to be verified or corroborated. Furthermore, to develop more complete maps at the subspecies level, when authors reported their findings at the species level and when the corresponding subspecies are known to be well demarcated geographically, we inferred the subspecies from the geographical location, while marking the corresponding circles on the maps with a different colour (grey) to flag this assumption. In future, it would be helpful if authors of scientific publications could be more explicit in describing how they determined the tsetse subspecies.

LINKAGES BETWEEN THE CONTINENTAL ATLAS AND NATIONAL ATLASES

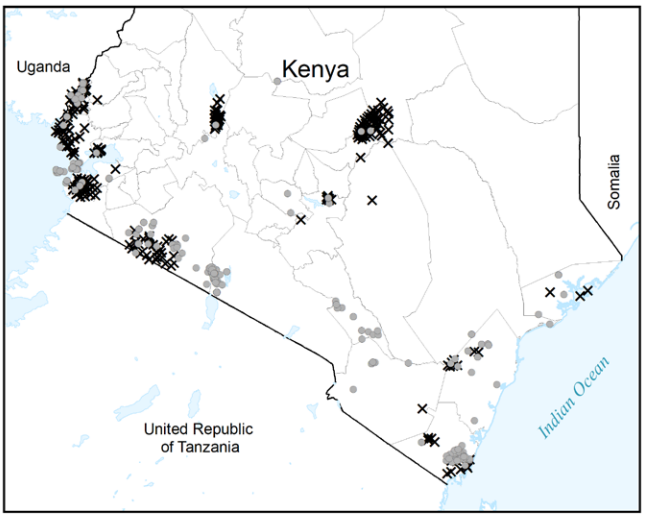
The continental atlas and national atlases can be regarded as two prongs of a single, coordinated initiative aimed at improving the management of field data on tsetse and AAT for improved, evidence-based decision-making. Following up on the "Background" section, we summarize here the main linkages between the two components.

The first link between the continental atlas developed by FAO and the national atlases developed at the country level by the mandated veterinary authorities is methodological. Indeed, one of the main drivers for FAO to develop the continental atlas was to provide countries with a blueprint to develop their own national atlases or information systems. We believe that this objective was broadly achieved, as the general approach of building a data repository, processing the information and then centralizing the harmonized data in a single database has already been adopted by more than 15 countries, with more to follow.

Second, there is some overlap between continental and national atlases in terms of data sources, in that publications provide input for both. However, scientific papers are the only source for the FAO atlas, and data extraction is limited to information that is explicitly reported in the papers, and which is therefore in the public domain. By contrast, for national atlases, scientific papers are only one of many sources of data, alongside other types of publications and, crucially, unpublished data. Furthermore, when incorporating data from publications, countries can go beyond what FAO does, as they can collate and integrate the detailed, unpublished raw information that lies behind the papers.

Third, once a national atlas is published, the information and data made available in the corresponding paper can also be incorporated into the continental atlas. For the present publication on tsetse distribution in Africa, this was the case for the atlases of Sudan (Ahmed *et al.*, 2016), Mali (Diarra *et al.*, 2019) and Kenya (Ngari *et al.*, 2020), while the atlases of Zimbabwe (Shereni *et al.*, 2021), Burkina Faso (Percoma *et al.*, 2022) and Ethiopia (Gebre *et al.*, 2022) were left out because they were published after 2020. It bears

FIGURE 46
The continental atlas of tsetse flies (component for Kenya)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: Information extracted from the national atlas for Kenya (Ngari *et al.*, 2020) is presented differently from that extracted from all other papers.

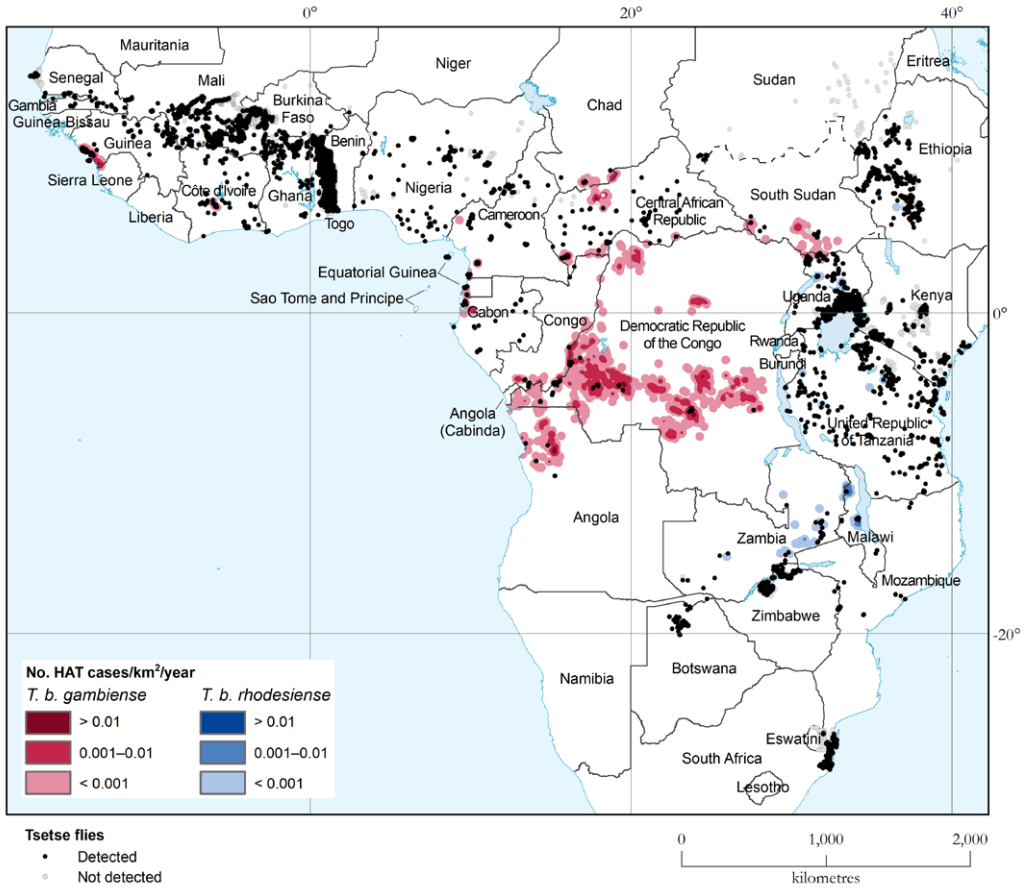
repeating that the inclusion of national atlases into the continental atlas is limited to the information that is released by countries in the public domain through the corresponding papers, and not the raw data behind these publications. In this sense, FAO treats publications on national atlases just like any other scientific publication providing eligible information for the continental atlas. Figure 46 provides an example of how data extracted from a published national atlas, specifically the one for Kenya (Ngari *et al.*, 2020), were incorporated in the continental atlas.

Finally, it is worth mentioning that in terms of data, the linkage between continental and national atlases also goes in the opposite direction (i.e. from continental to national). This is because when national authorities are in the process of developing a national atlas, FAO provides them with the component of the continental atlas for their respective country. This avoids duplication of effort in terms of identification of, and access to, relevant scientific publications. Furthermore, in case that the raw data from a given publication cannot be retrieved by the national authority, the data extracted by FAO from the paper can be used instead, thus further reducing duplication of effort. The sharing of the national component of the continental atlas has the added benefit of enhancing country understanding of the FAO database structure, which can be used as a template or starting point for designing the national database.

THE CONTINENTAL ATLAS OF TSETSE FLIES AND HUMAN AFRICAN TRYPANOSOMIASIS

Tsetse flies transmit both the animal and human form of African trypanosomosis, and therefore the continental tsetse atlas, while developed in connection with the animal disease, is also relevant for ongoing efforts aimed at HAT elimination. This is more directly the case for the zoonotic rhodesiense form of HAT, but also for the mainly anthroponotic gambiense form (FAO and WHO, 2022).

FIGURE 47
The continental atlas of tsetse flies (1990–2020) and the density of cases of human African trypanosomiasis (2016–2020)



Source: Franco *et al.* (2022a) and authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

Figure 47 shows the reported occurrence of tsetse flies as per the continental atlas (1990–2020) overlaid onto the density of reported cases of HAT in 2016–2020 (Franco *et al.*, 2022a). Figure 47 illustrates how, unlike AAT, HAT is not ubiquitous across the tsetse belt, only occurring in rather well-defined areas of endemicity, often referred to as "foci" (Simarro *et al.*, 2010).

Having discussed in a previous section the main geographical gaps of the atlas in relation to the overall historical distribution of tsetse, we can appreciate here where these gaps affect HAT endemic areas. We note that very few HAT endemic areas in the Democratic Republic of the Congo are covered by published tsetse surveys; the other main gaps are arguably in Angola and South Sudan. These observations point to countries and areas where further tsetse surveys would be relevant in a broader One Health framework.

Chapter 5
Conclusions

The present publication is an important step towards filling the gaps in our knowledge of the geographic distribution of tsetse flies in Africa. However, because of its limitations, further efforts will be needed to update and enhance the atlas. As a matter of priority, a regular update of the atlas is needed. In particular, data published in the scientific literature from 2021 onwards need to be included. Furthermore, the possibility of expanding the sources of the atlas to other types of publications could be explored. By contrast, for technical reasons, as well as for issues of data ownership, the centralization at the continental level of all the raw data collected at the country level is difficult to envisage at this stage.

In addition to future updates and enhancements of the continental atlas, there is also a need to promote the utilization of its outputs to enhance trypanosomosis control in the enzootic countries. To this end, several applications of the continental atlas can be envisaged. For example, countries that have not yet developed a national atlas could temporarily fill the gap with the corresponding national component of the continental atlas, as it was already the case in Nigeria (de Gier *et al.*, 2020). However, in the long run the continental atlas cannot be considered as a substitute for a functioning information system at the national level (i.e. a "national atlas"), whose development is considered as a top priority and key requirement to advance along the PCP for AAT.

Furthermore, given the geographical gaps in the tsetse maps presented in this paper, it would be useful to apply geospatial modelling techniques to extrapolate the results of the atlas to areas where no published survey is available. To do this, an increasing number of tools and approaches for modelling the ecological niche or the distribution of species are now available (e.g. maximum entropy [Phillips, Anderson and Schapire, 2006], random forests [Breiman, 2001] and others). Many of these techniques have already been tested on tsetse field data from the local (Dicko *et al.*, 2014; Gachoki *et al.*, 2021) to the transnational level (Bishop *et al.*, 2021; Bouyer *et al.*, 2015; de Beer *et al.*, 2021). However, these methods are yet to be applied to a large-scale and heterogeneous dataset like the one underpinning the continental atlas of tsetse flies.

Another envisaged application of the present distribution maps, ideally in combination with modelled maps, is the optimization of the spatial targeting of new entomological surveys to fill the main geographical gaps.

Finally, within the continental atlas initiative but beyond tsetse geographical distribution, there is a need to publish and disseminate the results of the other components of the atlas. These are the data on trypanosomal infection rates in tsetse, and the atlases of AAT and surra.

Inquiries related to this publication, and the FAO continental atlas of tsetse flies and animal trypanosomosis in Africa more generally, can be sent to PAAT@fao.org. High-resolution versions of all maps included in this publication can be accessed from the PAAT website (www.fao.org/paat), while the underlying georeferenced data can also be accessed from the FAO Agro-informatics Platform (https://data.apps.fao.org).

References

Abdi, R.D., Agga, G.E., Aregawi, W.G., Bekana, M., van Leeuwen, T., Delespaux, V. & Duchateau, L. 2017. A systematic review and meta-analysis of trypanosome prevalence in tsetse flies. *BMC Veterinary Research,* 13. https://doi.org/10.1186/s12917-017-1012-9

Acapovi-Yao, G., Cissé, B., Mavoungou, J.F., Lendzele, S.S. & Nguertoum, A.E. 2019. Preliminary study on vectors of bovine trypanosomosis in the central African republic one decade after the socio-military crisis. *Journal of Animal and Plant Sciences,* 39(3): 6487–6494.

Acapovi-Yao, G.L., Lendzele, S.S. & Cissé, B. 2017. Glossines Fauna of North, South and Center Divisions of Ivory Coast. *International Journal of Research in Biosciences*, 6(3): 1–8. www.ijrbs.in/index.php/ijrbs/article/view/240

Adam, Y., Marcotty, T., Cecchi, G., Mahama, C.I., Solano, P., Bengaly, Z. & van den Bossche, P. 2012. Bovine trypanosomosis in the Upper West Region of Ghana: Entomological, parasitological and serological cross-sectional surveys. *Research in Veterinary Science,* 92(3): 462–468. https://doi.org/10.1016/j.rvsc.2011.04.004

Ahmed, S.K., Rahman, A.H., Hassan, M.A., Salih, E.M., Paone, M. & Cecchi, G. 2016. An atlas of tsetse and bovine trypanosomosis in Sudan. *Parasites & Vectors,* 9. https://doi.org/10.1186/s13071-016-1485-6

Ajayi, S.A., Ogedengbe, J.D., Dogo, G.I. & Frame, I.A. 1997. Monitoring of a tsetse and trypanosomosis control programme in plateau and Bauchi State, Nigeria, using antigen ELISA and parasitological techniques. *Proceedings of the Workshop on Epidemiological Tools for Monitoring Trypanosomosis and Tsetse Control Programmes organized by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and the IAEA Department of Technical Co-operation held in Addis Ababa, Ethiopia, 17-28 April 1995*. Vienna, International Atomic Energy Agency. https://inis.iaea.org/collection/NCLCollectionStore/_Public/28/036/28036703.pdf

Aksoy, E., Telleria, E.L., Echodu, R., Wu, Y., Okedi, L.M., Weiss, B.L., Aksoy, S. *et al.* 2014. Analysis of multiple tsetse fly populations in Uganda reveals limited diversity and species-specific gut microbiota. *Applied and Environmental Microbiology,* 80(14): 4301–4312. https://doi.org/10.1128/AEM.00079-14

Alibu, V.P., Enyaru, J.C.K., Matovu, E., Malele, I.I., Chisi, J.E., Mbongo, N., Mansinsa, P. *et al.* 2015. Molecular xenomonitoring of trypanosomes in tsetse flies. *Journal of Parasitology and Vector Biology,* 7(6): 108–114.

Aregawi, W.G., Agga, G.E., Abdi, R.D. & Büscher, P. 2019. Systematic review and meta-analysis on the global distribution, host range, and prevalence of *Trypanosoma evansi*. *Parasites & Vectors,* 12(1): 67. https://doi.org/10.1186/s13071-019-3311-4

Artzrouni, M. & Gouteux, J.-P. 2003. Estimating tsetse population parameters: Application of a mathematical model with density-dependence. *Medical and Veterinary Entomology,* 17(3): 272–279. https://doi.org/10.1046/j.1365-2915.2003.00437.x

Asghari, M.M. & Rassouli, M. 2022. First identification of *Trypanosoma vivax* among camels (*Camelus dromedarius*) in Yazd, central Iran, jointly with *Trypanosoma evansi*. *Parasitology International,* 86. https://doi.org/10.1016/j.parint.2021.102450

Barclay, H.J. & Hargrove, J.W. 2005. Probability models to facilitate a declaration of pest-free status, with special reference to tsetse (Diptera: Glossinidae). *Bulletin of Entomological Research,* 95(1): 1–11. https://doi.org/10.1079/ber2004331

Bett, B., Irungu, P., Nyamwaro, S.O., Murilla, G., Kitala, P., Gathuma, J., Randolph, T.F. *et al.* 2008. Estimation of tsetse challenge and its relationship with trypanosomosis incidence in cattle kept under pastoral production systems in Kenya. *Veterinary Parasitology,* 155(3–4): 287–298. https://doi.org/10.1016/j.vetpar.2008.05.028

Bishop, A.P., Amatulli, G., Hyseni, C., Pless, E., Bateta, R., Okeyo, W.A., Mireji, P.O. *et al.* 2021. A machine learning approach to integrating genetic and ecological data in tsetse flies (*Glossina pallidipes*) for spatially explicit vector control planning. *Evolutionary Applications,* 14(7): 1762–1777. https://doi.org/10.1111/eva.13237

Boulangé, A., Lejon, V., Berthier, D., Thévenon, S., Gimonneau, G., Desquesnes, M., Abah, S. *et al.* 2022. The COMBAT project: Controlling and progressively minimizing the burden of vector-borne animal trypanosomosis in Africa [version 2; peer review 3 approved]. *Open Research Europe*, 2(67). https://doi.org/10.12688/openreseurope.14759.2

Bourn, D., Reid, R., Rogers, D., Snow, B. & Wint, W. *Environmental change and the autonomous control of tsetse and trypanosomosis in sub-Saharan Africa: Case histories from Ethiopia, The Gambia, Kenya, Nigeria and Zimbabwe.* Environmental Research Group Oxford Limited, Oxford, UK, 2001.

Bouyer, J., Dicko, A.H., Cecchi, G., Ravel, S., Guerrini, L., Solano, P., Vreysen, M.J.B. *et al.* 2015. Mapping landscape friction to locate isolated tsetse populations that are candidates for elimination. *Proceedings of the National Academy of Sciences,* 112(47): 14575–14580. https://doi.org/10.1073/pnas.1516778112

Breiman, L. 2001. Random Forests. *Machine Learning,* 45: 5–32. https://doi.org/10.1023/A:1010933404324

Büscher, P., Cecchi, G., Jamonneau, V. & Priotto, G. 2017. Human African trypanosomiasis. *The Lancet,* 390(10110): 2397–2409. https://doi.org/10.1016/S0140-6736(17)31510-6

Cano, J., Descalzo, M.A., Ndong-Mabale, N., Ndongo-Asumu, P., Bobuakasi, L., Buatiché, J.N., Nzambo-Ondo, S., *et al.* 2007a. Spatial and temporal variability of the *Glossina palpalis palpalis* population in the Mbini focus (Equatorial Guinea). *International Journal of Health Geographics,* 6(36). https://doi.org/10.1186/1476-072X-6-36

Cano, J., Descalzo, M.A., Ndong-Mabale, N., Ndong-Asumu, P., Bobuakasi, L., Nzambo-Ondo, S., Benito, A. *et al.* 2007b. Predicted distribution and movement of *Glossina palpalis palpalis* (Diptera: Glossinidae) in the wet and dry seasons in the Kogo trypanosomiasis focus (Equatorial Guinea). *Journal of Vector Ecology,* 32(2): 218–225. https://doi.org/10.3376/1081-1710(2007)32[218:PDAMOG]2.0.CO;2

Carter, R.M. 1906. Tsetse fly in Arabia. *The British Medical Journal*, 2: 1393–1394.

Cecchi, G., Paone, M., Argilés-Herrero, R., Vreysen, M.J.B. & Mattioli, R.C. 2015. Developing a continental atlas of the distribution and trypanosomal infection of tsetse flies (*Glossina* species). *Parasites & Vectors,* 8. https://doi.org/10.1186/s13071-015-0898-y

Cecchi, G., Paone, M., Feldmann, U., Vreysen, M.J.B., Diall, O. & Mattioli, R.C. 2014. Assembling a geospatial database of tsetse-transmitted animal trypanosomosis for Africa. *Parasites & Vectors,* 7. https://doi.org/10.1186/1756-3305-7-39

Cecchi, G., Paone, M., Franco, J.R., Fèvre, E., Diarra, A., Ruiz, J. A., Mattioli, R.C. *et al.* 2009. Towards the Atlas of human African trypanosomiasis. *International Journal of Health Geographics,* 8(15). https://doi.org/10.1186/1476-072X-8-15

Cecchi, G., Mattioli, R.C., Slingenbergh, J., de la Rocque, S. & Feldmann, U. 2008. *Standardizing land cover mapping for tsetse and trypanosomiasis decision making.* PAAT Technical and Scientific Series, No. 8. Rome, Food and Agriculture Organization of the United Nations. https://openknowledge.fao.org/handle/20.500.14283/i0215e

Challier, A., Gouteux, J.-P. & Coosemans, M. 1983. La limite géographique entre les sous-espèces *Glossina palpalis palpalis* (Rob-Desv.) et *G. palpalis gambiensis* Vanderplank (Diptera: Glossinidae) en Afrique occidentale. *Cahiers ORSTOM*: *Série entomologie médicale et parasitologie,* 21(4): 207–220. https://horizon.documentation.ird.fr/exl-doc/pleins_textes/cahiers/entomo/15430.pdf

Channumsin, M., Ciosi, M., Masiga, D., Turner, C.M.R. & Mable, B.K. 2018. *Sodalis glossinidius* presence in wild tsetse is only associated with presence of trypanosomes in complex interactions with other tsetse-specific factors. *BMC Microbiology,* 18(Suppl 1): 69–82. https://doi.org/10.1186/s12866-018-1285-6

Daffa, J., Byamungu, M., Nsengwa, G., Mwambembe, E. & Mleche, W. 2013. Tsetse distribution in Tanzania: 2012 status. *Tanzania Veterinary Journal,* 28: 1–11.

Dagnogo, M., Lohuirignon, K. & Traore, G. 1997. Diversity of *Glossina* in the forest belt of Cote d'Ivoire. *Acta Tropica,* 65(3): 149–153. https://doi.org/10.1016/s0001-706x(96)00647-x

Dankwa, D., Oddoye, E.O.K. & Mzamo, K.B. 2000. Efficacy of three trap types for trapping *Glossina palpalis*, *G. tachinoides*, and *G. mortisans* in the Mole Game Reserve in Ghana. *Ghana Journal of Agricultural Science,* 33: 177–181.

Dao, B., Hendrickx, G., Sidibé, I., Belem, A.M.G. & de la Rocque, S. 2008. Impact de la sécheresse et de la dégradation des aires protégées sur la répartition des trypanosomoses bovines et de leurs vecteurs dans le bassin versant de l'Oti au nord du Togo. *Revue d'élevage et de médecine vétérinaire des pays tropicaux,* 61(3-4): 153–160. https://doi.org/10.19182/remvt.9982

de Beer, C.J., Dicko, A.H., Ntshangase, J., Moyaba, P., Taioe, M.O., Mulandane, F.C., Neves, L. *et al.* 2021. A distribution model for *Glossina brevipalpis* and *Glossina austeni* in Southern Mozambique, Eswatini and South Africa for enhanced area-wide integrated pest management approaches. *PLOS Neglected Tropical Diseases,* 15(11). https://doi.org/10.1371/journal.pntd.0009989

de Beer, C.J., Venter, G.J., Vreysen, M.J.B., Mulandane, F.C., Neves, L., Mdluli, S. & Koekemoer, O. 2019. Using genetic and phenetic markers to assess population isolation within the southernmost tsetse fly belt in Africa. *Onderstepoort Journal of Veterinary Research*, 86(1). https://doi.org/10.4102/ojvr.v86i1.1768

de Beer, C.J., Venter, G.J., Kappmeier Green, K., Esterhuizen, J., de Klerk, D.G., Ntshangase, J., Vreysen, M.J.B. *et al.* 2016. An update of the tsetse fly (Diptera: Glossinidae) distribution and African animal trypanosomosis prevalence in north-eastern KwaZulu-Natal, South Africa. *Onderstepoort Journal of Veterinary Research,* 83(1). www.journals.co.za/doi/abs/10.4102/ojvr.v83i1.1172

de Carvalho, E.O.A. 2011. Estrutura genética de populações de Glossina Palpalis gambiensis (Diptera: Glossinidae) na República da Guiné-Bissau. Lisbon, Universidade NOVA de Lisboa. MSc thesis. http://hdl.handle.net/10362/13964

de Gier, J., Cecchi, G., Paone, M., Dede, P. & Zhao, W. 2020. The continental atlas of tsetse and African animal trypanosomosis in Nigeria. *Acta Tropica,* 204. https://doi.org/10.1016/j.actatropica.2020.105328

de Meeûs, T., Bouyer, J., Ravel, S. & Solano, P. 2015. Ecotype evolution in *Glossina palpalis* subspecies, major vectors of sleeping sickness. *PLOS Neglected Tropical Diseases,* 9(3). https://doi.org/10.1371/journal.pntd.0003497

de Meeûs, T., Ravel, S., Rayaisse, J.-B., Kaba, D., Courtin, F., Bouyer, J., Dayo, G.-K. *et al.* 2014. Genetic correlations within and between isolated tsetse populations: What can we learn? *Acta Tropica,* 138: S6–S11. https://doi.org/10.1016/j.actatropica.2014.03.004

Dennis, J.W., Durkin, S.M., Downie, J.E.H., Hamill, L.C., Anderson, N.E. & MacLeod, E.T. 2014. *Sodalis glossinidius* prevalence and trypanosome presence in tsetse from Luambe National Park, Zambia. *Parasites & Vectors,* 7. https://doi.org/10.1186/1756-3305-7-378

Desquesnes, M., Holzmuller, P., Lai, D.-H., Dargantes, A., Lun, Z.-R. & Jittaplapong, S. 2013. *Trypanosoma evansi* and surra: A review and perspectives on origin, history, distribution, taxonomy, morphology, hosts, and pathogenic effects. *BioMed Research International,* 2013. https://doi.org/10.1155/2013/194176

Dia, M.L., van Meirvenne, N., Magnus, E., Luckins, A.G., Diop, C., Thiam, A., Jacquiet, P. *et al.* 1997. Evaluation de quatre tests de diagnostic: frottis sanguins, CATT, IFI et ELISA-Ag dans l'étude de l'épidémiologie de la trypanosomose cameline à *Trypanosoma evansi* en Mauritanie. *Revue d'élevage et de médecine vétérinaire des pays tropicaux*, 50(1): 29–36. https://agritrop.cirad.fr/389298/1/ID389298.pdf

Diall, O., Cecchi, G., Wanda, G., Argiles-Herrero, R., Vreysen, M.J.B., Cattoli, G., Viljoen, *et al.* 2017. Developing a progressive control pathway for African animal trypanosomosis. *Trends in Parasitology,* 33(7): 499–509. https://doi.org/10.1016/j.pt.2017.02.005

Diarra, B., Diarra, M., Diall, O., Bass, B., Sanogo, Y., Coulibaly, E., Sylla, M. *et al.* 2019. A national atlas of tsetse and African animal trypanosomosis in Mali. *Parasites & Vectors,* 12. https://doi.org/10.1186/s13071-019-3721-3

Dibakou, E.S., Mounioko, F., Koumba, C.R.Z., Nguema, O.A.M., Acapovi-Yao, G. & Mavoungou, J. 2015. Distribution des Glossines vecteurs de la Trypanosomose humaine africaine dans le Parc National de Moukalaba Doudou (Sud-ouest Gabon). *Journal of Applied Biosciences*, 86: 7957–7965. https://doi.org/10.4314/jab.v86i1.7

Dicko, A.H., Lancelot, R., Seck, M.T., Guerrini, L., Sall, B., Lo, M., Vreysen, M.J.B. *et al.* 2014. Using species distribution models to optimize vector control in the framework of the tsetse eradication campaign in Senegal. *Proceedings of the National Academy of Sciences,* 111(28): 10149–10154. https://doi.org/10.1073/pnas.1407773111

Djohan, V., Kaba, D., Rayaisse, J.-B., Dayo, G.K., Coulibaly, B., Salou, E., Dofini, F. *et al.* 2015. Detection and identification of pathogenic trypanosome species in tsetse flies along the Comoé River in Côte d'Ivoire. *Parasite,* 22. https://doi.org/10.1051/parasite/2015018

Du Toit, R. 1954. Trypanosomiasis in Zululand and the control of tsetse flies by chemical means. *Onderstepoort Journal of Veterinary Research*, 26(3). www.hdl.handle.net/2263/58793

Dyer, N.A., Ravel, S., Choi, K.-S., Darby, A.C., Causse, S., Kapitano, B., Hall, M.J.R. *et al.* 2011. Cryptic diversity within the major trypanosomiasis vector *Glossina fuscipes* revealed by molecular markers. *PLOS Neglected Tropical Diseases,* 5(8). https://doi.org/10.1371/journal.pntd.0001266

Dyer, N.A., Furtado, A., Cano, J., Ferreira, F., Odete Afonso, M., Ndong-Mabale, N., Ndong-Asumu, P. *et al.* 2009. Evidence for a discrete evolutionary lineage within Equatorial Guinea suggests that the tsetse fly *Glossina palpalis palpalis* exists as a species complex. *Molecular Ecology,* 18(15): 3268–3282. https://doi.org/10.1111/j.1365-294X.2009.04265.x

Dyer, N.A., Lawton, S.P., Ravel, S., Choi, K.S., Lehane, M.J., Robinson, A.S., Okedi, L.M. *et al.* 2008. Molecular phylogenetics of tsetse flies (Diptera: Glossinidae) based on mitochondrial (COI, 16S, ND2) and nuclear ribosomal DNA sequences, with an emphasis on the *palpalis* group. *Molecular Phylogenetics and Evolution,* 49(1): 227–239. https://doi.org/10.1016/j.ympev.2008.07.011

Ebhodaghe, F., Gomez, D. & Isaac, C. 2016. Spatial distribution of tsetse flies in some areas within western, eastern and northern regions of Ghana. *The Zoologist,* 14: 50–55. www.ajol.info/index.php/tzool/article/view/160448

Elsen, P., Amoudi, M.A. & Leclercq, M. 1990. First record of *Glossina fuscipes fuscipes* Newstead, 1910 and *Glossina morsitans submorsitans* Newstead, 1910 in southwestern Saudi Arabia. *Annales de la Societe belge de medecine tropicale,* 70(4): 281–287. www.lib.itg.be/open/ASBMT/1990/1990asbm0281.pdf

Essono, P.Y.B., Dechaume-Moncharmont, F.X., Mavoungou, J., Mba, R.O., Duvallet, G. & Bretagnolle, F. 2015. Distribution and abundance of hematophagous flies (Glossinidae, *Stomoxys*, and Tabanidae) in two national parks of Gabon. *Parasite*, 22. https://doi.org/10.1051/parasite/2015023

Esterhuizen, J., Rayaisse, J.B., Tirados, I., Mpiana, S., Solano, P., Vale, G.A., Lehane, M.J. *et al.* 2011. Improving the cost-effectiveness of visual devices for the control of riverine tsetse flies, the major vectors of human African trypanosomiasis. *PLOS Neglected Tropical Diseases,* 5(8). https://doi.org/10.1371/journal.pntd.0001257

FAO & WHO. 2022. *Vector control and the elimination of gambiense human African trypanosomiasis (HAT): Joint FAO/WHO Virtual Expert Meeting – 5-6 October 2021*. PAAT Meeting Report Series, No. 1. Rome, Food and Agriculture Organization of the United Nations and World Health Organization. https://doi.org/10.4060/cc0178en

FAO. 2019. *Improving food security in sub-Saharan Africa by supporting the progressive reduction of tsetse-transmitted trypanosomosis in the framework of NEPAD (Phase 2): Project findings and recommendations*. Rome. https://openknowledge.fao.org/handle/20.500.14283/ca3271en

FAO. 2016. *Improving food security in sub-Saharan Africa by supporting the progressive reduction of tsetse-transmitted trypanosomosis in the framework of New Partnership for Africa's Development: Project findings and recommendations*. Rome. https://openknowledge.fao.org/handle/20.500.14283/ca3187en

FAO 1982a. *Training manual for tsetse control personnel: Volume 1 – Tsetse biology, systematics and distribution; techniques.* Rome. https://openknowledge.fao.org/handle/20.500.14283/p5178e

FAO 1982b. *Training manual for tsetse control personnel: Volume 2 – Ecology and behaviour of tsetse.* Rome. https://openknowledge.fao.org/server/api/core/bitstreams/de6d9791-0f4e-4fd3-804d-28ddbb701930/content

Ford, J. & Katondo, K.M. 1977a. Maps of tsetse flies (*Glossina*) distribution in Africa, 1973 according to sub-generic groups on scale of 1:5 000 000. *Bulletin of Animal Health and Production in Africa,* 25: 188–194.

Ford, J. & Katondo, K.M. 1977b. *The Distribution of Tsetse Flies in Africa (3 Maps).* Nairobi, Organization of African Unity, Hammond & Kell.

Ford, J. & Katondo, K.M. 1975. Revision of the *Glossina* distribution map of Africa. 14th Meeting of the International Scientific Council for Trypanosomiasis Research and Control, Dakar, Organization of African Unity.

Ford, J. 1963. The distribution of the vectors of African pathogenic trypanosomes. *Bulletin of the World Health Organization,* 28(5–6): 653–669. https://iris.who.int/bitstream/handle/10665/266946/PMC2554952.pdf

Ford, J., Glasgow, J.P., Johns, D.L. & Welch, J.R. 1959. Transect fly-rounds in field studies of Glossina. *Bulletin of Entomological Research,* 50(2): 275–285.

Fournet, F., Traoré, S. & Hervouët, J.P. 1999. Effects of urbanization on transmission of human African trypanosomiasis in a suburban relict forest area of Daloa, Côte d'Ivoire. *Transactions of The Royal Society of Tropical Medicine and Hygiene,* 93(2): 130–132. https://doi.org/10.1016/S0035-9203(99)90283-3

Franco, J.R., Cecchi, G., Paone, M., Diarra, A., Grout, L., Kadima Ebeja, A., Simarro, P.P. *et al.* 2022a. The elimination of human African trypanosomiasis: Achievements in relation to WHO road map targets for 2020. *PLOS Neglected Tropical Diseases,* 16(1). https://doi.org/10.1371/journal.pntd.0010047

Franco, J.R., Cecchi, G., Priotto, G., Paone, M., Kadima Ebeja, A., Simarro, P.P., Diarra, A. *et al.* 2022b. Human African trypanosomiasis cases diagnosed in non-endemic countries (2011–2020). *PLOS Neglected Tropical Diseases,* 16(11). https://doi.org/10.1371/journal.pntd.0010885

Franco, J.R., Cecchi, G., Priotto, G., Paone, M., Diarra, A., Grout, L., Simarro, P.P. *et al.* 2020. Monitoring the elimination of human African trypanosomiasis at continental and country level: Update to 2018. *PLOS Neglected Tropical Diseases,* 14(5). https://doi.org/10.1371/journal.pntd.0008261

Franco, J.R., Cecchi, G., Priotto, G., Paone, M., Diarra, A., Grout, L., Simarro, P.P. *et al.* 2018. Monitoring the elimination of human African trypanosomiasis: Update to 2016. *PLOS Neglected Tropical Diseases,* 12(12). https://doi.org/10.1371/journal.pntd.0006890

Franco, J.R., Cecchi, G., Priotto, G., Paone, M., Diarra, A., Grout, L., Mattioli, R.C. *et al.* 2017. Monitoring the elimination of human African trypanosomiasis: Update to 2014. *PLOS Neglected Tropical Diseases,* 11(5). https://doi.org/10.1371/journal.pntd.0005585

Franco, J.R., Priotto, G., Paone, M., Cecchi, G., Kadima Ebeja, A., Simarro, P.P., Sankara, D., *et al.* 2024. The elimination of human African trypanosomiasis: Monitoring progress towards the 2021–2030 WHO road map targets. *PLOS Neglected Tropical Diseases,* 18(4). https://doi.org/10.1371/journal.pntd.0012111

Gachoki, S., Groen, T., Vrieling, A., Okal, M., Skidmore, A. & Masiga, D. 2021. Satellite-based modelling of potential tsetse (*Glossina pallidipes*) breeding and foraging sites using teneral and non-teneral fly occurrence data. *Parasites & Vectors,* 14. https://doi.org/10.1186/s13071-021-05017-5

Garms, R., Mehlitz, D. & Zillmann, U. 1987. Geographical distribution of *Glossina palpalis gambiensis* and *G.p.palpalis* in Liberia. *Medical and Veterinary Entomology,* 1(4): 343–347.

Gashururu, R.S., Githigia, S.M., Gasana, M.N., Habimana, R., Maingi, N., Cecchi, G. & Paone, M. 2021. An update on the distribution of *Glossina* (tsetse flies) at the wildlife-human-livestock interface of Akagera National Park, Rwanda. *Parasites & Vectors,* 14. https://doi.org/10.1186/s13071-021-04786-3

Gebre, T., Kapitano, B., Beyene, D., Alemu, D., Beshir, A., Worku, Z., Kifle, T. *et al.* 2022. The national atlas of tsetse flies and African animal trypanosomosis in Ethiopia. *Parasites & Vectors,* 15. https://doi.org/10.1186/s13071-022-05617-9

Gomes, J., Leão, C., Ferreira, F., Afonso, M.O., Santos, C., Josenando, T., Seixas, J. *et al.* 2009. Molecular identification of *T. brucei* s.l. in tsetse flies after long-term permanence in field traps. *The Journal of Infection in Developing Countries,* 3(9): 735–738. www.jidc.org/index.php/journal/article/view/19858577

Gonzatti, M.I., González-Baradat, B., Aso, P.M. & Reyna-Bello, A. 2014. *Trypanosoma (Duttonella) Vivax* and Typanosomosis in Latin America: Secadera/Huequera/Cacho Hueco. In: Magez, S. & Radwanska, M., eds. *Trypanosomes and Trypanosomiasis*. Springer, Vienna. https://doi.org/10.1007/978-3-7091-1556-5_11

Gooding, R.H. 1988. Preliminary analysis of genetics of hybrid sterility in crosses of *Glossina palpalis palpalis* (Robineau-Desvoidy) and Glossina palpalis gambiensis Vanderplank. *The Canadian Entomologist,* 120(11): 997–1001. https://doi.org/10.4039/Ent120997-11

Gouteux, J.-P., Sinda, D. & de Foresta, H. 1991. Répartition et écodistribution de *Glossina frezili* (Diptera: Glossinidae) au Congo. *Annales de la Société entomologique de France,* 27(4): 483–494. https://doi.org/10.1080/21686351.1991.12277850

Gouteux, J.-P., Frézil, J.-L., Louembet, M.-T. & Noireau, F. 1987. Présence en République Populaire du Congo, de *Glossina medicorum* Austen, 1911 et *G. caliginea* Austen, 1911 (Diptera: Muscidae). *Comptes rendus de l'Académie des Sciences,* 304.

Griffith, B.C., Weiss, B.L., Aksoy, E., Mireji, P.O., Auma, J.E., Wamwiri, F.N., Echodu, R. *et al.* 2018. Analysis of the gut-specific microbiome from field-captured tsetse flies, and its potential relevance to host trypanosome vector competence. *BMC Microbiology,* 18(Suppl 1): 55–67. https://doi.org/10.1186/s12866-018-1284-7

Grébaut, P., Melachio, T., Nyangmang, S., Ebo'o Eyenga, V., Njitchouang, G.-R., Ofon, E., Njiokou, F. *et al.* 2016. Xenomonitoring of sleeping sickness transmission in Campo (Cameroon). *Parasites & Vectors,* 9. https://doi.org/10.1186/s13071-016-1479-4

Grébaut, P., Mbida Mbida, J.A., Kondjio, C.A., Njiokou, F., Penchenier, L. & Laveissiére, C. 2004. Spatial and temporal patterns of human African trypanosomosis (HAT) transmission risk in the Bipindi focus, in the forest zone of southern Cameroon. *Vector-Borne & Zoonotic Diseases,* 4(3). https://doi.org/10.1089/vbz.2004.4.230

Guerra, C.A., Hay, S.I., Lucioparedes, L.S., Gikandi, P.W., Tatem, A.J., Noor, A.M. & Snow, R.W. 2007. Assembling a global database of malaria parasite prevalence for the Malaria Atlas Project. *Malaria Journal,* 6(17). https://doi.org/10.1186/1475-2875-6-17

Hassan-Kadle, A.A., Ibrahim, A.M., Nyingilili, H.S., Yusuf, A.A. & Vieira, R.F.C. 2020. Parasitological and molecular detection of *Trypanosoma* spp. in cattle, goats and sheep in Somalia. *Parasitology,* 147(14): 1786–1791. https://doi.org/10.1017/S003118202000178X

Hay, S.I., Sinka, M.E., Okara, R.M., Kabaria, C.W., Mbithi, P.M., Tago, C.C., Benz, D. *et al.* 2010. Developing global maps of the dominant *anopheles* vectors of human malaria. *PLOS Medicine,* 7(2). https://doi.org/10.1371/journal.pmed.1000209

Hendrickx, G., Napala, A., Dao, B., Batawui, D., de Deken, R., Vermeilen, A. & Slingenbergh, J.H.W. 1999. A systematic approach to area-wide tsetse distribution and abundance maps. *Bulletin of Entomological Research,* 89(3): 231–244. https://doi.org/10.1017/s0007485399000358

Henríquez, A.M., Tejedor-Junco, M.T., González-Martín, M., Morales Doreste, M., Martín Martel, S., Paone, M., Cecchi, G. *et al.* 2024. An Atlas of surra in Spain: A tool to support epidemiological investigations and disease control. *Animals*, 14. https://doi.org/10.3390/ani14020243

ICRC. 2017. Somalia: Trapping the tsetse fly to save livestock and income. In: International Committee of the Red Cross, Geneva. [Cited 10 January 2024]. http://blogs.icrc.org/somalia/2017/06/19/resilience-trapping-tsetse-fly-save-livestock-income

Isaac, C., Igbinosa, I.B. & Nmorsi, O.P.G. 2011. The ecology of *Glossina palpalis* in Abraka, Nigeria. *European Journal of Experimental Biology,* 1(3): 37–43.

Itard, J. 1969. La distribution des glossines au Nord Togo. *Revue d'Elevage et de Médecine Vétérinaire des Pays Tropicaux,* 26: 154–167.

Jaenson, T.G.T., Dos Santos, R.C.B. & Hall, D.R. 1991. Attraction of *Glossina longipalpis* (Diptera: Glossinidae) in Guinea-Bissau to odor-baited biconical traps. *Journal of Medical Entomology,* 28(2): 284–286. https://doi.org/10.1093/jmedent/28.2.284

Jordan, A.M. & Okoth, J.O. 1990. A. record of *Glossina medicorum* Austen (Diptera: Glossinidae) from Uganda. *Annals of Tropical Medicine & Parasitology,* 84(4): 423–426. https://doi.org/10.1080/00034983.1990.11812490

Jordan, A.M. 1961. An assessment of the economic importance of the tsetse species of southern Nigeria and the Southern Cameroons based on their trypanosome infection rates and ecology. *Bulletin of Entomological Research,* 52(3): 431–441. https://doi.org/10.1017/S0007485300055504

Jordan, A.M. 1993. Tsetse-flies (Glossinidae). In: R.P. Lane & R.W. Crosskey, eds. *Medical Insects and Arachnids,* pp. 333–388. Springer, Dordrecht.

Kalu, A.U. & Lawani, F.A.G. 1996. Observations on the epidemiology of ruminant trypanosomosis in Kano State, Nigeria. *Revue d'élevage et de médecine vétérinaire des pays tropicaux,* 49(3): 213–217. https://doi.org/10.19182/REMVT.9515

Katondo, K.M. 1984. Revision of second edition of tsetse distribution maps: An interim report. *International Journal of Tropical Insect Science,* 5(5): 381–388. https://doi.org/10.1017/S1742758400008705

Kgori, P.M. & Modo, S. 2009. Transboundary programme to eliminate tsetse from the River frontiers of Botswana and Namibia using the sequential aerial spraying technique. 30th Meeting of the International Scientific Council for Trypanosomiasis Research and Control, Kampala, African Union Interafrican Bureau for Animal Resources.

Kgori, P.M., Modo, S. & Torr, S.J. 2006. The use of aerial spraying to eliminate tsetse from the Okavango Delta of Botswana. *Acta Tropica,* 99(2–3): 184–99. https://doi.org/10.1016/j.actatropica.2006.07.007

Kohagne Tongué, L., Gounoue Kamkuimo, R., Mengue M'eyi, P., Kaba, D., Louis, F.J. & Mimpfoundi, R. 2011. Enquête entomologique dans le foyer historique de trypanosomose humaine africaine de Bendjé (Gabon). *Parasite,* 18(4): 303–309. https://doi.org/10.1051/parasite/2011184303

Kohagne Tongué, L., M'Eyi, M., Mimpfoundi, R. & Louis, J. 2010. Entomological patterns in the human African trypanosomiasis focus of Komo Mondah, Gabon. *African Health Sciences,* 10(4): 341–348. www.ajol.info/index.php/ahs/article/view/63840

Krafsur, E.S. & Endsley, M.A. 2006. Shared microsatellite loci in *Glossina morsitans sensu lato* (Diptera: Glossinidae). *Journal of Medical Entomology,* 43(3): 640–642. https://doi.org/10.1093/jmedent/43.3.640

Laveissière, C., Penchenier, L., Sinda, D. & Zoulani, A. 1998. Comparaison de systèmes attractifs pour la lutte contre les *Glossines* au Congo. *International Journal of Tropical Insect Science,* 18(1): 1–7. https://doi.org/10.1017/S1742758400007396

Leak, S.G.A., Ejigu, D. & Vreysen, M.J.B. 2008. *Collection of entomological baseline data for tsetse area-wide integrated pest management programmes.* FAO Animal Production and Health Guidelines Vol. 1. Rome, Food and Agriculture Organization of the United Nations. https://www.fao.org/3/i0535e/i0535e.pdf

Lewis, E.A. 1939. Observations on *Glossina fuscipleuris* and other tsetses in the Oyani valley, Kenya Colony. *Bulletin of Entomological Research,* 30(3): 345–358. https://doi.org/10.1017/S0007485300004697

Lord, J.S., Lea, R.S., Allan, F.K., Byamungu, M., Hall, D.R., Lingley, J., Mramba, F. *et al.* 2020. Assessing the effect of insecticide-treated cattle on tsetse abundance and trypanosome transmission at the wildlife-livestock interface in Serengeti, Tanzania. *PLOS Neglected Tropical Diseases,* 14(8). https://doi.org/10.1371/journal.pntd.0008288

Lord, J.S., Torr, S.J., Auty, H.K., Brock, P.M., Byamungu, M., Hargrove, J.W., Morrison, L.J. *et al.* 2018. Geostatistical models using remotely-sensed data predict savanna tsetse decline across the interface between protected and unprotected areas in Serengeti, Tanzania. *Journal of Applied Ecology,* 55(4): 1997–2007. https://doi.org/10.1111/1365-2664.13091

Machado, A.d.B. 1954. *Révision systématique des Glossines du groupe palpalis (Diptera).* Publicações Culturais da Diamang No. 22. Lisbon, Companhia de Diamantes de Angola.

Mahama, C.I., Desquesnes, M., Dia, M.L., Losson, B., de Deken, R. & Geerts, S. 2004. A cross-sectional epidemiological survey of bovine trypanosomosis and its vectors in the Savelugu and West Mamprusi districts of northern Ghana. *Veterinary Parasitology,* 122(1): 1–13. https://doi.org/10.1016/j.vetpar.2004.03.009

Maillot, L. 1956. Présence de *Glossina medicorum* Austen, 1911 au Gabon (Afrique Equatoriale Francaise). *Bulletin de la Société de pathologie exotique,* 49(5): 823–827.

Makumi, J.N., Stevenson, P. & Green, C.H. 2000. Control of *Glossina longipennis* (Diptera: Glossinidae) by insecticide-treated targets at Galana Ranch, Kenya, and confirmation of the role of *G. longipennis* as a vector of cattle trypanosomiasis. *Bulletin of Entomological Research,* 90(5): 397–406. https://doi.org/10.1017/S0007485300000535

Malele, I.I., Ouma, J.O., Nyingilili, H.S., Kitwika, W.A., Malulu, D.J., Magwisha, H.B. & Kweka, E.J. 2016. Comparative performance of traps in catching tsetse flies (Diptera: Glossinidae) in Tanzania. *Onderstepoort Journal of Veterinary Research,* 83(1). https://doi.org/10.4102/ojvr.v83i1.1057

Malele, I.I., Kinung'hi, S.M., Nyingilili, H.S., Matemba, L.E., Sahani, J.K., Mlengeya, T.D.K., Wambura, M. *et al.* 2007. *Glossina* dynamics in and around the sleeping sickness endemic Serengeti ecosystem of northwestern Tanzania. *Journal of Vector Ecology,* 32(2): 263–268. https://doi.org/10.3376/1081-1710(2007)32[263:GDIAAT]2.0.CO;2

Malele, I.I., Craske, L., Knight, C., Ferris, V., Njiru, Z., Hamilton, P. & Lehane, S. 2003. The use of specific and generic primers to identify trypanosome infections of wild tsetse flies in Tanzania by PCR. *Infection, Genetics and Evolution,* 3(4): 271–279. https://doi.org/10.1016/S1567-1348(03)00090-X

Masiga, D.K., McNamara, J.J., Laveissiere, C., Truc, P. & Gibson, W.C. 1996. A high prevalence of mixed trypanosome infections in tsetse flies in Sinfra, Côte d'Ivoire, detected by DNA amplification. *Parasitology,* 112(1): 75–80. https://doi.org/10.1017/S0031182000065094

Mayoke, A., Muya, S.M., Bateta, R., Mireji, P.O., Okoth, S.O., Onyoyo, S.G., Auma, J.E. *et al.* 2020a. Genetic diversity and phylogenetic relationships of tsetse flies of the *palpalis* group in Congo Brazzaville based on mitochondrial *cox*1 gene sequences. *Parasites & Vectors,* 13. https://doi.org/10.1186/s13071-020-04120-3

Mayoke, A., Ouma, J.O., Mireji, P.O., Omondi, S.F., Muya, S.M., Itoua, A., Okoth, S.O. & Bateta, R. 2020b. Population structure and migration patterns of the tsetse fly *Glossina fuscipes* in Congo-Brazzaville. *The American Journal of Tropical Medicine and Hygiene,* 104(3): 917–927. https://doi.org/10.4269/ajtmh.20-0774

Mbang Nguema, O.A., Bouyou-Akotet, M.K, Mavoungou, J. & Mawili Mboumba, D.P. 2019. Variations of *Glossina* sp. and trypanosome species frequency within different habitats in a sleeping sickness focus, Gabon. *Journal of Infection in Developing Countries,* 13(1): 67–72. https://doi.org/10.3855/jidc.9654

Mbang Nguema, O.A., Mawili-Mboumba, D.P., Chouaibou, M., Mavoungou, J., M'batchi, B. & Bouyou-Akotet, M.K. 2016. High frequency of (Kinetoplastida: Trypanosomatidae) type among (Diptera: Glossinidae) in a historic Trypanosoma foci in north-eastern Gabon: Preliminary study. *Journal of Medical Entomology,* 53(4): 945–948. https://doi.org/10.1093/jme/tjw047

Mbang Nguema, O.A., Mavoungou, J.F., Mawili-Mboumba, D.P., Zinga Koumba, R.C., Bouyou-Akotet, M.K. & M'batchi, B. 2015. Inventory of potential vectors of trypanosoma and infection rate of the Tsetse fly in the National Park of Ivindo, Gabon. *African Health Sciences,* 15(3): 762–767. https://doi.org/10.4314/ahs.v15i3.9

McNamara, J.J., Laveissiere, C. & Masiga, D.K. 1995. Multiple trypanosome infections in wild tsetse in Côte d'Ivoire detected by PCR analysis and DNA probes. *Acta Tropica,* 59(2): 85–92. https://doi.org/10.1016/0001-706x(94)00087-h

Mihok, S. 2002. The development of a multipurpose trap (the Nzi) for tsetse and other biting flies. *Bulletin of Entomological Research,* 92(5): 385–403. https://doi.org/10.1079/BER2002186

Mihok, S., Moloo, S.K., Odeny, J.O., Brett, R.A., Rakwar, J.G., Munyoki, E., Kiilu, J. *et al.* 1996. Attractiveness of black rhinoceros (Diceros bicornis) to tsetse flies (*Glossina* spp) (Diptera: Glossinidae) and other biting flies. *Bulletin of Entomological Research,* 86(1): 33–41. https://doi.org/10.1017/s0007485300052172

Mihok, S., Otieno, L.H. & Tarimo, C.S. 1992. Trypanosome infection rates in tsetse flies (Diptera: Glossinidae) and cattle during tsetse control operations in the Kagera River region of Rwanda. *Bulletin of Entomological Research,* 82(3): 361–367. https://doi.org/10.1017/S0007485300041158

Moloo, S.K. 1993. The distribution of *Glossina* species in Africa and their natural hosts. *Insect Science and its Application,* 14(4): 511–527. https://doi.org/10.1017/S1742758400014211

Morlais, I., Grébaut, P., Bodo, J.M., Djoha, S. & Cuny, G. 1998. Characterization of trypanosome infections by polymerase chain reaction (PCR) amplification in wild tsetse flies in Cameroon. *Parasitology,* 116(6): 547–554. https://doi.org/10.1017/s0031182098002625

Mounioko, F., Zinga Koumba, C.R., Koumba, A.A., Maganga, G.D., Tamesse, J.L., Simo, G., M'bactchi, B. *et al.* 2018. Contribution to the evaluation of the diversity and abundance of hematophage dipteries in the Moukalaba Doudou National Park (Southern Gabon) in rain season. *International Journal of Advanced Research,* 6(2): 1170–1182. http://dx.doi.org/10.21474/IJAR01/6542

Mounioko, F., Dibakou, E.S., Zinga-Koumba, C.R., Mbang-Nguema, O.A., Acapovi-Yao, G., Mutambwe, S. & Mavoungou, J.F. 2015. Rythme d'activité journalière de *Glossina fuscipes fuscipes*, vecteur majeur de la trypanosomiase humaine africaine dans le parc national de Moukalaba Doudou (Sud-Ouest Gabon). *International Journal of Biological and Chemical Sciences,* 9(1): 419–429. http://dx.doi.org/10.4314/ijbcs.v9i1.35

Mulandane, F.C., Snyman, L.P., Brito, D.R.A., Bouyer, J., Fafetine, J., van den Abbeele, J. & Oosthuizen, M. 2020. Evaluation of the relative roles of the Tabanidae and Glossinidae in the transmission of trypanosomosis in drug resistance hotspots in Mozambique. *Parasites & Vectors,* 13. https://doi.org/10.1186/s13071-020-04087-1

Muyobela, J., Pirk, C.W.W., Yusuf, A.A. & Sole, C.L. 2023. Spatial distribution of *Glossina morsitans* (Diptera: Glossinidae) in Zambia: A vehicle-mounted sticky trap survey and Maxent species distribution model. *PLOS Neglected Tropical Diseases,* 17(7). https://doi.org/10.1371/journal.pntd.0011512

Nash, T.A.M. 1948. *Tsetse Flies in British West Africa.* London, His Majesty's Stationery Office.

Ngari, N.N., Gamba, D.O., Olet, P.A., Zhao, W., Paone, M. & Cecchi, G. 2020. Developing a national atlas to support the progressive control of tsetse-transmitted animal trypanosomosis in Kenya. *Parasites & Vectors,* 13. https://doi.org/10.1186/s13071-020-04156-5

Ngonyoka, A., Gwakisa, P.S., Estes, A.B., Nnko, H.J., Hudson, P.J. & Cattadori, I.M. 2017a. Variation of tsetse fly abundance in relation to habitat and host presence in the Maasai Steppe, Tanzania. *Journal of Vector Ecology,* 42(1): 34–43. https://doi.org/10.1111/jvec.12237

Ngonyoka, A., Gwakisa, P.S., Estes, A.B., Salekwa, L.P., Nnko, H.J., Hudson, P.J. & Cattadori, I.M. 2017b. Patterns of tsetse abundance and trypanosome infection rates among habitats of surveyed villages in Maasai steppe of northern Tanzania. *Infectious Diseases of Poverty,* 6(1). https://doi.org/10.1186/s40249-017-0340-0

Nnko, H.J., Ngonyoka, A., Salekwa, L., Estes, A.B., Hudson, P.J., Gwakisa, P.S. & Cattadori, I.M. 2017. Seasonal variation of tsetse fly species abundance and prevalence of trypanosomes in the Maasai Steppe, Tanzania. *Journal of Vector Ecology,* 42(1): 24–33. https://doi.org/10.1111/jvec.12236

Odeniran, P.O., Macleod, E.T., Ademola, I.O., Ohiolei, J.A., Majekodunmi, A.O. & Welburn, S.C. 2020. Morphological, molecular identification and distribution of trypanosome-transmitting Dipterans from cattle settlements in Southwest Nigeria. *Acta Parasitologica,* 66: 116–128. https://doi.org/10.1007/s11686-020-00260-9

Offori, E.D. 1964. Tsetse flies in Ghana. *Ghana Journal of Science,* 4: 1–8.

Ogedegbe, A. & Rotimi, J. 2006. A survey of tsetse flies (*Glossina* spp) in the Niger Delta area, southern Nigeria. *African Journal of Environment, Pollution and Health,* 5: 68–73.

Omonona, A.O., Abioye, S.A., Odeniran, P.O. & Ademola, I.O. 2020. Distribution of tsetse flies and its *Trypanosoma* species infection in Old Oyo National Park, Nigeria. *The Zoologist,* 18: 33–38. https://doi.org/10.4314/tzool.v18i1.6

Ouma, J.O., Marquez, J.G. & Krafsur, E.S. 2007. Patterns of genetic diversity and differentiation in the tsetse fly *Glossina morsitans morsitans* Westwood populations in East and southern Africa. *Genetica,* 130: 139–151. https://doi.org/10.1007/s10709-006-9001-0

Ouma, J.O., Masake, R.A., Masiga, D.K., Moloo, S.K., Njuguna, J.T. & Ndung'u, J.M. 2000. Comparative sensitivity of dot-ELISA, PCR and dissection method for the detection of trypanosome infections in tsetse flies (Diptera: Glossinidae). *Acta Tropica,* 75(3): 315–321. https://doi.org/10.1016/s0001-706x(00)00065-6

Pagabeleguem, S., Sangaré, M., Bengaly, Z., Akoudjin, M., Belem, A.M.G. & Bouyer, J. 2012. Climate, cattle rearing systems and African animal trypanosomosis risk in Burkina Faso. *PLOS ONE,* 7(11). https://doi.org/10.1371/journal.pone.0049762

Percoma, L., Rayaissé, J.B., Gimonneau, G., Bengaly, Z., Pooda, S.H., Pagabeleguem, S., Ganaba, R. *et al.* 2022. An atlas to support the progressive control of tsetse-transmitted animal trypanosomosis in Burkina Faso. *Parasites & Vectors,* 15. https://doi.org/10.1186/s13071-021-05131-4

Perich, P. 1982. Les foyers de trypanosomiase humaine africaine à *Trypanosoma rhodesiense* (vecteur *Glossina morsitans*) au Burundi. *Médecine tropicale,* 42(1): 33–41.

Phillips, S.J., Anderson, R.P. & Schapire, R.E. 2006. Maximum entropy modeling of species geographic distributions. *Ecological Modelling,* 190 (3–4): 231–259. https://doi.org/10.1016/j.ecolmodel.2005.03.026

Rageau, J. & Adam, J.-P. 1953. Répartition des glossines au Cameroun français (1953). *Revue d'élevage et de médecine vétérinaire des pays tropicaux,* 6(2): 73–76.

Rayaisse, J.-B., Salou, E., Kiema, S., Akoudjin, M., Kaba, D., Kagbadouno, M., Djohan, V. *et al.* 2015. Tsetse diversity and abundance in Southern Burkina Faso in relation with the vegetation. *Parasitology Research,* 114: 3357–3363. https://doi.org/10.1007/s00436-015-4560-6

Rayaisse, J.B., Courtin, F., Akoundjin, M., César, J. & Solano, P. 2009. Influence de l'anthropisation sur la végétation locale et l'abondance des tsé-tsé au sud du Burkina Faso. *Parasite,* 16(1): 21–28. https://doi.org/10.1051/parasite/2009161021

Rogers, D.J. & Robinson, T.P. 2004. Tsetse distribution. In: I. Maudlin, P.H. Holmes & M.A. Miles, eds. *The Trypanosomiases,* pp. 139–179. Wallingford, UK, Cabi Publishing.

Rouamba, J., Salissou, A., Sakandé, H., Jamonneau, V. & Courtin, F. 2019. Identification des Villages à Risque (IVR): Pour un état des lieux de la Trypanosomiase Humaine Africaine au Niger. *Confins,* 42. https://doi.org/10.4000/confins.22982

Saini, R.K. & Simarro, P.P. 2008. *Tsetse survey in Swaziland: Report for WHO*. Geneva, World Health Organization. www.who.int/publications/m/item/tsetse-fly-survey-in-eswatini-april-to-may-2008

Salekwa, L.P., Nnko, H.J., Ngonyoka, A., Estes, A.B., Agaba, M. & Gwakisa, P.S. 2014. Relative abundance of tsetse fly species and their infection rates in Simanjiro, Northern Tanzania. *Livestock Research for Rural* Development, 26(12). www. lrrd.cipav.org.co/lrrd26/12/sale26213.htm

Sasaki, H. & Nishida, T. 1999. Notes on the flies associated with wild chimpanzees at Mahale Mountains National Park, Tanzania, East Africa. *Medical Entomology and Zoology,* 50(2): 151–155. https://doi.org/10.7601/mez.50.151

Shereni, W., Neves, L., Argilés, R., Nyakupinda, L. & Cecchi, G. 2021. An atlas of tsetse and animal African trypanosomiasis in Zimbabwe. *Parasites & Vectors,* 14. https://doi.org/10.1186/s13071-020-04555-8

Shereni, W., Anderson, N.E., Nyakupinda, L. & Cecchi, G. 2016. Spatial distribution and trypanosome infection of tsetse flies in the sleeping sickness focus of Zimbabwe in Hurungwe District. *Parasites & Vectors,* 9. https://doi.org/10.1186/s13071-016-1879-5

Sigauque, I., van den Bossche, P., Moiana, M., Jamal, S. & Neves, L. 2000. The distribution of tsetse (Diptera: Glossinidae) and bovine trypanosomosis in the Matutuine District, Maputo Province, Mozambique. *Onderstepoort Journal of Veterinary Research*, 67: 167–172. www.repository.up.ac.za/bitstream/handle/2263/19417/26sigauque2000.pdf

Simarro, P.P., Cecchi, G., Franco, J.R., Paone, M., Diarra, A., Priotto, G., Mattioli, R.C. *et al.* 2015. Monitoring the progress towards the elimination of gambiense human African trypanosomiasis. *PLOS Neglected Tropical Diseases,* 9(6). https://doi.org/10.1371/journal.pntd.0003785

Simarro, P.P., Cecchi, G., Franco, J.R., Paone, M., Diarra, A., Ruiz-Postigo, J.A., Mattioli, R.C. *et al.* 2014. Mapping the capacities of fixed health facilities to cover people at risk of gambiense human African trypanosomiasis. *International Journal of Health Geographics,* 13. https://doi.org/10.1186/1476-072X-13-4

Simarro, P.P., Cecchi, G., Franco, J.R., Paone, M., Diarra, A., Ruiz-Postigo, J.A., Fèvre, E.M. *et al.* 2012a. Estimating and mapping the population at risk of sleeping sickness. *PLOS Neglected Tropical Diseases,* 6(10). https://doi.org/10.1371/journal.pntd.0001859

Simarro, P.P., Franco, J.R., Cecchi, G., Paone, M., Diarra, A., Ruiz-Postigo, J.A. & Jannin, J.G. 2012b. Human African trypanosomiasis in non-endemic countries (2000–2010). *Journal of Travel Medicine,* 19(1): 44–53. https://doi.org/10.1111/j.1708-8305.2011.00576.x

Simarro, P.P., Cecchi, G., Franco, J.R., Paone, M., Fèvre, E.M., Diarra, A., Ruiz-Postigo, J.A. *et al.* 2011. Risk for human African trypanosomiasis, Central Africa, 2000–2009. *Emerging Infectious Diseases,* 17 (12): 2322–2324. https://doi.org/10.3201/eid1712.110921

Simarro, P.P., Cecchi, G., Paone, M., Franco, J.R., Diarra, A., Ruiz, J.A., Fèvre, *et al.* 2010. The Atlas of human African trypanosomiasis: A contribution to global mapping of neglected tropical diseases. *International Journal of Health Geographics,* 9. https://doi.org/10.1186/1476-072X-9-57

Simo, G., Magang, E.M.K., Mewamba, E.M., Farikou, O., Kamga, R.M.N., Tume, C., Solano, P. *et al.* 2020. Molecular identification of diminazene aceturate resistant trypanosomes in tsetse flies from Yoko in the Centre region of Cameroon and its epidemiological implications. *Parasite Epidemiology and Control,* 9. https://doi.org/10.1016/j.parepi.2020.e00135

Simo, G., Silatsa, B., Flobert, N., Lutumba, P., Mansinsa, P., Madinga, J., Manzambi, E. *et al.* 2012. Identification of different trypanosome species in the mid-guts of tsetse flies of the Malanga (Kimpese) sleeping sickness focus of the Democratic Republic of Congo. *Parasites & Vectors,* 5. https://doi.org/10.1186/1756-3305-5-201

Solano, P., Argiro, L., Reifenberg, J.M., Yao, Y. & Duvallet, G. 1995. Field application of the polymerase chain reaction (PCR) to the detection and characterization of trypanosomes in *Glossina longipalpis* (Diptera: Glossinidae) in Côte d'Ivoire. *Molecular Ecology,* 4(6): 781–786. https://doi.org/10.1111/j.1365-294X.1995.tb00280.x

Soudah, B., Essodina, T., Toï, N., Balabadi, D., Yao, L., Somda, M.B., S. & Salou, E.W. 2022. Assessment of α-cypermethrin pour-on application and diminazene aceturate for treating trypanosome-related diseases caused by tsetse flies on cattle in Mô, Togo. *Journal of Medical Entomology,* 59(2): 598–606. https://doi.org/10.1093/jme/tjab201

Späth, J. 2000. Feeding patterns of three sympatric tsetse species (*Glossina* spp.) (Diptera: Glossinidae) in the preforest zone of Cote d'Ivoire. *Acta Tropica,* 75(1): 109–118. https://doi.org/10.1016/s0001-706x(99)00096-0

Späth, J. 1997. Natural host odours as possible attractants for *Glossina tachinoides* and *G. longipalpis* (Diptera: Glossinidae). *Acta Tropica,* 68(2): 149–158. https://doi.org/10.1016/s0001-706x(97)00083-1

Stiles, J.K., Otieno, L.H., Chaudhury, M.F.B. & Moloo, S.K. 1994. Upsurge of the tsetse fly *Glossina swynnertoni* at Nguruman, Kenya. *Medical and Veterinary Entomology,* 8(2): 199–200. https://doi.org/10.1111/j.1365-2915.1994.tb00164.x

Thakersi, H. 1992. New records of tsetse flies in Eastern Zimbabwe. *Transactions of the Zimbabwe Scientific Association,* 66: 30–34.

Truc, P., Grébaut, P., Lando, A., Donzoau, F.M., Penchenier, L., Herder, S., Geiger, A. *et al.* 2011. Epidemiological aspects of the transmission of the parasites causing human African trypanosomiasis in Angola. *Annals of Tropical Medicine and Parasitology,* 105(3): 261–265. https://doi.org/10.1179/136485911x12987676649467

van Zyl, J.J. 2001. The Shuttle Radar Topography Mission (SRTM): a breakthrough in remote sensing of topography. *Acta Astronautica,* 48(5–12): 559–565. https://doi.org/10.1016/S0094-5765(01)00020-0

Vreysen, M.J.B., Seck, M.T., Sall, B., Mbaye, A.G., Bassene, A., Fall, G., Lô, M. *et al.* 2021. Area-wide integrated management of a *Glossina palpalis gambiensis* population from the Niayes area of Senegal: A review of operational research in support of a phased conditional approach. In: J. Hendrichs, R. Pereira & M.J.B.Vreysen, eds. *Area-wide Integrated Pest Management: Development and Field Application*, Boca Raton, Florida, USA, CRC Press.

Vreysen, M.J.B., Saleh, K.M., Ali, M.Y., Abdulla, A.M., Zhu, Z.-R., Juma, K.G., Dyck, V.A. *et al.* 2000. *Glossina austeni* (Diptera: Glossinidae) erradicated on the island of Unguja, Zanzibar, using the sterile insect technique. *Journal of Economic Entomology,* 93(1): 123–135. https://doi.org/10.1603/0022-0493-93.1.123

Vreysen, M.J.B., Khamis, I.S. & van der Vloedt, A.M.V. 1996. Evaluation of sticky panels to monitor populations of *Glossina austeni* (Diptera: Glossinidae) on Unguja island of Zanzibar. *Bulletin of Entomological Research,* 86(3): 289–296. https://doi.org/10.1017/s0007485300052585

World Organisation for Animal Health (WOAH). 2021. Infection with *Trypanosoma brucei*, *T. congolense*, *T. simiae* and *T. vivax*. In: WOAH, *Terrestrial Animal Health Code*. Paris, 2023.

WHO. 2013. *Control and surveillance of human African trypanosomiasis*. Geneva, World Health Organization. http://apps.who.int/iris/bitstream/10665/95732/1/9789241209847_eng.pdf

Wint, W. & Rogers, D. 2000. *Consultants report: Predicted distributions of tsetse in Africa*. Rome, FAO.

Zinga Koumba, C.R., Mbang Nguema, O., Midoko Iponga, D., Mounioko, F., Mutambwe, S., Mavoungou J. F. & M'batchi, B. 2016. Repartition des Glossines dans la province de l'Ogooué Ivindo ancien foyer de trypanosomose humaine africaine. *European Scientific Journal,* 12(12): 281–297. https://doi.org/10.19044/esj.2016.v12n12p281

Zinga Koumba, C.R., Mbang Nguema, O.A., Kohagne Tongué, L., Yao, G.L.A., Kutomy, P.O.O., Mutambwe, S. & Mavoungou, J.F. 2014. Contribution à l'évaluation de la diversité des vecteurs biologiques de la Trypanosomose Humaine Africaine et de leur activité journalière dans le Parc National de l'Ivindo (Nord est Gabon). *Journal of Applied Biosciences,* 80: 7060–7070. https://doi.org/10.4314/jab.v80i1.8

Zinga Koumba, R.C., Bouyer, J., Mavoungou, J.F., Acapovi-Yao, G.L., Kohagne Tongué, L., Mbang Nguema, O.A. & Ondo, K.P.O. 2013. Evaluation de la diversité des diptères hématophages dans une clairière marécageuse du Gabon à l'aide des pièges Vavoua et Nzi. *Revue d'élevage et de médecine vétérinaire des pays tropicaux*, 66(3): 91–96. https://doi.org/10.19182/remvt.10136

Annexes

Annex 1
Scientific papers used as sources to develop the atlas

1 Byamungu, M. *et al.* Standardising visual control devices for Tsetse: East and Central African Savannah species *Glossina swynnertoni*, *G. morsitans centralis* and *G. pallidipes*. *PLOS Neglected Tropical Diseases* 12 (2018). https://doi.org/10.1371/journal.pntd.0006831

2 Geiger, A. *et al.* First isolation of *Enterobacter*, *Enterococcus*, and *Acinetobacter* spp. as inhabitants of the tsetse fly (*Glossina palpalis palpalis*) midgut. *Infection Genetics and Evolution* 9, 1364-1370 (2009). https://doi.org/10.1016/j.meegid.2009.09.013

3 Gomes, J. *et al.* Molecular identification of *T. brucei* s.l. in tsetse flies after long-term permanence in field traps. *The Journal of Infection in Developing Countries* 3, 735-738 (2009). https://doi.org/10.3855/jidc.389

4 Kaba, D. *et al.* Standardising Visual Control Devices for Tsetse Flies: Central and West African Species *Glossina palpalis palpalis*. *PLOS Neglected Tropical Diseases* 8 (2014). https://doi.org/10.1371/journal.pntd.0002601

5 Truc, P. *et al.* Epidemiological aspects of the transmission of the parasites causing human African trypanosomiasis in Angola. *Annals of Tropical Medicine and Parasitology* 105, 261-265 (2011). https://doi.org/10.1179/136485911x12987676649467

6 Dehoux, J. P. Lutte contre *Glossina tachinoides* au Bénin. Utilisation particulière de piège-pneus imprégnés de deltaméthrine. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 46, 581-589 (1993). https://doi.org/10.19182/remvt.9414

7 Allsopp, R. & Phillemon-Motsu, T. K. Tsetse control in Botswana-a reversal in strategy. *Pesticide Outlook* 13, 73-76 (2002). https://doi.org/10.1039/B202993F

8 Kgori, P. M., Modo, S. & Torr, S. J. The use of aerial spraying to eliminate tsetse from the Okavango Delta of Botswana. *Acta Tropica* 99, 184-199 (2006). https://doi.org/10.1016/j.actatropica.2006.07.007

9 Krafsur, E. S., Endsley, M. A., Wohlford, D. L., Griffiths, N. T. & Allsopp, R. Genetic differentiation of *Glossina morsitans centralis* populations. *Insect Molecular Biology* 10, 387-395 (2001). https://doi.org/10.1046/j.0962-1075.2001.00277.x

10 Amsler, S., Filledier, J. & Millogo, R. Attractifs olfactifs pour la capture de *Glossina tachinoides* et *Glossina morsitans submorsitans* (Diptera : Glossinidae) au Burkina Faso. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 47, 301-311 (1994). https://doi.org/10.19182/remvt.9093

11 Amsler, S., Filledier, J. & Millogo, R. Efficacité comparée de différents pièges pour la capture de *Glossina tachinoides* (Diptera : Glossinidae) au Burkina Faso. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 47, 207-214 (1994). https://doi.org/10.19182/remvt.9111

12 Amsler, S. & Filledier, J. Comparaison de différents systèmes de collecte avec deux types de pièges pour la capture des glossines et des Tabanidés. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 47, 387-396 (1994). http://agritrop.cirad.fr/532223/1/ID532223.pdf

13 Amsler-Delafosse, S., Kabore, I. & Bauer, B. Lutte contre les vecteurs de la trypanosomose animale africaine au Burkina Faso. *Cahiers Agricultures* 4, 440-443 (1995). [Cited 10 January 2024.] https://revues.cirad.fr/index.php/cahiers-agricultures/article/view/29919/29679

14 Augustinos, A. A. *et al.* Nuclear and *Wolbachia*-based multimarker approach for the rapid and accurate identification of tsetse species. *BMC Microbiology* 18 (2018). https://doi.org/10.1186/s12866-018-1295-4

15 Bauer, B., Amsler-Delafosse, S., Kaboré, I. & Kamuanga, M. Improvement of Cattle Productivity through Rapid Alleviation of African Animal Trypanosomosis by Integrated Disease Management Practices in the Agropastoral Zone of Yalé, Burkina Faso. *Tropical Animal Health and Production* 31, 89-102 (1999). https://doi.org/10.1023/A:1005115707181

16 Bauer, B., Amslerdelafosse, S., Clausen, P. H., Kabore, I. & Petrichbauer, J. Successful application of deltamethrin pour on to cattle in a campaign against tsetse flies (*Glossina* spp.) in the pastoral zone of Samorogouan, Burkina Faso. *Tropical Medicine and Parasitology* 46, 183-189 (1995).

17 Bouyer, J., Koné, N. & Bengaly, Z. Dynamics of tsetse natural infection rates in the Mouhoun river, Burkina Faso, in relation with environmental factors. *Frontiers in Cellular and Infection Microbiology* 3 (2013). https://doi.org/10.3389/fcimb.2013.00047

18 Bouyer, J. *et al.* Population structure of *Glossina palpalis gambiensis* (Diptera: Glossinidae) between river basins in Burkina Faso: Consequences for area-wide integrated pest management. *Infection Genetics and Evolution* 10, 321-328 (2010). https://doi.org/10.1016/j.meegid.2009.12.009

19 Bouyer, J. Does isometamidium chloride treatment protect tsetse flies from trypanosome infections during SIT campaigns? *Medical and Veterinary Entomology* 22, 140-143 (2008). https://doi.org/10.1111/j.1365-2915.2008.00727.x

20 Bouyer, J., Guerrini, L., Cesar, J., De la Rocque, S. & Cuisance, D. A phyto-sociological analysis of the distribution of riverine tsetse flies in Burkina Faso. *Medical and Veterinary Entomology* 19, 372-378 (2005). https://doi.org/10.1111/j.1365-2915.2005.00584.x

21 Dama, E. *et al.* Identification of *Glossina palpalis gambiensis* specific salivary antigens: towards the development of a serologic biomarker of human exposure to tsetse flies in West Africa. *Microbes and Infection* 15, 416-427 (2013). https://doi.org/10.1016/j.micinf.2013.03.001

22 De La Rocque, S., Michel, J.-F., Bouyer, J., De Wispelaere, G. & Cuisance, D. Geographical information systems in parasitology: a review of potential applications using the example of animal trypanosomosis in West Africa. *Parassitologia* 47, 97 (2005). http://agritrop.cirad.fr/540987/1/document_540987.pdf

23 De La Rocque, S. *et al.* Importance des interfaces spatiales et temporelles entre les bovins et les glossines dans la transmission de la trypanosomose animale en Afrique de l'Ouest. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 52, 215-222 (1999). https://doi.org/10.19182/remvt.9666

24 De La Rocque, S. *et al.* PCR Analysis and Spatial Repartition of Trypanosomes Infecting Tsetse Flies in Sidéradougou Area of Burkina Fasoa. *Annals of the New York Academy of Sciences* 849, 32-38 (1998). https://doi.org/10.1111/j.1749-6632.1998.tb11030.x

25 De Meeus, T., Bouyer, J., Ravel, S. & Solano, P. Ecotype Evolution in *Glossina palpalis* Subspecies, Major Vectors of Sleeping Sickness. *PLOS Neglected Tropical Diseases* 9 (2015). https://doi.org/10.1371/journal.pntd.0003497

26 De Meeus, T. *et al.* Genetic correlations within and between isolated tsetse populations: What can we learn? *Acta Tropica* 138, S6-S11 (2014). https://doi.org/10.1016/j.actatropica.2014.03.004

27 De Meeus, T., Ravel, S., Rayaisse, J. B., Courtin, F. & Solano, P. Understanding local population genetics of tsetse: The case of an isolated population of *Glossina palpalis gambiensis* in Burkina Faso. *Infection Genetics and Evolution* 12, 1229-1234 (2012). https://doi.org/10.1016/j.meegid.2012.04.005

28 Desquesnes, M. & Dia, M. L. Mechanical transmission of *Trypanosoma vivax* in cattle by the African tabanid *Atylotus fuscipes*. *Veterinary Parasitology* 119, 9-19 (2004). https://doi.org/10.1016/j.vetpar.2003.10.015

29 Desquesnes, M. & Dia, M. L. *Trypanosoma vivax*: mechanical transmission in cattle by one of the most common African tabanids, *Atylotus agrestis*. *Experimental Parasitology* 103, 35-43 (2003). https://doi.org/https://doi.org/10.1016/S0014-4894(03)00067-5

30 Doudoumis, V. *et al.* Challenging the *Wigglesworthia, Sodalis, Wolbachia* symbiosis dogma in tsetse flies: *Spiroplasma* is present in both laboratory and natural populations. *Scientific Reports* 7, 4699 (2017). https://doi.org/10.1038/s41598-017-04740-3

31 Duvallet, G. *et al.* Review on the Molecular Tools for the Understanding of the Epidemiology of Animal Trypanosomosis in West Africa. *Memórias do Instituto Oswaldo Cruz* 94 (1999). https://doi.org/10.1590/S0074-02761999000200023

32 Esterhuizen, J. *et al.* Improving the Cost-Effectiveness of Visual Devices for the Control of Riverine Tsetse Flies, the Major Vectors of Human African Trypanosomiasis. *PLOS Neglected Tropical Diseases* 5 (2011). https://doi.org/10.1371/journal.pntd.0001257

33 Hoppenheit, A., Murugaiyan, J., Bauer, B., Clausen, P. H. & Roesler, U. Analysis of *Glossina palpalis gambiensis* and *Glossina tachinoides* from two distant locations in Burkina Faso using MALDI TOF MS. *Parasitology Research* 113, 723-726 (2014). https://doi.org/10.1007/s00436-013-3701-z

34 Kamuanga, M. & Kabore, I. La lutte contre les glossines dans la zone agropastorale de Yalé (Burkina Faso): résultats d'enquêtes socio-économiques. *Tropicultura* 23, 146-153 (2005). www.tropicultura.org/text/v23n3/146.pdf

35 Kone, N. *et al.* Contrasting Population Structures of Two Vectors of African Trypanosomoses in Burkina Faso: Consequences for Control. *PLOS Neglected Tropical Diseases* 5 (2011). https://doi.org/10.1371/journal.pntd.0001217

36 Kone, N., N'Goran, E. K., Sidibe, I., Kombassere, A. W. & Bouyer, J. Spatio-temporal distribution of tsetse and other biting flies in the Mouhoun River basin, Burkina Faso. *Medical and Veterinary Entomology* 25, 156-168 (2011). https://doi.org/10.1111/j.1365-2915.2010.00938.x

37 Kone, N. *et al.* Population structuring of the tsetse *Glossina tachinoides* resulting from landscape fragmentation in the Mouhoun River basin, Burkina Faso. *Medical and Veterinary Entomology* 24, 162-168 (2010). https://doi.org/10.1111/j.1365-2915.2010.00857.x

38 Laveissière, C. *et al.* Trapping tsetse flies on water. *Parasite* 18, 141-144 (2011). https://doi.org/10.1051/parasite/2011182141

39 Lefrançois, T. *et al.* Polymerase chain reaction characterization of trypanosomes in *Glossina morsitans submorsitans* and *G. tachinoides* collected on the game ranch of Nazinga, Burkina Faso. *Acta Tropica* 72, 65-77 (1999). https://doi.org/10.1016/s0001-706x(98)00080-1

40 Lefrançois, T. *et al.* New epidemiological features on animal trypanosomiasis by molecular analysis in the pastoral zone of Sideradougou, Burkina Faso. *Molecular Ecology* 7, 897-904 (1998). https://doi.org/10.1046/j.1365-294x.1998.00420.x

41 McDermott, J. *et al.* Field studies of drug-resistant cattle trypanosomes in Kenedougou Province, Burkina Faso. *Acta Tropica* 86, 93-103 (2003). https://doi.org/10.1016/s0001-706x(03)00019-6

42 Ouedraogo, G. M. S. *et al.* Prevalence of trypanosomes, salivary gland hypertrophy virus and *Wolbachia* in wild populations of tsetse flies from West Africa. *BMC Microbiology* 18 (2018). https://doi.org/10.1186/s12866-018-1287-4

43 Pagabeleguem, S. *et al.* A Molecular Method to Discriminate between Mass-Reared Sterile and Wild Tsetse Flies during Eradication Programmes That Have a Sterile Insect Technique Component. *PLOS Neglected Tropical Diseases* 10 (2016). https://doi.org/10.1371/journal.pntd.0004491

44 Pagabeleguem, S. *et al.* Climate, Cattle Rearing Systems and African Animal Trypanosomosis Risk in Burkina Faso. *PLOS ONE* 7 (2012). https://doi.org/10.1371/journal.pone.0049762

45 Percoma, L. *et al.* Impact of an integrated control campaign on tsetse populations in Burkina Faso. *Parasites & Vectors* 11 (2018). https://doi.org/10.1186/s13071-017-2609-3

46 Percoma, L. *et al.* Enquêtes entomologiques préparatoires à une lutte à grande échelle contre les glossines, assistées par un système d'information géographique : cas de la Pattec au Burkina Faso. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 68, 157-165 (2016). https://doi.org/10.19182/remvt.31163

47 Ravel, S., Rayaisse, J. B., Courtin, F., Solano, P. & de Meeus, T. Genetic signature of a recent southern range shift in *Glossina tachinoides* in East Burkina Faso. *Infection Genetics and Evolution* 18, 309-314 (2013). https://doi.org/10.1016/j.meegid.2013.05.024

48 Rayaisse, J. B. *et al.* Baited-boats: an innovative way to control riverine tsetse, vectors of sleeping sickness in West Africa. *Parasites & Vectors* 8 (2015). https://doi.org/10.1186/s13071-015-0851-0

49 Rayaisse, J. B. *et al.* Tsetse diversity and abundance in Southern Burkina Faso in relation with the vegetation. *Parasitology Research* 114, 3357-3363 (2015). https://doi.org/10.1007/s00436-015-4560-6

50 Rayaisse, J. B. *et al.* Standardizing Visual Control Devices for Tsetse Flies: West African Species *Glossina tachinoides*, *G. palpalis gambiensis* and *G. morsitans submorsitans*. *PLOS Neglected Tropical Diseases* 6 (2012). https://doi.org/10.1371/journal.pntd.0001491

51 Rayaisse, J. B. *et al.* Towards an Optimal Design of Target for Tsetse Control: Comparisons of Novel Targets for the Control of Palpalis Group Tsetse in West Africa. *PLOS Neglected Tropical Diseases* 5 (2011). https://doi.org/10.1371/journal.pntd.0001332

52 Rayaisse, J. B. *et al.* Prospects for the Development of Odour Baits to Control the Tsetse Flies *Glossina tachinoides* and *G. palpalis s.l. PLOS Neglected Tropical Diseases* 4 (2010). https://doi.org/10.1371/journal.pntd.0000632

53 Rayaisse, J. B., Courtin, F., Akoundjin, M., César, J. & Solano, P. Influence de l'anthropisation sur la végétation locale et l'abondance des tsé-tsé au sud du Burkina Faso. *Parasite* 16, 21-28 (2009). https://doi.org/10.1051/parasite/2009161021

54 Reifenberg, J.-M. *et al.* Apport de la technique PCR pour une meilleure compréhension de l'épizootiologie des trypanosomoses bovines : exemple de la zone d'aménagement pastoral de Yalé au Burkina Faso. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 50, 14-22 (1997). https://doi.org/10.19182/remvt.9596

55 Rouamba, J., Jamonneau, V., Sidibé, I., Solano, P. & Courtin, F. Impact de la dynamique de peuplement sur la distribution des glossines et des trypanosomoses dans la boucle du Mouhoun (Burkina Faso). *Parasite* 16, 11-19 (2009). https://doi.org/10.1051/parasite/2009161011

56 Salou, E. *et al.* Variations in attack behaviours between *Glossina palpalis gambiensis* and *G. tachinoides* in a gallery forest suggest host specificity. *Medical and Veterinary Entomology* 30, 403-409 (2016). https://doi.org/10.1111/mve.12187

57 Salou, E., Rayaissé, J. B., Laveissière, C., Sanon, A. & Solano, P. Interactions comportementales et rythmes d'activité de *Glossina palpalis gambiensis* et *G. tachinoides* (Diptera : Glossinidae) en galerie forestière au Burkina Faso. *Parasite* 19, 217-225 (2012). https://doi.org/10.1051/parasite/2012193217

58 Sedda, L., Guerrini, L., Bouyer, J., Koné, N. & Rogers, D. J. Spatio-temporal modelling of *Glossina palpalis gambiensis* and *Glossina tachinoides* apparent densities in fragmented ecosystems of Burkina Faso. *Ecography* 33, 772-783 (2010). https://doi.org/10.1111/j.1600-0587.2009.06135.x

59 Solano, P. *et al.* Do tsetse flies only feed on blood? *Infection Genetics and Evolution* 36, 184-189 (2015). https://doi.org/10.1016/j.meegid.2015.09.016

60 Solano, P. *et al.* Microsatellite DNA markers reveal genetic differentiation among populations of *Glossina palpalis gambiensis* collected in the agro-pastoral zone of Sideradougou, Burkina Faso. *Insect Molecular Biology* 9, 433-439 (2000). https://doi.org/10.1046/j.1365-2583.2000.00205.x

61 Solano, P. *et al.* Intraspecific variability in natural populations of *Glossina palpalis gambiensis* from West Africa, revealed by genetic and morphometric analyses. *Medical and Veterinary Entomology* 13, 401-407 (1999). https://doi.org/10.1046/j.1365-2915.1999.00189.x

62 Solano, P. *et al.* Trypanosome characterization by polymerase chain reaction in *Glossina palpalis gambiensis* and *G. tachinoides* from Burkina Faso. *Medical and Veterinary Entomology* 10, 354-358 (1996). https://doi.org/10.1111/j.1365-2915.1996.tb00756.x

63 Solano, P. & Amsler Delafosse, S. *Trypanosoma congolense* chez différentes espèces de taons (Diptera: Tabanidae) au Burkina Faso. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 48, 145-146 (1995). https://doi.org/10.19182/remvt.9465

64 Somda, M. B. *et al.* First insights into the cattle serological response to tsetse salivary antigens: A promising direct biomarker of exposure to tsetse bites. *Veterinary Parasitology* 197, 332-340 (2013). https://doi.org/10.1016/j.vetpar.2013.05.018

65 Sow, A. *et al.* Irradiated Male Tsetse from a 40-Year-Old Colony Are Still Competitive in a Riparian Forest in Burkina Faso. *PLOS ONE* 7 (2012). https://doi.org/10.1371/journal.pone.0037124

66 Achukwi, M. D., Gillingwater, J., Nloga, A. M. N. & Simo, G. Lack of evidence for sufficiently isolated populations of *Glossina morsitans submorsitans* on the Adamawa plateau of Cameroon following geometric morphometric analysis. *Advances in Entomology* 1, 1-7 (2013). http://dx.doi.org/10.4236/ae.2013.11001

67 Achukwi, M. D. & Musongong, G. A. Trypanosomosis in the Doayo/Namchi (*Bos taurus*) and zebu white Fulani (*Bos indicus*) cattle in Faro division, North Cameroon. *Journal of Applied Biosciences* 15, 807-814 (2009). https://m.elewa.org/JABS/2009/15/2.pdf

68 Farikou, O. *et al.* Genetic Diversity and Population Structure of the Secondary Symbiont of Tsetse Flies, *Sodalis glossinidius*, in Sleeping Sickness Foci in Cameroon. *PLOS Neglected Tropical Diseases* 5 (2011). https://doi.org/10.1371/journal.pntd.0001281

69 Farikou, O. *et al.* Tsetse fly blood meal modification and trypanosome identification in two sleeping sickness foci in the forest of southern Cameroon. *Acta Tropica* 116, 81-88 (2010). https://doi.org/10.1016/j.actatropica.2010.06.002

70 Farikou, O. *et al.* Tripartite interactions between tsetse flies, *Sodalis glossinidius* and trypanosomes-An epidemiological approach in two historical human African trypanosomiasis foci in Cameroon. *Infection Genetics and Evolution* 10, 115-121 (2010). https://doi.org/10.1016/j.meegid.2009.10.008

71 Fogue, P. S., Njiokou, F. & Simo, G. Genetic structure of *Trypanosoma congolense* "forest type" circulating in domestic animals and tsetse flies in the South-West region of Cameroon. *Parasite* 24 (2017). https://doi.org/10.1051/parasite/2017052

72 Geiger, A. *et al.* Bacterial Diversity Associated with Populations of *Glossina* spp. from Cameroon and Distribution within the Campo Sleeping Sickness Focus. *Microbial Ecology* 62, 632-643 (2011). https://doi.org/10.1007/s00248-011-9830-y

73 Grébaut, P. *et al.* Xenomonitoring of sleeping sickness transmission in Campo (Cameroon). *Parasites & Vectors* 9 (2016). https://doi.org/10.1186/s13071-016-1479-4

74 Grébaut, P. *et al.* Spatial and temporal patterns of Human African Trypanosomosis (HAT) Transmission risk in the Bipindi focus, in the forest zone of southern Cameroon. *Vector-Borne & Zoonotic Diseases* 4, 230-238 (2004). https://doi.org/10.1089/vbz.2004.4.230

75 Jacob, F. *et al.* Intestinal Bacterial Communities of Trypanosome-Infected and Uninfected *Glossina palpalis palpalis* from Three Human African Trypanomiasis Foci in Cameroon. *Frontiers in Microbiology* 8 (2017). https://doi.org/10.3389/fmicb.2017.01464

76 Kamdem, C. N. *et al.* Molecular identification of different trypanosome species in tsetse flies caught in the wildlife reserve of Santchou in the western region of Cameroon. *Parasitology Research* 119, 805-813 (2020). https://doi.org/10.1007/s00436-020-06606-6

77 Kame-Ngasse, G. I. *et al.* Prevalence of symbionts and trypanosome infections in tsetse flies of two villages of the "Faro and Deo" division of the Adamawa region of Cameroon. *BMC Microbiology* 18 (2018). https://doi.org/10.1186/s12866-018-1286-5

78 Kante, S. T., Melachio, T., Ofon, E., Njiokou, F. & Simo, G. Detection of *Wolbachia* and different trypanosome species in *Glossina palpalis palpalis* populations from three sleeping sickness foci of southern Cameroon. *Parasites & Vectors* 11 (2018). https://doi.org/10.1186/s13071-018-3229-2

79 Kohagne Tongué, L., Acapovi-Yao, G. L., Kaba, D., Abah, S. & Nchiwan, E. N. Updating tsetse distribution: presence of *Austenina* subgenus group in Northern Cameroon. *Journal of Basic and Applied Research International* 7, 66-72 (2015).

80 Mamoudou, A. *et al.* Preliminary assessment of bovine trypanosomiasis and its vectors in Santa, Bali and Bafut Sub-Divisions of the, North West Region, Cameroon. *International Journal of Biological and Chemical Sciences* 10, 1-12 (2016). https://doi.org/10.4314/ijbcs.v10i1.1

81 Mamoudou, A., Njanloga, A., Hayatou, A., Suh, P. F. & Achukwi, M. D. Animal trypanosomosis in clinically healthy cattle of north Cameroon: epidemiological implications. *Parasites & Vectors* 9 (2016). https://doi.org/10.1186/s13071-016-1498-1

82 Mamoudou, A., Woudamyata, A., Mouiche, M. & Zoli, P. Control of bovine trypanosomiasis and its vectors through the use of 3% cypermethrin in the infested area of Adamawa, Cameroon. *Bulletin of Animal Health and Production in Africa* 63, 33-42 (2015). [Cited 11 January 2024.] http://repository.au-ibar.org/xmlui/bitstream/handle/123456789/478/BAHPA_63-1.pdf?sequence=1&isAllowed=y#page=33

83 Mamoudou, A. *et al.* Seasonal distribution and abundance of tsetse flies (*Glossina* spp.) in the Faro and Deo Division of the Adamaoua Plateau in Cameroon. *Medical and Veterinary Entomology* 22, 32-36 (2008). https://doi.org/10.1111/j.1365-2915.2008.00711.x

84 Mamoudou, A. *et al.* Prevalence and incidence of bovine trypanosomosis on the Adamaoua plateau in Cameroon 10 years after the tsetse eradication campaign. *Veterinary Parasitology* 142, 16-22 (2006). https://doi.org/10.1016/j.vetpar.2006.06.033

85 Massussi, J. A. *et al.* Diversity and spatial distribution of vectors and hosts of *T. brucei* gambiense in forest zones of, Southern Cameroon: Epidemiological implications. *Acta Tropica* 114, 44-48 (2010). https://doi.org/10.1016/j.actatropica.2010.01.002

86 Mbida, J. A. M., Mimpfoundi, R., Njiokou, F., Manga, L. & Laveissière, C. Distribution et écologie des vecteurs de la trypanosomose humaine africaine de type savanicole en zone de forêt dégradée au sud Cameroun: cas du foyer de Doumé. *Bulletin de la Société Pathologique Exotique* 102, 101-105 (2009). https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers12-10/010046534.pdf

87 Mélachio, T. T. T. *et al.* Effect of sampling methods, effective population size and migration rate estimation in *Glossina palpalis palpalis* from Cameroon. *Infection Genetics and Evolution* 33, 150-157 (2015). https://doi.org/10.1016/j.meegid.2015.04.023

88 Mélachio , T. T. T. *et al.* Population genetics of *Glossina palpalis palpalis* from central African sleeping sickness foci. *Parasites & Vectors* 4 (2011). https://doi.org/10.1186/1756-3305-4-140

89 Morlais, I., Grebaut, P., Bodo, J. M., Djoha, S. & Cuny, G. Characterization of trypanosome infections by polymerase chain reaction (PCR) amplification in wild tsetse flies in Cameroon. *Parasitology* 116, 547-554 (1998). https://doi.org/10.1017/s0031182098002625

90 Ngomtcho, S. C. H. *et al.* Molecular screening of tsetse flies and cattle reveal different *Trypanosoma* species including *T. grayi* and *T. theileri* in northern Cameroon. *Parasites & Vectors* 10 (2017). https://doi.org/10.1186/s13071-017-2540-7

91 Njiokou, F. *et al.* A study of host preference in tsetse flies using a modified heteroduplex PCR-based method. *Acta Tropica* 91, 117-120 (2004). https://doi.org/10.1016/j.actatropica.2004.03.006

92 Njitchouang, G. R. *et al.* A new transmission risk index for human African trypanosomiasis and its application in the identification of sites of high transmission of sleeping sickness in the Fontem focus of southwest Cameroon. *Medical and Veterinary Entomology* 25, 289-296 (2011). https://doi.org/10.1111/j.1365-2915.2010.00936.x

93 Shaida, S. S. *et al.* Diversity and phylogenetic relationships of *Glossina* populations in Nigeria and the Cameroonian border region. *BMC Microbiology* 18 (2018). https://doi.org/10.1186/s12866-018-1293-6

94 Simo, G. *et al.* Molecular identification of diminazene aceturate resistant trypanosomes in tsetse flies from Yoko in the Centre region of Cameroon and its epidemiological implications. *Parasite Epidemiology and Control* 9, e00135 (2020). https://doi.org/10.1016/j.parepi.2020.e00135

95 Simo, G. *et al.* Trypanosome infection rates in tsetse flies in the "silent" sleeping sickness focus of Bafia in the Centre Region in Cameroon. *Parasites & Vectors* 8 (2015). https://doi.org/10.1186/s13071-015-1156-z

96 Simo, G. *et al.* Population genetics of forest type of *Trypanosoma congolense* circulating in *Glossina palpalis palpalis* of Fontem in the South-West region of Cameroon. *Parasites & Vectors* 7 (2014). https://doi.org/10.1186/1756-3305-7-385

97 Simo, G. *et al.* Challenges towards the elimination of Human African Trypanosomiasis in the sleeping sickness focus of Campo in southern Cameroon. *Parasites & Vectors* 7 (2014). https://doi.org/10.1186/1756-3305-7-374

98 Simo, G., Njitchouang, G. R., Njiokou, F., Cuny, G. & Asonganyi, T. *Trypanosoma brucei* s.l.: Microsatellite markers revealed high level of multiple genotypes in the mid-guts of wild tsetse flies of the Fontem sleeping sickness focus of Cameroon. *Experimental Parasitology* 128, 272-278 (2011). https://doi.org/10.1016/j.exppara.2011.02.023

99 Simo, G. *et al.* Tsetse fly host preference from sleeping sickness foci in Cameroon: Epidemiological implications. *Infection Genetics and Evolution* 8, 34-39 (2008). https://doi.org/10.1016/j.meegid.2007.09.005

100 Tagueu, S. K., Farikou, O., Njiokou, F. & Simo, G. Prevalence of *Sodalis glossinidius* and different trypanosome species in *Glossina palpalis palpalis* caught in the Fontem sleeping sickness focus of the southern Cameroon. *Parasite* 25 (2018). https://doi.org/10.1051/parasite/2018044

101 Tchouomene Labou, J. *et al.* Single-strand conformation polymorphism (SSCP) of mitochondrial genes helps to estimate genetic differentiation, demographic parameters and phylogeny of *Glossina palpalis palpalis* populations from West and Central Africa. *Infection, Genetics and Evolution* 82, 104303 (2020). https://doi.org/10.1016/j.meegid.2020.104303

102 Tchouomene-Labou, J. *et al.* Spatial and temporal variations relevant to tsetse control in the Bipindi focus of southern Cameroon. *Parasites & Vectors* 6 (2013). https://doi.org/10.1186/1756-3305-6-193

103 Tsagmo Ngoune, J. M. *et al.* Transcriptional Profiling of Midguts Prepared from *Trypanosoma/T. congolense*-Positive *Glossina palpalis palpalis* Collected from Two Distinct Cameroonian Foci: Coordinated Signatures of the Midguts' Remodeling As *T. congolense*-Supportive Niches. *Frontiers in Immunology* 8 (2017). https://doi.org/10.3389/fimmu.2017.00876

104 Acapovi-Yao, G., Cissé, B., Mavoungou, J. F., Lendzele, S. S. & Nguertoum, A. E. Preliminary study on vectors of bovine trypanosomosis in the central African republic one decade after the socio-military crisis. *Journal of Animal & Plant Sciences* 39, 6487-6494 (2019). https://m.elewa.org/Journals/wp-content/uploads/2019/03/2.Acapovi-Yao.pdf

105 Artzrouni, M. & Gouteux, J. P. Estimating tsetse population parameters: application of a mathematical model with density-dependence. *Medical and Veterinary Entomology* 17, 272-279 (2003). https://doi.org/10.1046/j.1365-2915.2003.00437.x

106 Blanc, F. *et al.* Etude de la répartition des tsé tsé (Diptera : Glossinidae) en zone de savane humide (République Centrafricaine) : évaluation de techniques de prospection entomologique. *Tropical Medicine and Parasitology* 42, 127-130 (1991). https://horizon.documentation.ird.fr/exl-doc/pleins_textes/pleins_textes_5/b_fdi_31-32/34368.pdf

107 D'Amico, F., Moussa, A., Sarda, J. & Gouteux, J.-P. Distribution et importance des gîtes à *Glossina fuscipes fuscipes* Newstead, 1910 dans l'agglomération de Bangui (République Centrafricaine). *Bulletin de la Société de Pathologie Exotique* 85, 64-68 (1992). https://horizon.documentation.ird.fr/exl-doc/pleins_textes/pleins_textes_5/b_fdi_31-32/35959.pdf

108 Gouteux, J. P., Artzrouni, M. & Jarry, M. A density-dependent model with reinvasion for estimating tsetse fly populations (Diptera: Glossinidae) through trapping. *Bulletin of Entomological Research* 91, 177-183 (2001). https://doi.org/10.1079/BER200185

109 Gouteux, J.-P. Un nouveau dispositif expérimental pour la mise au point de pièges à tsé-tsé. Premier essai sur *Glossina fuscipes fuscipes* en République centrafricaine. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 51, 317-319 (1998). https://revues.cirad.fr/index.php/REMVT/article/download/9615/9609/9616

110 Gouteux, J. P., Le Gall, F., Guillerme, J. M. & Demba, D. Traitement épicutané (Pour on et Spot on) du bétail contre *Glossina fuscipes fuscipes* en République centrafricaine. *Veterinary Research* 27, 273-284 (1996). https://hal.science/hal-00902421/document

111 Gouteux, J. P., Blanc, F., Cuisance, D., d'Amico, F. & Guinza, A. K. Trials of olfactory attractants to enhance trap catches of *Glossina fuscipes fuscipes* (Diptera: Glossinidae) in the Central African republic. *Veterinary research* 26, 335-340 (1995). https://hal.science/file/index/docid/902357/filename/hal-00902357.pdf

112 Gouteux, J. P. *et al.* Tsé-tsé et élevage en République Centrafricaine: le recul de *Glossina morsitans submorsitans* (Diptera, Glossinidae). *Bulletin de la Société de Pathologie Exotique* 87, 52-56 (1994). https://horizon.documentation.ird.fr/exl-doc/pleins_textes/pleins_textes_6/b_fdi_47-48/010012165.pdf

113 Gouteux, J. P. *et al.* Man-fly contact in the Gambian trypanosomiasis focus of Nola-Bilolo (Central African Republic). *Tropical Medicine and Parasitology* 44, 213-218 (1993). https://horizon.documentation.ird.fr/exl-doc/pleins_textes/pleins_textes_6/b_fdi_35-36/39791.pdf

114 Gouteux, J. P., D'Amico, F., Kounda Gboumbi, J. C., Noutoua, L. & Bailly, C. *Glossina fuscipes fuscipes* and *Glossina palpalis palpalis* as joint vectors of sleeping sickness in the focus of Nola-Bilolo in the Central African Republic. *Acta tropica* 51, 163-166 (1992). https://doi.org/10.1016/0001-706x(92)90059-7

115 Gouteux, J. P., Cuisance, D., Demba, D., Ndokoué, F. & Le Gall, F. La lutte par piégeage contre *Glossina fuscipes fuscipes* pour la protection de l'élevage en République centrafricaine. I. Mise au point d'un piège adapté à un milieu d'éleveurs semi-nomades. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 44, 287-294 (1991). https://doi.org/10.19182/remvt.9169

116 Le Gall, F. *et al.* La lutte par piégeage contre *Glossina fuscipes fuscipes* pour la protection de l'élevage en République centrafricaine. IV. Impact entomologique, parasitologique et zootechnique. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 48, 161-169 (1995). https://doi.org/10.19182/remvt.9468

117 Ott, D., Gouteux, J. P. & Sarda, J. Prophylaxie de la trypanosomiase humaine africaine dans les unités séjournant en zone d'endémie. *Médecine et armées* 20, 507-509 (1992).

118 Votypka, J. *et al.* A tsetse and tabanid fly survey of African great apes habitats reveals the presence of a novel trypanosome lineage but the absence of *Trypanosoma brucei*. *International Journal for Parasitology* 45, 741-748 (2015). https://doi.org/10.1016/j.ijpara.2015.06.005

119 Mahamat, M. H. *et al.* Adding tsetse control to medical activities contributes to decreasing transmission of sleeping sickness in the Mandoul focus (Chad). *PLOS Neglected Tropical Diseases* 11 (2017). https://doi.org/10.1371/journal.pntd.0005792

120 Mallaye, P., Kohagne Tongué, L., Ndeledje, N., Louis, F. J. & Mahamat Hassane, H. Transmission concomitante de trypanosomose humaine et animale : le foyer de Mandoul au Tchad. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 67, 5-12 (2014). https://doi.org/10.19182/remvt.10154

121 Ndeledje, N. *et al.* Treating Cattle to Protect People? Impact of Footbath Insecticide Treatment on Tsetse Density in Chad. *PLOS ONE* 8 (2013). https://doi.org/10.1371/journal.pone.0067580

122 Alibu, V. P. *et al.* Molecular xenomonitoring of trypanosomes in tsetse flies. *Journal of Parasitology and Vector Biology* 7, 108-114 (2015). https://doi.org/10.5897/JPVB2015.0188

123 Kohagne Tongué, L., Diabakana, P. M., Bitsindou, P. & Louis, F. J. Have tsetse flies disappeared from Brazzaville town? *Pan African Medical Journal* 3, 3 (2009). https://doi.org/10.4314/pamj.v3i1.52441

124 Laveissière, C., Penchenier, L., Sinda, D. & Zoulani, A. Comparaison de systèmes attractifs pour la lutte contre les *Glossines* au Congo. *International Journal of Tropical Insect Science* 18, 1-7 (1998). https://doi.org/10.1017/S1742758400007396

125 Mayoke, A. *et al.* Population Structure and Migration Patterns of the Tsetse Fly *Glossina fuscipes* in Congo-Brazzaville. *The American Journal of Tropical Medicine and Hygiene* 104, 917-927 (2020). https://doi.org/10.4269/ajtmh.20-0774

126 Mayoke, A. *et al.* Genetic diversity and phylogenetic relationships of tsetse flies of the *palpalis* group in Congo Brazzaville based on mitochondrial cox1 gene sequences. *Parasites & Vectors* 13, 253 (2020). https://doi.org/10.1186/s13071-020-04120-3

127 Acapovi-Yao, G. L., Lendzele, S. S. & Cisse, B. Glossines Fauna of North, South and Center Divisions of Ivory Coast. *International Journal of Research in Biosciences 6, 1-8* (2017). [Cited 11 January 2024.] www.ijrbs.in/index.php/ijrbs/article/view/240/163

128 Acapovi-Yao, G. L., Kaba, D., Allou, K., Zoh, D. D. & N'Goran, K. E. Assessment of the efficiency of insecticide paint and impregnated nets on tsetse populations: Preliminary study in forest relics of Abidjan, Côte d'Ivoire. *West African Journal of Applied Ecology* 22, 17-25 (2014). [Cited 11 January 2024.] www.ajol.info/index.php/wajae/article/view/107989/97823

129 Allou, K. *et al.* Chorologie et infection par les trypanosomes de *Glossina palpalis palpalis* dans la forêt du Banco et ses reliques, Abidjan (Côte d'ivoire). *Parasite* 16, 289-295 (2009). https://doi.org/10.1051/parasite/2009164289

130 Berté, D. *et al.* Population genetics of *Glossina palpalis palpalis* in sleeping sickness foci of Côte d'Ivoire before and after vector control. *Infection Genetics and Evolution* 75 (2019). https://doi.org/10.1016/j.meegid.2019.103963

131 Courtin, F. *et al.* Towards understanding the presence/absence of Human African Trypanosomosis in a focus of Côte d'Ivoire: a spatial analysis of the pathogenic system. *International Journal of Health Geographics* 4, 27 (2005). https://doi.org/10.1186/1476-072X-4-27

132 Dagnogo, M., Traore, G. & Souleymane, F. Determination of sleeping sickness transmission risk areas from trypanosome infection rates of tsetse flies in Daloa, Côte. d'Ivoire. *International Journal of Tropical Insect Science* 24, 170-176 (2004). https://doi.org/10.1079/IJT200413

133 Dagnogo, M. & Gouteux, J. P. Nouvelles données sur le parasitisme de *Glossina palpalis palpalis* (Diptera : Glossinidae) par *Hexamermis glossinae* (Nematoda : Mermithidae) en secteur pré-forestier de Côte d'Ivoire. *Parasite* 10, 269-272 (2003). https://doi.org/10.1051/parasite/2003103269

134 Dagnogo, M., Lohuirignon, K. & Traore, G. Diversity of *Glossina* in the forest belt of Côte d'Ivoire. *Acta Tropica* 65, 149-153 (1997). https://doi.org/10.1016/s0001-706x(96)00647-x

135 Diallo, B. P., Truc, P. & Laveissière, C. A new method for identifying blood meals of human origin in tsetse flies. *Acta Tropica* 63, 61-64 (1997). https://doi.org/10.1016/S0001-706X(97)86626-0

136 Djohan, V. *et al.* Detection and identification of pathogenic trypanosome species in tsetse flies along the Comoe River in Côte d'Ivoire. *Parasite* 22 (2015). https://doi.org/10.1051/parasite/2015018

137 Dujardin, J.-P. *et al.* Outline-based morphometrics, an overlooked method in arthropod studies? *Infection, Genetics and Evolution* 28, 704-714 (2014). https://doi.org/10.1016/j.meegid.2014.07.035

138 Fournet, F., Kone, A., Traore, S. & Hervouet, J. P. Heterogeneity in the risk of sleeping sickness in coffee and cocoa commercial plantations in Ivory Coast. *Medical and Veterinary Entomology* 13, 333-335 (1999). https://doi.org/10.1046/j.1365-2915.1999.00164.x

139 Fournet, F., Traoré, S. & Hervouët, J. P. Effects of urbanization on transmission of human African trypanosomiasis in a suburban relict forest area of Daloa, Côte d'Ivoire. *Transactions of The Royal Society of Tropical Medicine and Hygiene* 93, 130-132 (1999). https://doi.org/10.1016/S0035-9203(99)90283-3

140 Jamonneau, V. *et al.* Mixed infections of trypanosomes in tsetse and pigs and their epidemiological significance in a sleeping sickness focus of Côte d'Ivoire. *Parasitology* 129, 693-702 (2004). https://doi.org/10.1017/s0031182004005876

141 Kaba, D. *et al.* The wing venation patterns to identify single tsetse flies. *Infection Genetics and Evolution* 47, 132-139 (2017). https://doi.org/10.1016/j.meegid.2016.10.008

142 Kaba, D. *et al.* Phenetic and genetic structure of tsetse fly populations (*Glossina palpalis palpalis*) in southern Ivory Coast. *Parasites & Vectors* 5 (2012). https://doi.org/10.1186/1756-3305-5-153

143 Keck, N. *et al.* Epidemiological study of canine trypanosomosis in an urban area of Ivory Coast. *Parasite* 16, 305-308 (2009). https://doi.org/10.1051/parasite/2009164305

144 Lamour, T., Watier-Grillot, S., Ulmer, P. & Ginesta, J. Trypanosomose dans un effectif de chiens militaires en Côte d'Ivoire Canine trypanosomiasis in military working dogs in Ivory Coast. *Bulletin de l'Académie Vétérinaire de France*, 67-74 (2004). https://doi.org/10.4267/2042/47715

145 Leak, S. G. A. & Rowlands, G. J. The dynamics of trypanosome infections in natural populations of tsetse (Diptera:Glossinidae) studied using wing-fray and ovarian ageing techniques. *Bulletin of Entomological Research* 87, 273-282 (1997). https://doi.org/10.1017/s0007485300037226

146 Masiga, D. K., McNamara, J. J., Laveissiere, C., Truc, P. & Gibson, W. C. A high prevalence of mixed trypanosome infections in tsetse flies in Sinfra, Côte d'Ivoire, detected by DNA amplification. *Parasitology* 112, 75-80 (1996). https://doi.org/10.1017/s0031182000065094

147 McNamara, J. J., Laveissiere, C. & Masiga, D. K. Multiple trypanosome infections in wild tsetse in Côte d'Ivoire detected by PCR analysis and DNA probes. *Acta Tropica* 59, 85-92 (1995). https://doi.org/10.1016/0001-706x(94)00087-h

148 Nekpeni, E. B., Eouzan, J.-P. & Dagnogo, M. Infection de *Glossina palpalis palpalis* (Diptera: Glossinidae) par les trypanosomes en zone forestière de Gagnoa en Côte d'Ivoire. *Tropical Medicine and Parasitology* 42, 399-403 (1991). [Cited 19 January 2024.] https://core.ac.uk/reader/39862160

149 Ravel, S. *et al.* The tsetse fly *Glossina palpalis palpalis* is composed of several genetically differentiated small populations in the sleeping sickness focus of Bonon, Côte d'Ivoire. *Infection Genetics and Evolution* 7, 116-125 (2007). https://doi.org/10.1016/j.meegid.2006.07.002

150 Rowlands, G. J. *et al.* Effect of tsetse control on trypanosome prevalence in livestock: Problems of experimental design and statistical interpretation - A case study in northern Côte d'Ivoire. *Veterinary Parasitology* 63, 199-214 (1996). https://doi.org/10.1016/0304-4017(95)00894-2

151 Sané, B., Laveissière, C. & Meda, H. A. Diversité du régime alimentaire de *Glossina palpalis palpalis* en zone forestière de Côte d'Ivoire: relation avec la prévalence de la trypanosomiase humaine africaine. *Tropical Medicine & International Health* 5, 73-78 (2000). https://doi.org/10.1046/j.1365-3156.2000.00488.x

152 Sané, B., Laveissière, C. & Méda, H. A. Répartition spatiale et préférences trophiques de *Glossina palpalis palpalis* dans le foyer forestier de Zoukougbeu (Côte d'Ivoire). Implications épidémiologiques. *Parasite* 7, 241-244 (2000). https://doi.org/10.1051/parasite/2000073241

153 Solano, P., Argiro, L., Reifenberg, J. M., Yao, Y. A. O. & Duvallet, G. Field application of the polymerase chain reaction (PCR) to the detection and characterization of trypanosomes in *Glossina longipalpis* (Diptera: Glossinidae) in Côte d'Ivoire. *Molecular Ecology* 4, 781-786 (1995). https://doi.org/10.1111/j.1365-294X.1995.tb00280.x

154 Späth, J. Natural host odours as possible attractants for *Glossina tachinoides* and *G. longipalpis* (Diptera: Glossinidae). *Acta Tropica* 68, 149-158 (1997). https://doi.org/10.1016/s0001-706x(97)00083-1

155 Späth, J. Trap-orientated Behaviour of the Tsetse-Fly *Glossina tachinoides* (Diptera: Glossinidae). *Entomologia generalis*, 209-224 (1994). https://doi.org/10.1127/entom.gen/19/1995/209

156 Zézé, G. D., N'dri, L., Coulibaly, B. & Sane, B. Actualité et perspectives de recherche sur l'hétérogénéité des populations de *Glossina palpalis palpalis* (Diptera: Muscidea) en Côte d'Ivoire. *Belgian Journal of Entomology* (2007).

157 De Deken, R. *et al.* Trypanosomiasis in Kinshasa: distribution of the vector, *Glossina fuscipes quanzensis*, and risk of transmission in the peri-urban area. *Medical and Veterinary Entomology* 19, 353-359 (2005). https://doi.org/10.1111/j.1365-2915.2005.00580.x

158 Dyer, N. A. *et al.* Cryptic Diversity within the Major Trypanosomiasis Vector *Glossina fuscipes* Revealed by Molecular Markers. *PLOS Neglected Tropical Diseases* 5 (2011). https://doi.org/10.1371/journal.pntd.0001266

159 Ebeja, A. K. *et al.* La maladie de sommeil dans la région Ville de Kinshasa: une analyse rétrospective des données de surveillance sur la période 1996–2000. *Tropical Medicine & International Health* 8, 949-955 (2003). https://doi.org/10.1046/j.1365-3156.2003.01116.x

160 Grébaut, P. *et al.* Monitoring the presence of trypanosomes' DNA - Including *Trypanosoma brucei gambiense* DNA - From the midguts of riverine *Glossina* trapped in the south east outskirts of Kinshasa City (Democratic Republic of Congo). *Infection Genetics and Evolution* 77 (2020). https://doi.org/10.1016/j.meegid.2019.104095

161 Grébaut, P. *et al.* Characterization of sleeping sickness transmission sites in rural and periurban areas of Kinshasa (Republique Democratique du Congo). *Vector-Borne and Zoonotic Diseases* 9, 631-636 (2009). https://doi.org/10.1089/vbz.2008.0118

162 Van der Kelen, C. *et al.* Feasibility of community-based control of tsetse: A pilot project using Tiny Targets in the Democratic Republic of Congo. *PLOS Neglected Tropical Diseases* 14 (2020). https://doi.org/10.1371/journal.pntd.0008696

163 Lombe, B. *et al.* Evaluation de l'efficacité de la fluméthrine dans la lutte contre les glossines à Lutendele, République démocratique du Congo. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 66, 123-130 (2013). https://doi.org/10.19182/remvt.10151

164 Meki, I. K. *et al.* Hytrosavirus genetic diversity and eco-regional spread in *Glossina* species. *BMC Microbiology* 18 (2018). https://doi.org/10.1186/s12866-018-1297-2

165 Omolo, M. O. *et al.* Prospects for Developing Odour Baits To Control *Glossina fuscipes* spp., the Major Vector of Human African Trypanosomiasis. *PLOS Neglected Tropical Diseases* 3 (2009). https://doi.org/10.1371/journal.pntd.0000435

166 Simo, G. *et al.* Molecular identification of *Wolbachia* and *Sodalis glossinidius* in the midgut of *Glossina fuscipes quanzensis* from the Democratic Republic of Congo. *Parasite* 26 (2019). https://doi.org/10.1051/parasite/2019005

167 Simo, G. *et al.* Identification of different trypanosome species in the mid-guts of tsetse flies of the Malanga (Kimpese) sleeping sickness focus of the Democratic Republic of Congo. *Parasites & Vectors* 5 (2012). https://doi.org/10.1186/1756-3305-5-201

168 Simo, G. *et al.* Human African trypanosomiasis transmission, Kinshasa, Democratic Republic of Congo. *Emerging Infectious Diseases* 12, 1968-1970 (2006). https://doi.org/10.3201/eid1212.060516

169 Sumbu, J. *et al.* Variation spatiale du risque pour les porcs de contracter la trypanosomose dans la zone périurbaine de Kinshasa. *Parasite* 16, 153-159 (2009). https://doi.org/10.1051/parasite/2009162153

170 Tirados, I. *et al.* Impact of tiny targets on *Glossina fuscipes quanzensis*, the primary vector of human African trypanosomiasis in the Democratic Republic of the Congo. *PLOS Neglected Tropical Diseases* 14 (2020). https://doi.org/10.1371/journal.pntd.0008270

171 Brunhes, J., Bodo, J.-M., Simarro, Penchenier, L. & Grebault, P. Une nouvelle Glossine pour la faune de la Guinée Équatoriale (Dipt. Glossinidae). *Bulletin de la Société entomologique de France*, 43-44 (1999). [Cited 11 January 2024.] www.persee.fr/doc/bsef_0037-928x_1999_num_104_1_16543

172 Cano, J. *et al.* Predicted distribution and movement of *Glossina palpalis palpalis* (Diptera: Glossinidae) in the wet and dry seasons in the Kogo trypanosomiasis focus (Equatorial Guinea). *Journal of Vector Ecology* 32, 218-225 (2007). https://doi.org/10.3376/1081-1710(2007)32[218:PDAMOG]2.0.CO;2

173 Cano, J. *et al.* Spatial and temporal variability of the *Glossina palpalis palpalis* population in the Mbini focus (Equatorial Guinea). *International Journal of Health Geographics* 6, 36 (2007). https://doi.org/10.1186/1476-072X-6-36

174 Cordon-Obras, C. *et al.* Screening of *Trypanosoma brucei gambiense* in Domestic Livestock and Tsetse Flies from an Insular Endemic Focus (Luba, Equatorial Guinea). *PLOS Neglected Tropical Diseases* 4 (2010). https://doi.org/10.1371/journal.pntd.0000704

175 Dyer, N. A. *et al.* Evidence for a discrete evolutionary lineage within Equatorial Guinea suggests that the tsetse fly *Glossina palpalis palpalis* exists as a species complex. *Molecular Ecology* 18, 3268-3282 (2009). https://doi.org/10.1111/j.1365-294X.2009.04265.x

176 Ferreira, F. *et al.* An alternative approach to detect *Trypanosoma* in *Glossina* (Diptera, Glossinidae) without dissection. *The Journal of Infection in Developing Countries* 2, 063-067 (2008). https://doi.org/10.3855/jidc.324

177 De Beer, C. J. *et al.* Using genetic and phenetic markers to assess population isolation within the southernmost tsetse fly belt in Africa. *Onderstepoort Journal of Veterinary Research* 86 (2019). https://doi.org/10.4102/ojvr.v86i1.1768

178 Abebe, R., Gute, S. & Simon, I. Bovine trypanosomosis and vector density in Omo-Ghibe tsetse belt, South Ethiopia. *Acta Tropica* 167, 79-85 (2017). https://doi.org/10.1016/j.actatropica.2016.12.016

179 Abebe, R. & Wolde, A. Preliminary survey on equine trypanosomosis and its vectors in Asosa and Homosha districts in Benishangul Gumuz Regional State, northwest Ethiopia. *Livestock Research for Rural Development* 22, 140-145 (2010). [Cited 11 January 2024.] https://lrrd.cipav.org.co/lrrd22/1/abeb22018.htm

180 Abebe, R. & Wolde, A. A cross-sectional study of trypanosomosis and its vectors in donkeys and mules in Northwest Ethiopia. *Parasitology Research* 106, 911-916 (2010). https://doi.org/10.1007/s00436-010-1758-5

181 Addisalem, H. B., Tafere, C. A., Beshatu, F. W. & Asamnew, T. M. Prevalence of bovine trypanosomosis in Addisamba and Amarit district of West Gojjam zone, Amhara regional state. *American-Eurasian Journal of Scientific Research* 7, 112-117 (2012). www.idosi.org/aejsr/7(3)12/4.pdf

182 Ademe, M. & Abebe, G. Field study on drug resistant trypanosomes of cattle (*Bos indicus*) in Kindo Koysha Woreda, Southern Ethiopia. *Bulletin of Animal Health and Production in Africa* 48, 131-137 (2000).

183 Aki, A. *et al.* Epidemiology of cattle trypanosomosis and its vector density in Bullen district. *International Journal of Vaccines & Vaccination* 2, 00050 (2016). https://medcraveonline.com/IJVV/IJVV-02-00050.pdf

184 Amante, M. & Tesgera, H. Prevalence of Cattle Trypanosomosis and Apparent Density of Its Fly Vectors in Bambasi District of Benishangul-Gumuz Regional State, Western Ethiopia. *Veterinary Medicine International* 2020, 8894188 (2020). https://doi.org/10.1155/2020/8894188

185 Anjulo, A., Alemu, B. & Yohannes, B. Prevalence of Bovine Trypanosomosis and apparent fly density of tsetse and biting flies in step intervention area of Arbaminch Zuria Wereda. *International Journal of Advanced Multidisciplinary Research* 6 (2019).

186 Ayana, Z., Lemma, D., Abera, B. & Eticha, E. Prevalence of small ruminant trypanosomosis in Assosa and Homosha districts, Benishangul Gumuz Regional State, North West of Ethiopia. *Journal of Veterinary Medicine and Animal Health* 7, 186-192 (2015). https://doi.org/10.5897/JVMAH2014.0372

187 Ayano, A. A., Olbamo, T. & Kapitano, B. Experimental study on the efficacy and persistence of deltamethrin1%, pour-on (smash) for the control of tsetse flies in the southern rift valley of Ethiopia. *Research Journal of Chemical and Environmental Sciences* 1, 89-98 (2013). [Cited 19 January 2024.] www.academia.edu/23129969/Experimental_Study_on_the_Efficacy_and_Persistence_of_Deltamethrin1_Pour_on_Smash_for_the_Control_of_Tsetse_Flies_in_the_Southern_Rift_Valley_of_Ethiopia

188 Ayele, T. *et al.* Prevalence of bovine trypanosomosis and its vector density in Daramallo District, South Western Ethiopia. *Journal of Veterinary Advances* 2, 266-272 (2012). [Cited 11 January 2024.] www.academia.edu/6181727/Prevalence_of_Bovine_Trypanosomosis_and_its_Vector_Density_in_Daramallo_District_South_Western_Ethiopia

189 Batu, G., Abera, Z., Tadesse, A. & Hundera, A. Survey of Apparent Density of Tsetse and other Biting flies in Gimbi district, West Wollega, Western Ethiopia. *Symbiosis Journal of Veterinary Science* 4, 1-8 (2017). http://dx.doi.org/10.15226/2381-2907/4/2/00147

190 Bedaso, K. K. & Dereje, T. Prevalence of bovine Trypanosomosis, tsetse density and farmers perceptions on the impact of control program in Kellem Wollega Zone, western Oromia, Ethiopia. *Journal of Veterinary Science and Technology* 7, 295 (2016). https://dx.doi.org/10.4172/2157-7579.1000295

191 Bekele, D., Beshir, A., Debela, N. & Abdeta, E. Bovine Trypanosomosis in Dano District, West Shoa Zone West Ethiopia. *Advances in Biological Research* 14, 200-206 (2020). www.idosi.org/abr/14(4)20/5.pdf

192 Bekele, J., Asmare, K., Abebe, G., Ayelet, G. & Gelaye, E. Evaluation of Deltamethrin applications in the control of tsetse and trypanosomosis in the southern rift valley areas of Ethiopia. *Veterinary Parasitology* 168, 177-184 (2010). https://doi.org/10.1016/j.vetpar.2009.11.028

193 Belete, H., Tikubet, G., Petros, B., Oyibo, W. A. & Otigbuo, I. N. Control of human African trypanosomiasis: trap and odour preference of tsetse flies (*Glossina morsitans submorsitans*) in the upper Didessa river valley of Ethiopia. *Tropical Medicine & International Health* 9, 710-714 (2004). https://doi.org/10.1111/j.1365-3156.2004.01248.x

194 Belete, H., Tikubet, G., Petros, B. & Kang'ethe, E. K. Host range determination of tsetse fly *Glossina morsitans submorsitans* by bloodmeal analysis in the upper Didessa River valley (Western Ethiopia). *SINET: Ethiopian Journal of Science* 24, 229-238 (2001). https://doi.org/10.4314/sinet.v24i2.18188

195 Benalfew, E., Tilahun, A., Berhanu, A., Teshale, A. & Getachew, A. A study on cattle trypanosomosis and its vectors in Gimbo and Guraferda districts of Southwest Ethiopia. *Journal of Veterinary Medicine and Animal Health* 8, 112-119 (2016). https://dx.doi.org/10.5897/JVMAH2016.0464

196 Berhe, T., Bayleyegn, G., Assefa, F. & Girma, S. Prevalence of Bovine Trypanosomosis and Its Vector Density in Tembro District, South Eastern Ethiopia. *Journal of Animal Science Advances* 5, 1333-1343 (2015).

197 Bitew, M., Amide, Y., Zenebe, T. & Degefu, H. Trypanosome infection rate in *Glossina pallidipes* and *Glossina fuscipes fuscipes* in Gojeb Valley, Southwest Ethiopia. *Global Veterinaria* 6, 131-135 (2011). www.idosi.org/gv/gv6(2)11/4.pdf

198 Cherenet, T. *et al.* Seasonal prevalence of bovine trypanosomosis in a tsetse-infested zone and a tsetse-free zone of the Amhara Region, north-west Ethiopia. *Onderstepoort Journal of Veterinary Research* 71, 307-312 (2004). https://ojvr.org/index.php/ojvr/article/view/250

199 Dagnachew, S. *et al.* Bovine and equine trypanosomosis in Northwest Ethiopia: Prevalence, density of vectors and control measures. *Parasite Epidemiology and Control* 11, e00170 (2020). https://doi.org/10.1016/j.parepi.2020.e00170

200 Dagnachew, S. & Shibeshi, S. Prevalence and vector distributions of bovine trypanosomosis in control (Sibu Sire) and noncontrol (Guto Gida) districts bordering upper Anger valley of East Wollega Zone, Western Ethiopia. *Ethiopian Veterinary Journal* 15 (2011). https://doi.org/10.4314/evj.v15i2.67696

201 Dagnachew, S., Sangwan, A. K. & Abébé, G. Epidemiology of bovine trypanosomosis in the Abay (Blue Nile) basin areas of Northwest Ethiopia. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 58 (2005). https://revues.cirad.fr/index.php/REMVT/article/download/9927/9921/0

202 Dawit, A. *et al.* Prevalence of bovine trypanosomosis, and it's Associated risk factors in Abaya District, Borena Zone, Ethiopia. *Natural Sciences* 13, 64-70 (2015).

203 Denu, T. A., Asfaw, Y. & HailuTolossa, Y. Bovine trypanosomosis in three districts of Southwest Oromia, Ethiopia. *Ethiopian Veterinary Journal* 16, 23-39 (2012). https://dx.doi.org/10.4314/evj.v16i1.3

204 Desta, T. & Lelisa, K. Trypanosomosis and Apparent Densities of *Glossina* Species in Bilo Nopha District, Southwestern Ethiopia. *European Journal of Applied Sciences* 10, 43-47 (2018). www.idosi.org/ejas/10(2)18/1.pdf

205 Desta, T., Itefa, T. & Lelisa, K. Trypanosomosis in cattle of three selected villages of Metu district, Oromia Regional State, Southwestern Ethiopia. *Journal of Parasitology and Vector Biology* 9, 153-157 (2017). https://academicjournals.org/journal/JPVB/article-full-text-pdf/9F3CBFE66775.pdf

206 Desta, M. Trypanosome infection rate of *Glossina morsitans* and trypanosomosis prevalence in cattle in upper Didessa valley western Ethiopia. *International Journal of Current Microbiology and Applied Sciences* 3, 378-388 (2014). www.ijcmas.com/vol-3-3/Mulugeta%20Desta2.pdf

207 Desta, M., Beyene, D. & Haile, S. Trypanosome infection rate of *Glossina pallidipes* and trypanosomosis prevalence in cattle in Amaro Special District of Southern Ethiopia. *Journal of Veterinary Medicine and Animal Health* 5, 164 (2013). https://academicjournals.org/journal/JVMAH/article-full-text-pdf/BF4DDE65003.pdf

208 Desta, M., Menkir, S. & Kebede, A. The study on tsetse fly (*Glossina* species) and their role in the trypanosome infection rate in Birbir valley, Baro Akobo River system, western Ethiopia. *Journal of Veterinary Medicine and Animal Health* 5, 186-194 (2013). www.academicjournals.org/article/article1379685471_Desta%20et%20al.pdf

209 Dinede, G. & Aki, A. Epidemiology of Cattle Trypanosomosis and Associated Anaemia in Mandura District. *Nature and Science* 14 (2016). https://doi.org/10.7537/marsnsj14051612

210 Dinka, H. & Abebe, G. Small ruminants trypanosomosis in the southwest of Ethiopia. *Small Ruminant Research* 57, 239-243 (2005). https://doi.org/10.1016/j.smallrumres.2004.07.008

211 Duguma, R. *et al.* Spatial distribution of *Glossina sp.* and *Trypanosoma sp.* in south-western Ethiopia. *Parasites & Vectors* 8 (2015). https://doi.org/10.1186/s13071-015-1041-9

212 Edget, A. & Meseret, T. Assessing the impact of *Trypanosoma* spp. in cattle and its vector infestation in controlled and uncontrolled Kebeles in Kucha Wereda, Southern Ethiopia. *Journal of Veterinary Medicine and Animal Health* 11, 100-105 (2019). https://doi.org/10.5897/JVMAH2019.0760

213 Efrem, D. *et al.* A cross-sectional study of bovine trypanosomosis in Sayo District, Oromia regional state, Western Ethiopia. *International Journal of Nutrition and Food Sciences* 7, 56 (2018). https://doi.org/10.11648/j.ijnfs.20180702.13

214 Efrem, D. B., Yacob, H. T., Hagos, A. T. & Basu, A. K. Bovine trypanosomosis in Gimbi district of Western Oromia, Ethiopia. *Animal Biology* 60, 123-131 (2010). https://dx.doi.org/10.1163/157075610X491653

215 Eyob, A., Mekuria, S., Regassa, A. & Abebe, R. A cross-sectional study of equine trypanosomosis and its vectors in Wolayta zone, Southern Ethiopia. *Journal of Veterinary Medicine and Animal Health* 3, 21-26 (2011). www.academicjournals.org/JVMAH/PDF/2011/June/Eyob%20et%20al.pdf

216 Fayisa, G., Mandefro, A., Hailu, B., Chala, G. & Alemayehu, G. Epidemiological status and vector identification of bovine trypanosomiosis in Didesa district of Oromia regional state, Ethiopia. *International Journal of Nutrition and Food Sciences* 4, 373-380 (2015). https://doi.org/10.11648/j.ijnfs.20150403.25

217 Fedesa, H., Assefa, K. & Tekalegn, D. Study on spatial distribution of tsetse fly and prevalence of bovine trypanosomosis and other risk factors: case study in Darimu District, Ilu Aba Bora Zone, Western Ethiopia. *Journal of Pharmacy and Alternative Medicine P* 7 (2015). https://core.ac.uk/download/pdf/234689508.pdf

218 Fentahun, T., Tekeba, M., Mitiku, T. & Chanie, M. Prevalence of bovine trypanosomosis and distribution of vectors in Hawa Gelan district, Oromia region, Ethiopia. *Global Veterinaria* 3, 297-302 (2012). https://core.ac.uk/download/pdf/199937279.pdf

219 Gebisa, G., Beriso, K., Bogale, B., Gizaw, O. & Chala, D. Bovine Trypanosomosis and Its Vectors in Three Selected Districts of Buno Bedele Zone of Oromia Region, Ethiopia. *Veterinary Medicine International* 2020, 1571947 (2020). https://doi.org/10.1155/2020/1571947

220 Gebre, S. & Kaaya, G. P. Prevalence of camel ticks and haemoparasites in Southern rangelands of Ethiopia. *Biosciences Biotechnology Research Asia* 3, 311-316 (2006). https://bit.ly/2PFXKOE

221 Gechere, G., Terefe, G. & Belihu, K. Impact of tsetse and trypanosomiasis control on cattle herd composition and calf growth and mortality at Arbaminch District (Southern Rift Valley, Ethiopia). *Tropical Animal Health and Production* 44, 1745-1750 (2012). https://doi.org/10.1007/s11250-012-0132-2

222 Gellebo, G. A. & Zeweld, S. W. Detection of Bovine Trypanosomosis and Efficacy of Selected Trypanocidal Drugs in Konso District, Southern Ethiopia. *Open Science Repository Veterinary Medicine*, e23050445 (2013). https://doi.org/10.7392/openaccess.23050445

223 Getachew, S., Kabeta, T., Abera, Z. & Deressa, B. Epidemiological survey of Bovine trypanosomosis in Sayo district of kellem Wollega zone, Western Ethiopia. *American-Eurasian Journal of Scientific Research* 9, 67-75 (2014). https://dx.doi.org/10.5829/idosi.aejsr.2014.9.3.85199

224 Getahun, M. N., Cecchi, G. & Seyoum, E. Population studies of *Glossina pallidipes* in Ethiopia: emphasis on cuticular hydrocarbons and wing morphometric analysis. *Acta Tropica* 138, S12-S21 (2014). https://doi.org/10.1016/j.actatropica.2014.04.015

225 Girma, K. *et al.* Prevalence of bovine trypanosomosis, its vector density and distribution in and around Arbaminch, Gamogofa Zone, Ethiopia. *Acta Parasitologica Globalis* 5, 169-176 (2014). https://dx.doi.org/10.5829/idosi.apg.2014.5.3.859

226 Girmay, G. *et al.* Community-based tsetse fly control significantly reduces fly density and trypanosomosis prevalence in Metekel Zone, Northwest, Ethiopia. *Tropical Animal Health and Production* 48, 633-642 (2016). https://doi.org/10.1007/s11250-016-1010-0

227 Golessa, M. & Mekonnen, N. Vector identification and prevalence of bovine trypanosomosis in Oda Buldigilu district of Benishangul Gumuze regional state, Western Ethiopia. *Journal of Entomology and Zoology Studies* 5 (2017). www.entomoljournal.com/archives/2017/vol5issue5/PartP/5-5-122-211.pdf

228 Hadis, M., Endeshaw, T., Kebede, A., Asfaw, T. & Tilahun, T. Decline of *Glossina morsitans ugadensis* in Gambella, Ethiopia. *East African Medical Journal* 72, 365-369 (1995).

229 Haile, G., Nigussie, L., Mekonnen, N. & Furgassa, W. Prevalence of Bovine Trypanomosis and Vector Density in Four Selected Settlements of Dangur Area, North Western Ethiopia. *Acta Parasitologica Globalis* 8, 01-08 (2017). https://doi.org/10.5829/idosi.apg.2017.01.08

230 Haile, G., Mekonnen, N., Lelisa, K. & Habtamu, Y. Vector identification, prevalence and anemia of bovine trypanosomosis in Yayo District, Illubabor Zone of Oromia Regional State, Ethiopia. *Ethiopian Veterinary Journal* 20, 39-54 (2016). https://dx.doi.org/10.4314/evj.v20i1.3

231 Hailemariam, A., Seyoum, E. & Vreysen, M. Studies on the reproductive status, catch and age compositions of the tsetse fly, *Glossina pallidipes* populations in the Nechisar National Park in Southern Ethiopia. *SINET: Ethiopian Journal of Science* 28, 51-60 (2005). [Cited 12 January 2024.] www.ajol.info/index.php/sinet/article/view/18231

232 Hornok, S. *et al.* Molecular screening for Anaplasmataceae in ticks and tsetse flies from Ethiopia. *Acta Veterinaria Hungarica* 64, 65-70 (2016). https://doi.org/10.1556/004.2016.007

233 Itefa, T., Zekarias, T. & Lelisa, K. Bovine Trypanosomosis in Four Settlement Areas Bordering Birbir River, Dale Wabera District, Western Ethiopia. *European Journal of Biological Sciences* 10, 47-51 (2018). https://idosi.org/ejbs/10(2)18/3.pdf

234 Jano, A. A. & Guremessa, K. Prevalence of Cattle Trypanosomosis, Vector density and associated risks in Dangur District of Benishangul Gumuz Regional State, Northwest Ethiopia. *Biomedicine and Nursing* (2017). https://dx.doi.org/10.7537/marsbnj030117.13

235 Jano, A. A. Study on the Prevalence of Trypanosomes Affecting Bovine in Tsetse Infested Asossa District of Benishangul Gumuz Regional State, Western Ethiopia. *World Rural Observations* (2016). https://doi.org/10.7537/marswro080316.03

236 Kariithi, H. M. *et al.* Prevalence and genetic variation of salivary gland hypertrophy virus in wild populations of the tsetse fly *Glossina pallidipes* from southern and eastern Africa. *Journal of Invertebrate Pathology* 112, S123-S132 (2013). https://doi.org/10.1016/j.jip.2012.04.016

237 Kassa, T., Eguale, T. & Chaka, H. Prevalence of camel trypanosomosis and its vectors in Fentale district, South East Shoa Zone, Ethiopia. *Veterinarski Arhiv* 81, 611-621 (2011). https://intranet.vef.hr/vetarhiv/papers/2011-81-5-6.pdf

238 Kassaye, B. K. *Journal of Veterinary Science and Technology* 6 (2015). https://dx.doi.org/10.4172/2157-7579.1000254

239 Kedir, M., Lelisa, K. & Damena, D. Bovine trypanosomosis and tsetse fly vectors in Abobo and Gambela Districts, Southwestern Ethiopia. *Journal of Veterinary Science and Technology* 7, 3-5 (2016). www.hilarispublisher.com/open-access/bovine-trypanosomosis-and-tsetse-fly-vectors-in-abobo-and-gambeladistricts-southwestern-ethiopia-2157-7579-1000380.pdf

240 Kedir, M. *et al.* Bovine trypanosomosis and tsetse fly density in Seyo District, Kellem Wollega Zone, Western Ethiopia. *Austin Journal of Veterinary Science & Animal Husbandry* 3, 1028 (2016). https://austinpublishinggroup.com/veterinary-science-research/fulltext/avsah-v3-id1028.pdf

241 Kitila, G. *et al.* Epidemiological investigation of bovine trypanosomosis and its vector apparent densities in Yayo District Illuababora Zone, Western Oromia, Ethiopia. *Austin Journal of Veterinary Science & Animal Husbandry* 4, 1-6 (2017). https://austinpublishinggroup.com/veterinary-science-research/fulltext/avsah-v4-id1031.pdf

242 Krafsur, E. S., Madsen, M., Wohlford, D. L., Mihok, S. & Griffiths, N. T. Population genetics of *Glossina morsitans submorsitans* (Diptera : Glossinidae). *Bulletin of Entomological Research* 90, 329-335 (2000). https://dx.doi.org/10.1017/S0007485300000456

243 Leak, S. G. A., Peregrine, A. S., Mulatu, W., Rowlands, G. J. & Dieteren, G. Use of insecticide-impregnated targets for the control of tsetse flies (*Glossina* spp) and trypanosomiasis occurring cattle in an area of south-west Ethiopia with a high prevalence of drug-resistant trypanosomes. *Tropical Medicine & International Health* 1, 599-609 (1996). https://dx.doi.org/10.1111/j.1365-3156.1996.tb00085.x

244 Leak, S. G. A., Mulatu, W., Rowlands, G. J. & d'Ieteren, G. D. M. A trial of a cypermethrin 'pour-on' insecticide to control *Glossina pallidipes*, *G. fuscipes fuscipes* and *G. morsitans submorsitans* (Diptera: Glossinidae) in South-west Ethiopia. *Bulletin of Entomological Research* 85, 241-251 (1995). https://dx.doi.org/10.1017/S0007485300034325

245 Leak, S. G. A. *et al.* Epidemiology of bovine trypanosomiasis in the Ghibe valley, southwest Ethiopia. 1. Tsetse challenge and its relationship to trypanosome prevalence in cattle. *Acta tropica* 53, 121-134 (1993). https://doi.org/10.1016/0001-706x(93)90024-6

246 Leak, S. G. A. & Mulatu, W. Advance of *Glossina morsitans submorsitans* and *G. pallidipes* along the Ghibe-river system in southwest Ethiopia. *Acta tropica* 55, 91-95 (1993). https://doi.org/10.1016/0001-706x(93)90052-d

247 Lejebo, F., Atsa, A., Hideto, M. & Bekele, T. Prevalence of bovine trypanosomosis its associated risk factors, and tsetse density in Bonke Woreda, Gamo Zone, Ethiopia. *International Journal of Research Studies in Biosciences* 7, 1-12 (2019). https://dx.doi.org/10.20431/2349-0365.0710001

248 Lejebo, F., Balcha, E., Estiphanos, E. & Gehano, G. Bovine Trypanosomosis: Prevalence, Vector Density and Livestock Farmers' Perception on the Impact of Trypanosomosis and Tsetse Control Interventions in Arbaminchzuriaworeda, Southern Ethiopia. *International Journal of Research Studies in Biosciences* 5, 9-21 (2019). https://dx.doi.org/10.20431/2455-2518.0504002

249 Lejebo, F., Dumale, D., Urga, B. & Balcha, E. The Effect of Delthamethrin Treated Net on Tsetse and other Insects in Shara Kebeles, Gamo Gofa Zone, Snnprs. *International Journal of Research* 7, 27-36 (2019). http://dx.doi.org/10.20431/2349-0365.0709003

250 Lelisa, K., Damena, D., Tasew, S., Kedir, M. & Megersa, M. Prevalence of bovine trypanosomosis and vector distributions in Chewaka settlement area of Ilubabor Zone, Southwestern Ethiopia. *Advances in Biological Research* 10, 71-76 (2016). www.idosi.org/abr/10(2)16/2.pdf

251 Lelisa, K., Damena, D., Kedir, M. & Feyera, T. Prevalence of bovine trypanosomosis and apparent density of tsetse and other biting flies in Mandura District, Northwest Ethiopia. *Journal of Veterinary Sciences and Technology* 6, 229 (2015). https://dx.doi.org/10.4172/2157-7579.1000229

252 Lelisa, K., Shimeles, S., Bekele, J. & Sheferaw, D. Bovine trypanosomosis and its fly vectors in three selected settlement areas of Hawa-Gelan district, western Ethiopia. *Onderstepoort Journal of Veterinary Research* 81 (2014). https://doi.org/10.4102/ojvr.v81i1.715

253 Lemecha, H., Lidetu, D. & Hussein, I. Prevalence and distribution of camel trypanosomosis in the semi-arid and arid Awash Valley of Ethiopia. *Ethiopian Journal of Animal Production* 8, 1-9 (2008). https://esap-ethiopia.org.et/sites/default/files/V.8%20P%201-9.pdf

254 Lemecha, H. *et al.* Response of four indigenous cattle breeds to natural tsetse and trypanosomosis challenge in the Ghibe valley of Ethiopia. *Veterinary Parasitology* 141, 165-176 (2006). https://doi.org/10.1016/j.vetpar.2006.04.035

255 Lemu, M., Bekuma, F., Abera, D. & Meharenet, B. Prevalence of Bovine Trypanosomosis and Apparent Density of Tsetse Fly in Botor Tolay District, Jimma Zone, Ethiopia. *Biomedical Journal* 1, 8 (2019). https://dx.doi.org/10.26717/BJSTR.2019.13.002401

256 Leta, S. & Mesele, F. Prevalence of small ruminant trypanosomosis and tsetse fly challenge in Upper Didessa Valley, Ethiopia. *Global Veterinaria* 5, 215-219 (2010). www.idosi.org/gv/gv5(4)10/4.pdf

257 Megersa, B., Seyoum, W., Lejebo, F., Moje, N. & Sheferew, D. Effect of insecticide treated nets fence in protecting cattle against tsetse and other biting flies in Arba Minch Zuria district, Southern Ethiopia. *Ethiopian Veterinary Journal* 21, 117-130 (2017). https://dx.doi.org/10.4314/evj.v21i1.10

258 Meharenet, B. & Alemu, D. Trypanosome infection rate in *Glossina tachinoides*: infested rivers of Limmu Kosa District Jimma Zone, Western Ethiopia. *BMC Research Notes* 13, 133 (2020). https://doi.org/10.1186/s13104-020-04970-1

259 Meharenet, B., Alemu, D. & Tsegaye, M. Bovine Trypanosomosis and *Glossina* Flies Density in and Around Chelo Settlement Areas of Didesa District of Buno Bedele Zone, Western Oromia. *American Journal of Zoology* 3, 1 (2020). https://doi.org/10.11648/j.ajz.20200301.11

260 Meharenet, B., Desta, T., Lelisa, K., Tsegaye, M. & Jula, D. Epidemiology of Bovine Trypanosomosis and Vector Distribution in Didessa River Basin, Ethiopia. *Acta Parasitologica* 65, 743-749 (2020). https://doi.org/10.2478/s11686-020-00214-1

261 Meharenet, B. Prevalence of Bovine Trypanosomosis and Their Infection Rate in Vector in Sokoru Wereda, Upper Ghibe Valley, Western Ethiopia. *Advances in Biological Research* 12, 204-210 (2018). https://doi.org/10.5829/idosi.abr.2018.204.210

262 Mekonnen, G., Gelane, F., Desalegn, M. & Birhanu, H. Prevalence of Bovine Trypanosomosis and Tsetse Fly Density in Sayo Woreda, Oromia, Ethiopia. *Ethiopian Journal of Veterinary Sciences and Animal Production* 3, 9-16 (2020). [Cited 19 January 2024.] www.academia.edu/44015113/Prevalence_of_Bovine_Trypanosomosis_and_Tsetse_Fly_Density_in_Sayo_Woreda_Oromia_Ethiopia

263 Mekonnen, N., Sika, Y., Lejebo, F. & Zeryehun, T. Evaluation of the efficacy of various concentration of deltamethrin impregnated targets on tsetse fly in and around Arba Minch, South Western Ethiopia. *Journal of Entomology and Zoology Studies* 5 (2017). www.entomoljournal.com/archives/2017/vol5issue6/PartF/5-5-123-640.pdf

264 Mekuria, S. & Gadissa, F. Survey on bovine trypanosomosis and its vector in Metekel and Awi zones of Northwest Ethiopia. *Acta Trop* 117, 146-151 (2011). https://doi.org/10.1016/j.actatropica.2010.11.009

265 Melaku, A. & Abebe, A. Bovine Trypanosomosis and Its Vector Type and Density at Debre Elias District, North-western, Ethiopia. *Journal of Advanced Veterinary Research* 2, 247-251 (2012). [Cited 12 January 2024.] /www.advetresearch.com/index.php/AVR/article/view/191

266 Melese, M., Alemu, S., Kemal, J., Muktar, Y. & Abraha, A. Vector identification and bovine trypanosomosis in Edja district, south Ethiopia. *Livestock Research for Rural Development* 29, 2-7 (2017). [Cited 19 January 2024.] www.academia.edu/32974993/Vector_identification_and_bovine_trypanosomosis_in_Edja_district_south_Ethiopia

267 Mulatu, E., Lelisa, K. & Damena, D. Prevalence of bovine trypanosomosis and apparent density of tsetse flies in eastern part of Dangur District, North Western Ethiopia. *J. Vet. Sci. Technol* 7, 10-4172 (2016). https://doi.org/10.4172/2157-7579.1000347

268 Negash, M., Girma, M. & Seyoum, E. Epizootiological importance of *Glossina morsitans submorsitans* (Diptera: Glossinidae) (Newstead) in the Ghibe River Valley, Southwest Ethiopia. *Acta Tropica* 102, 100-105 (2007). https://doi.org/10.1016/j.actatropica.2007.04.004

269 Negash, M., Girma, M. & Seyoum, E. Seasonality and diel activity pattern of *Glossina morsitans submorsitans* (Diptera: Glossinidae) in Ghibe River Valley, Southwest Ethiopia. *SINET: Ethiopian Journal of Science* 27, 135-142 (2004). [Cited 12 January 2024.] www.ajol.info/index.php/sinet/article/view/18241

270 Oloo, F. *et al.* Standardizing Visual Control Devices for Tsetse Flies: East African Species *Glossina fuscipes fuscipes* and *Glossina tachinoides*. *PLOS Neglected Tropical Diseases* 8 (2014). https://doi.org/10.1371/journal.pntd.0003334

271 Ouma, J. O., Marquez, J. G. & Krafsur, E. S. Macrogeographic population structure of the tsetse fly, *Glossina pallidipes* (Diptera: Glossinidae). *Bulletin of Entomological Research* 95, 437-447 (2005). https://doi.org/10.1079/ber2005376

272 Regasa, T. *et al.* Study on Spatial Distribution of Tsetse Fly and Prevalence of Bovine Trypanosomosis and Other Risk Factors: Case Study in Bedele Woreda, Ilu Aba Bora Zone, Southwestern Ethiopia. *Acta Parasitologica Globalis* 6, 174-181 (2015). www.academia.edu/download/51329692/5.pdf

273 Reid, R. S., Wilson, C. J., Kruska, R. L. & Mulatu, W. Impacts of tsetse control and land-use on vegetative structure and tree species composition in south-western Ethiopia. *Journal of Applied Ecology*, 731-747 (1997). https://dx.doi.org/10.2307/2404919

274 Rodrigues, C. M. F. *et al.* Genetic diversity of trypanosomes pathogenic to livestock in tsetse flies from the Nech Sar National Park in Ethiopia: A concern for tsetse suppressed area in Southern Rift Valley? *Infection Genetics and Evolution* 69, 38-47 (2019). https://doi.org/10.1016/j.meegid.2019.01.010

275 Rodrigues, C. M. F. *et al.* New insights from Gorongosa National Park and Niassa National Reserve of Mozambique increasing the genetic diversity of *Trypanosoma vivax* and *Trypanosoma vivax*-like in tsetse flies, wild ungulates and livestock from East Africa. *Parasites & Vectors* 10 (2017). https://doi.org/10.1186/s13071-017-2241-2

276 Rowlands, G. J. *et al.* The incidence of new and the prevalence and persistence of recurrent trypanosome infections in cattle in southwest Ethiopia exposed to a high challenge with drug-resistant parasites. *Acta Tropica* 79, 149-163 (2001). https://doi.org/10.1016/s0001-706x(01)00068-7

277 Rowlands, G. J. *et al.* Use of deltamethrin 'pour-on' insecticide for the control of cattle trypanosomosis in the presence of high tsetse invasion. *Medical and Veterinary Entomology* 15, 87-96 (2000). https://doi.org/10.1046/j.1365-2915.2001.00272.x

278 Rowlands, G. J., Mulatu, W., Leak, S. G. A., Nagda, S. M. & d'Ieteren, G. D. M. Estimating the effects of tsetse control on livestock productivity - A case study in southwest Ethiopia. *Tropical Animal Health and Production* 31, 279-294 (1999). https://doi.org/10.1023/a:1005251722797

279 Sciarretta, A., Tikubet, G., Baumgartner, J., Girma, M. & Trematerra, P. Spatial clustering and associations of two savannah tsetse species, *Glossina morsitans submorsitans* and *Glossina pallidipes* (Diptera: Glossinidae), for guiding interventions in an adaptive cattle health management framework. *Bulletin of Entomological Research* 100, 661-670 (2010). https://doi.org/10.1017/s0007485309990733

280 Sciarretta, A. *et al.* Development of an adaptive tsetse population management scheme for the Luke community, Ethiopia. *Journal of Medical Entomology* 42, 1006-1019 (2005). https://doi.org/10.1093/jmedent/42.6.1006

281 Sheferaw, D. *et al.* Prevalence of bovine trypanosomosis and vector density in a dry season in Gamo-Gofa and Dawuro Zones, Southern Ethiopia. *Veterinary Parasitology: Regional Studies and Reports* 18, 100343 (2019). https://doi.org/10.1016/j.vprsr.2019.100343

282 Sheferaw, D. *et al.* Bovine trypanosomosis and *Glossina* distribution in selected areas of southern part of Rift Valley, Ethiopia. *Acta Tropica* 154, 145-148 (2016). https://doi.org/10.1016/j.actatropica.2015.11.002

283 Shumago, N. & Tekalign, W. Distribution of Tsetse Fly in Selected Sites of Upper Omo Belt, Southern Ethiopia. *Advances in Life Science and Technology* (2016). [Cited 15 January 2024.] www.iiste.org/Journals/index.php/ALST/article/view/30406

284 Sinshaw, A., Abebe, G., Desquesnes, M. & Yoni, W. Biting flies and *Trypanosoma vivax* infection in three highland districts bordering lake Tana, Ethiopia. *Veterinary Parasitology* 142, 35-46 (2006). https://doi.org/10.1016/j.vetpar.2006.06.032

285 Tadesse, A. & Megerssa, G. Prevalence of trypanosomosis in small ruminants of Guto Gidda district, East Wellega zone, western Ethiopia. *Ethiopian Veterinary Journal* 14, 68-77 (2010). https://dx.doi.org/10.4314/evj.v14i2.63885

286 Tadesse, A. & Tsegaye, B. Bovine trypanosomosis and its vectors in two districts of Bench Maji zone, South Western Ethiopia. *Tropical Animal Health and Production* 42, 1757-1762 (2010). https://doi.org/10.1007/s11250-010-9632-0

287 Tafese, W., Melaku, A. & Fentahun, T. Prevalence of bovine trypanosomosis and its vectors in two districts of East Wollega Zone, Ethiopia. *Onderstepoort Journal of Veterinary Research* 79 (2012). https://doi.org/10.4102/ojvr.v79i1.385

288 Tamiru, F., Mideksa, B., Roy, R. K. & Terfa, W. Post control survey on prevalence of bovine trypanosomosis and vector distribution in Ameya District, South West Shewa, Ethiopia. *Global Journal of Medical Research* 14 (2014). [Cited 12 January 2024.] https://medicalresearchjournal.org/index.php/GJMR/article/view/711

289 Teka, W., Terefe, D. & Wondimu, A. Prevalence study of bovine trypanosomosis and tsetse density in selected villages of Arbaminch, Ethiopia. *Journal of Veterinary Medicine and Animal Health* 4, 36-41 (2012). www.academia.edu/download/32849495/Teka_et_al.pdf

290 Tekle, Y. & Mekonen, S. Prevalence of bovine trypanosomosis in tsetse controlled and uncontrolled areas of Eastern Wollega, Ethiopia. *Journal of scientific and innovative research* 2, 61-75 (2013). /www.jsirjournal.com/Vol2Issue109.pdf

291 Terefe, E., Haile, A., Mulatu, W., Dessie, T. & Mwai, O. Phenotypic characteristics and trypanosome prevalence of Mursi cattle breed in the Bodi and Mursi districts of South Omo Zone, southwest Ethiopia. *Tropical Animal Health and Production* 47, 485-493 (2015). https://doi.org/10.1007/s11250-014-0746-7

292 Tigicho, T., Belihu, K. & Terefe, G. Impacts of tsetse challenge on herd composition and mortality, lactation and reproductive performance of cattle in Dawuro Zone of southern region, Ethiopia. *Revue de Médecine Vétérinaire* 163, 405-410 (2012). www.revmedvet.com/2012/RMV163_405_410.pdf

293 Tilahun, Z. *et al.* Prevalence of bovine trypanosomosis, its vector density and distribution in Dale Sadi District, Kellem Wollega Zone, Ethiopia. *Acta Parasitologica Globalis* 5, 107-114 (2014). www.idosi.org/apg/5(2)14/6.pdf

294 Tola, M., Kebede, B., Kitila, G. & Gezehegn, E. Prevalence of bovine trypanosomosis and its vector apparent density in Chora District of Illuababora Western Oromia, Ethiopia. *Journal of Veterinary Medicine and Animal Health* 8, 64-71 (2016). https://dx.doi.org/10.5897/JVMAH2015.0430

295 Tsegaye, D., Terefe, G., Delema, D. & Tadesse, A. Bovine trypanosomosis and its vectors: prevalence and control operations in Kellem Wollega, Western Ethiopia. *Ethiopian Veterinary Journal* 25, 60-84 (2020). https://dx.doi.org/10.4314/evj.v25i2.5

296 Wodajo, W. Prevalence of Bovine Trypanosomosis and its Vectors in Selected Peasant Associations of Boloso Bombe Woreda, Southern Ethiopia. *International Journal of Research Studies in Biosciences* 5, 25-34 (2019). https://dx.doi.org/10.20431/2455-2518.0502004

297 Wondimu, A., Reta, E. & Fekadu, A. Tsetse density and bovine trypanosomosis in selected sites of Konta, Ethiopia. *Journal of Veterinary Medicine and Animal Health* 9, 78-82 (2017). https://doi.org/10.5897/JVMAH11.011

298 Yalew, S. T. & Fantahun, B. Prevalence of bovine trypanosomosis and its associated risk factors in Bambasi woreda, Western Ethiopia. *Journal of Dairy, Veterinary & Animal Research* 5, 44-49 (2017). www.idosi.org/abr/13(4)19/5.pdf

299 Yeshitila, A. Y., Getachew, A., Hagos, A. & Basu, A. K. Prevalence Of Bovine Trypanosomosis In Sokoru District, Jimma Zone, Oromiya Region, Southwest Of Ethiopia. *Bulletin of Animal Health and Production in Africa* 54, 242-258 (2008). www.doi.org/10.4314/BAHPA.V54I4.32775

300 Yigzaw, B., Asmare, T. & Derso, S. Prevalence of bovine trypanosomiasis and its vector density in sheka zone, anderacha woreda. *Online Journal of Animal and Feed Research* 7, 51-57 (2017). www.ojafr.com/main/attachments/article/127/OJAFR%207(3)%2051-57,%202017.pdf

301 Yimer, M. M., Bula, D. G., Tesama, T. K., Tadesse, K. A. & Abera, B. H. Prevalence of salivary gland hypertrophy syndrome in laboratory colonies and wild flies of *Glossina pallidipes* in Ethiopia. *Onderstepoort Journal of Veterinary Research* 82 (2015). https://doi.org/10.4102/ojvr.v82i1.896

302 Zekarias, T., Mandado, T., Gechere, G. & Kebede, A. Assessment of the Impacts of Tsetse and Trypanosomosis Control Activities in Dawuro Zone, Ethiopia. *Ethiopian Journal of Agricultural Sciences* 30, 143-154 (2020). [Cited 12 January 2024.] www.ajol.info/index.php/ejas/article/download/198464/187137

303 Zekarias, T., Kapitano, B., Mekonnen, S. & Zeleke, G. The dynamics of TseTse Fly in and around intensive suppression area of Southern Tsetse Eradication Project Site, Ethiopia. *Ethiopian Journal of Agricultural Sciences* 24, 59-67 (2014). [Cited 12 January 2024.] www.ajol.info/index.php/ejas/article/download/142826/132573

304 Zeleke, G. Preliminary survey on tsetse flies and trypanosomosis at grazing fields and villages in and around the Nech Sar National Park, Southern Ethiopia. *Ethiopian Veterinary Journal* 15 (2011). [Cited 12 January 2024.] www.ajol.info/index.php/evj/article/view/67685

305 Zemedkun, G., Ayichew, T. & Alebachew, T. Study on prevalence of bovine trypanosomosis and density of its vectors in three selected districts of Wolaita Zone, Southern Ethiopia. *Journal of Veterinary Medicine and Animal Health* 8, 128-135 (2016). https://dx.doi.org/10.5897/JVMAH2016.0468

306 Bitome-Essono, P.-Y. *et al.* Tracking zoonotic pathogens using blood-sucking flies as 'flying syringes'. *eLife* 6, e22069 (2017). https://doi.org/10.7554/eLife.22069

307 Dibakou, E. S. *et al.* Distribution des Glossines vecteurs de la Trypanosomose humaine africaine dans le Parc National de Moukalaba Doudou (Sud-ouest Gabon). *Journal of Applied Biosciences* 86, 7957-7965 (2015). https://dx.doi.org/10.4314/jab.v86i1.7

308 Essono, P. Y. B. *et al.* Distribution and abundance of hematophagous flies (Glossinidae, *Stomoxys*, and Tabanidae) in two national parks of Gabon. *Parasite* 22 (2015). https://doi.org/10.1051/parasite/2015023

309 Kohagne Tongué, L., Mavoungou, J. F., Fako, H. G. C., Pamba, R. & Mbatchi, B. Is there a suburban sleeping sickness in Libreville? *African Health Sciences* 13, 266-269 (2013). https://dx.doi.org/10.4314/ahs.v13i2.10

310 Kohagne Tongué, L. *et al.* Enquête entomologique dans le foyer historique de trypanosomose humaine africaine de Bendjé (Gabon). *Parasite* 18, 303-309 (2011). https://doi.org/10.1051/parasite/2011184303

311 Kohagne Tongué, L., M'Eyi, M., Mimpfoundi, R. & Louis, J. Entomological patterns in the human African trypanosomiasis focus of Komo Mondah, Gabon. *African health sciences* 10 (2010). www.ncbi.nlm.nih.gov/pmc/articles/PMC3052801/pdf/AFHS1004-0341.pdf

312 Mbang Nguema, O. A., Bouyou Akotet, M., Mavoungou, J. & Mawili Mboumba, D. P. Variations of *Glossina* sp. and trypanosome species frequency within different habitats in a sleeping sickness focus, Gabon. *Journal of Infection in developing countries* 13, 67-72 (2019). https://doi.org/10.3855/jidc.9654

313 Mbang Nguema, O. A. *et al.* High Frequency of (Kinetoplastida: Trypanosomatidae) Type Among (Diptera: Glossinidae) in a Historic *Trypanosoma* Foci in North-Eastern Gabon: Preliminary Study. *Journal of Medical Entomology* 53, 945-948 (2016). https://doi.org/10.1093/jme/tjw047

314 Mbang Nguema, O. A. *et al.* Inventory of potential vectors of *trypanosoma* and infection rate of the Tsetse fly in the National Park of Ivindo, Gabon. *African Health Sciences* 15, 762-767 (2015). https://doi.org/10.4314/ahs.v15i3.9

315 Mounioko, F. *et al.* Contribution to the evaluation of the diversity and abundance of hematophage dipteries in the Moukalaba Doudou National Park (Southern Gabon) in rain season. *International Journal of Approximate Reasoning* 6, 1170-1182 (2018). https://dx.doi.org/10.21474/IJAR01/6542

316 Mounioko, F. *et al.* Rythme d'activité journalière de *Glossina fuscipes fuscipes*, vecteur majeur de la trypanosomiase humaine africaine dans le parc national de Moukalaba Doudou (Sud-Ouest Gabon). *International Journal of Biological and Chemical Sciences* 9, 419-429 (2015). [Cited 12 January 2024.] /www.ajol.info/index.php/ijbcs/article/download/118873/108352

317 Zinga Koumba, C. R. *et al.* Repartition Des Glossines Dans La Province De L'ogooue Ivindo Ancien Foyer De Trypanosomose Humaine Africaine. *European Scientific Journal, ESJ* 12 (2016). https://doi.org/10.19044/esj.2016.v12n12p281

318 Zinga Koumba, C. R. *et al.* Contribution à l'évaluation de la diversité des vecteurs biologiques de la Trypanosomose Humaine Africaine et de leur activité journalière dans le Parc National de l'Ivindo (Nord est Gabon). *Journal of Applied Biosciences* 80, 7060-7070 (2014). https://dx.doi.org/10.4314/jab.v80i1.8

319 Zinga Koumba, R. C. *et al.* Evaluation de la diversité des diptères hématophages dans une clairière marécageuse du Gabon à l'aide des pièges Vavoua et Nzi. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 66, 91-96 (2013). https://doi.org/10.19182/remvt.10136

320 Zinga Koumba, R. C. *et al.* Influence de la saison sur l'écodistribution des glossines, tabanides, stomoxes du Baï de Momba Makokou, Gabon. *Agronomie Africaine* 25, 149-158 (2013). [Cited 12 January 2024.] www.ajol.info/index.php/aga/article/view/103983

321 Claxton, J. R., Leperre, P., Rawlings, P., Snow, W. F. & Dwinger, R. H. Trypanosomiasis in cattle in Gambia: incidence, prevalence and tsetse challenge. *Acta tropica* 50, 219-225 (1992). https://doi.org/10.1016/0001-706x(92)90078-c

322 Claxton, J. R., Faye, J. A. & Rawlings, P. Trypanosome infections in warthogs (*Phacochoerus aethiopicus*) in The Gambia. *Veterinary Parasitology* 41, 179-187 (1992). https://doi.org/10.1016/0304-4017(92)90077-M

323 Osaer, S., Goossens, B., Kora, S., Gaye, M. & Darboe, L. Health and productivity of traditionally managed Djallonke sheep and West African dwarf goats under high and moderate trypanosomosis risk. *Veterinary Parasitology* 82, 101-119 (1999). https://doi.org/10.1016/s0304-4017(99)00011-4

324 Snow, W. F. & Rawlings, P. Methods for the rapid appraisal of African animal trypanosomosis in the Gambia. *Preventive Veterinary Medicine* 42, 67-86 (1999). https://doi.org/10.1016/s0167-5877(99)00072-0

325 Wacher, T. J., Rawlings, P. & Snow, W. F. Cattle migration and stocking densities in relation to tsetse-trypanosomiasis challenge in The Gambia. *Annals of Tropical Medicine & Parasitology* 87, 517-524 (1993). https://doi.org/10.1080/00034983.1993.11812804

326 Adam, Y. *et al.* Genetic comparison of *Glossina tachinoides* populations in three river basins of the Upper West Region of Ghana and implications for tsetse control. *Infection Genetics and Evolution* 28, 588-595 (2014). https://doi.org/10.1016/j.meegid.2014.03.023

327 Adam, Y. *et al.* The Sequential Aerosol Technique: A Major Component in an Integrated Strategy of Intervention against Riverine Tsetse in Ghana. *PLOS Neglected Tropical Diseases* 7 (2013). https://doi.org/10.1371/journal.pntd.0002135

328 Adam, Y. *et al.* Bovine trypanosomosis in the Upper West Region of Ghana: Entomological, parasitological and serological cross-sectional surveys. *Research in Veterinary Science* 92, 462-468 (2012). https://doi.org/10.1016/j.rvsc.2011.04.004

329 Apaatah, F. *et al.* Trypanosome prevalence in pigs and tsetse flies from selected areas of Jomoro district of the western region of Ghana. *Veterinary Parasitology: Regional Studies and Reports* 21, 100444 (2020). https://doi.org/10.1016/j.vprsr.2020.100444

330 Bauer, B. *et al.* Managing tsetse transmitted trypanosomosis by insecticide treated nets--an affordable and sustainable method for resource poor pig farmers in Ghana. *PLOS Neglected Tropical Diseases* 5, e1343 (2011). https://doi.org/10.1371/journal.pntd.0001343

331 Dankwa, D., Oddoye, E. O. K. & Mzamo, K. B. Efficacy of three trap types for trapping *Glossina palpalis*, *G. tachinoides*, and *G. mortisans* in the Mole Game Reserve in Ghana. *Ghana Journal of Agricultural Science* 33, 177-181 (2000). [Cited 12 January 2024.] www.ajol.info/index.php/gjas/article/view/1868/10809

332 Ebhodaghe, F., Billah, M. K., Adabie-Gomez, D. & Yahaya, A. Morphometric diagnosis of *Glossina palpalis* (Diptera: Glossinidae) population structure in Ghana. *BMC Research Notes* 10, 778 (2017). https://doi.org/10.1186/s13104-017-3113-8

333 Ebhodaghe, F., Gomez, D. & Isaac, C. Spatial distribution of tsetse flies in some areas within western, eastern and northern regions of Ghana. *Zoologist (The)* 14, 50-55 (2016). [Cited 12 January 2024.] www.ajol.info/index.php/tzool/article/view/160448

334 Mahama, C. I. *et al.* A longitudinal epidemiological survey of bovine trypanosomosis and its vectors in the White Volta river basin of Northern Ghana. *Veterinary Parasitology* 128, 201-208 (2005). https://doi.org/10.1016/j.vetpar.2004.12.007

335 Mahama, C. I. *et al.* A cross-sectional epidemiological survey of bovine trypanosomosis and its vectors in the Savelugu and West Mamprusi districts of northern Ghana. *Veterinary Parasitology* 122, 1-13 (2004). https://doi.org/10.1016/j.vetpar.2004.03.009

336 Mahama, C. I. *et al.* Tsetse and trypanosomoses in Ghana in the twentieth century: a review. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* (2003). [Cited 15 January 2024.] https://revues.cirad.fr/index.php/REMVT/issue/download/825/268#page=28

337 Maia, M., Clausen, P. H., Mehlitz, D., Garms, R. & Bauer, B. Protection of confined cattle against biting and nuisance flies (Muscidae: Diptera) with insecticide-treated nets in the Ghanaian forest zone at Kumasi. *Parasitology Research* 106, 1307-1313 (2010). https://doi.org/10.1007/s00436-010-1796-z

338 Nakayima, J. *et al.* Molecular epidemiological studies on animal trypanosomiases in Ghana. *Parasites & Vectors* 5 (2012). https://doi.org/10.1186/1756-3305-5-217

339 Barry, A. M. & Vial, L. Etat de la Trypanosomose chez les bovins N'dama et évaluation de l'utilisation des trypanocides dans la zone cotonnière de la Haute Guinée (Guinée - Conakry). *Bulletin of Animal Health and Production in Africa* (2011). http://repository.au-ibar.org/bitstream/handle/123456789/498/BAHPA_59-2.pdf?sequence=1&isAllowed=y

340 Camara, M. *et al.* Genetic and morphometric evidence for population isolation of *Glossina palpalis gambiensis* (Diptera : Glossinidae) on the Loos islands, Guinea. *Journal of Medical Entomology* 43, 853-860 (2006). https://doi.org/10.1093/jmedent/43.5.853

341 Courtin, F. *et al.* Reducing Human-Tsetse Contact Significantly Enhances the Efficacy of Sleeping Sickness Active Screening Campaigns: A Promising Result in the Context of Elimination. *PLOS Neglected Tropical Diseases* 9 (2015). https://doi.org/10.1371/journal.pntd.0003727

342 Dicko, A. H. *et al.* A Spatio-temporal Model of African Animal Trypanosomosis Risk. *PLOS Neglected Tropical Diseases* 9, e0003921 (2015).

343 Kagbadouno, M. S. *et al.* Écologie de *Glossina palpalis gambiensis* VANDERPLANK, 1949 (Diptera : Glossinidae) en zone de mangrove de Guinée : influence des marées sur les densités capturées. *Bulletin de la Société de pathologie exotique* 109, 126-131 (2016). https://doi.org/10.1007/s13149-016-0478-1

344 Kagbadouno, M. S. *et al.* Epidemiology of Sleeping Sickness in Boffa (Guinea): Where Are the Trypanosomes? *PLOS Neglected Tropical Diseases* 6 (2012). https://doi.org/10.1371/journal.pntd.0001949

345 Kagbadouno, M. S. *et al.* Progress towards the eradication of Tsetse from the Loos islands, Guinea. *Parasites & Vectors* 4 (2011). https://doi.org/10.1186/1756-3305-4-18

346 Kagbadouno, M. S. *et al.* Tsetse elimination: its interest and feasibility in the historical sleeping sickness focus of Loos islands, Guinea. *Parasite* 16, 29-35 (2009). https://doi.org/10.1051/parasite/2009161029

347 Solano, P. *et al.* The Population Structure of *Glossina palpalis gambiensis* from Island and Continental Locations in Coastal Guinea. *PLOS Neglected Tropical Diseases* 3 (2009). https://doi.org/10.1371/journal.pntd.0000392

348 Adungo, F., Mokaya, T., Makwaga, O. & Mwau, M. Tsetse distribution, trypanosome infection rates, and small-holder livestock producers' capacity enhancement for sustainable tsetse and trypanosomiasis control in Busia, Kenya. *Tropical Medicine and Health* 48, 62 (2020). https://doi.org/10.1186/s41182-020-00249-0

349 Bateta, R. *et al.* Phylogeography and population structure of the tsetse fly *Glossina pallidipes* in Kenya and the Serengeti ecosystem. *PLOS Neglected Tropical Diseases* 14, e0007855 (2020). https://doi.org/10.1371/journal.pntd.0007855

350 Baylis, M. & Stevenson, P. Trypanosomiasis and Tsetse Control with Insecticidal Pour-ons— Fact and Fiction? *Parasitology Today* 14, 77-82 (1998). https://doi.org/10.1016/S0169-4758(97)01170-8

351 Baylis, M. The daily feeding rate of tsetse (Diptera: Glossinidae) on cattle at Galana Ranch, Kenya and comparison with trypanosomiasis incidence. *Acta Tropica* 65, 81-96 (1997). https://doi.org/10.1016/S0001-706X(97)00655-4

352 Baylis, M. Effect of defensive behaviour by cattle on the feeding success and nutritional state of the tsetse fly, *Glossina pallidipes* (Diptera: Glossinidae). *Bulletin of Entomological Research* 86, 329-336 (1996). https://doi.org/10.1017/S0007485300034891

353 Baylis, M. & Mbwabi, A. L. Feeding behaviour of tsetse flies (*Glossina pallidipes* Austen) on *Trypanosoma*-infected oxen in Kenya. *Parasitology* 110, 297-305 (1995). https://doi.org/10.1017/s0031182000080884

354 Baylis, M., Mbwabi, A. L. & Stevenson, P. The feeding success of tsetse flies, *Glossina pallidipes* (Diptera: Glossinidae), on oxen treated with pyrethroid pour-ons at Galana Ranch, Kenya. *Bulletin of Entomological Research* 84, 447-452 (1994). https://doi.org/10.1017/S0007485300032661

355 Baylis, M. & Nambiro, C. O. The responses of *Glossina pallidipes* and *G. longipennis* (Diptera: Glossinidae) to odour-baited traps and targets at Galana Ranch, south-eastern Kenya. *Bulletin of Entomological Research* 83, 145-151 (1993). https://doi.org/10.1017/S0007485300034635

356 Baylis, M. & Nambiro, C. O. The effect of cattle infection by *Trypanosoma congolense* on the attraction, and feeding success, of the tsetse fly *Glossina pallidipes*. *Parasitology* 106, 357-361 (1993). https://doi.org/10.1017/S0031182000067093

357 Baylis, M. & Nambiro, C. O. The nutritional state of male tsetse flies, *Glossina pallidipes*, at the time of feeding. *Medical and Veterinary Entomology* 7, 316-322 (1993). https://doi.org/10.1111/j.1365-2915.1993.tb00698.x

358 Beadell, J. S. *et al.* Phylogeography and Population Structure of *Glossina fuscipes fuscipes* in Uganda: Implications for Control of Tsetse. *PLOS Neglected Tropical Diseases* 4 (2010). https://doi.org/10.1371/journal.pntd.0000636

359 Bett, M. K., Saini, R. K. & Hassanali, A. Repellency of tsetse-refractory waterbuck (*Kobus defassa*) body odour to *Glossina pallidipes* (Diptera: Glossinidae): Assessment of relative contribution of different classes and individual constituents. *Acta Tropica* 146, 17-24 (2015). https://doi.org/10.1016/j.actatropica.2015.02.017

360 Bett, B. *et al.* Estimation of tsetse challenge and its relationship with trypanosomosis incidence in cattle kept under pastoral production systems in Kenya. *Veterinary Parasitology* 155, 287-298 (2008). https://doi.org/10.1016/j.vetpar.2008.05.028

361 Bosompem, K. M., Masake, R. A., Assoku, R. K. G., Opiyo, E. A. & Nantulya, V. M. Field evaluation of a dot-ELISA for the detection and differentiation of trypanosome species in infected tsetse flies (*Glossina* spp). *Parasitology* 112, 205-211 (1996). https://doi.org/10.1017/s0031182000084778

362 Brightwell, R. & Dransfield, R. Odour attractants for tsetse: *Glossina austeni*, *G. brevipalpis* and *G. swynnertoni*. *Medical and Veterinary Entomology* 11, 297-299 (1997). https://doi.org/10.1111/j.1365-2915.1997.tb00410.x

363 Brightwell, R., Dransfield, R. D., Stevenson, P. & Williams, B. Changes over twelve years in populations of *Glossina pallidipes* and *Glossina longipennis* (Diptera: Glossinidae) subject to varying trapping pressure at Nguruman, south-west Kenya. *Bulletin of Entomological Research* 87, 349-370 (1997). https://doi.org/10.1017/s0007485300037378

364 Channumsin, M., Ciosi, M., Masiga, D., Turner, C. M. R. & Mable, B. K. *Sodalis glossinidius* presence in wild tsetse is only associated with presence of trypanosomes in complex interactions with other tsetse-specific factors. *BMC Microbiology* 18 (2018). https://doi.org/10.1186/s12866-018-1285-6

365 Ciosi, M., Masiga, D. K. & Turner, C. M. R. Laboratory Colonisation and Genetic Bottlenecks in the Tsetse Fly *Glossina pallidipes*. *PLOS Neglected Tropical Diseases* 8, e2697 (2014). https://doi.org/10.1371/journal.pntd.0002697

366 Dransfield, R. D. & Brightwell, R. Trap efficiency for *Glossina pallidipes* (Diptera : Glossinidae) at Nguruman, south-west Kenya. *Bulletin of Entomological Research* 91, 429-444 (2001). https://doi.org/10.1079/ber2001127

367 Esterhuizen, J., Njiru, B., Vale, G. A., Lehane, M. J. & Torr, S. J. Vegetation and the Importance of Insecticide-Treated Target Siting for Control of *Glossina fuscipes fuscipes*. *PLOS Neglected Tropical Diseases* 5 (2011). https://doi.org/10.1371/journal.pntd.0001336

368 Gachohi, J. M., Bett, B. & Murill, G. A. Factors influencing prevalence of trypanosomosis in orma boran (trypanotolerant) and teso zebu (trypanosusceptible) crosses in Teso district, western Kenya. *Bulletin of Animal Health and Production in Africa* 57 (2009). [Cited 15 January 2024.] https://cgspace.cgiar.org/server/api/core/bitstreams/c95f4169-9395-4586-b096-106ad4402eff/content

369 Griffith, B. C. *et al.* Analysis of the gut-specific microbiome from field-captured tsetse flies, and its potential relevance to host trypanosome vector competence. *BMC Microbiology* 18 (2018). https://doi.org/10.1186/s12866-018-1284-7

370 Kanyari, P. W. N. Efficacy of Alphamethrin (Dominex®) pour-on in the control of bovine trypanosomosis. *Bulletin of Animal Health and Production in Africa* 49, 130-133 (2001).

371 Kidambasi, K. O., Masiga, D. K., Villinger, J., Carrington, M. & Bargul, J. L. Detection of blood pathogens in camels and their associated ectoparasitic camel biting keds, *Hippobosca camelina*: the potential application of keds in xenodiagnosis of camel haemopathogens. *AAS Open Research* (2020). https://doi.org/10.12688/aasopenres.13021.2

372 Kihurani, D. O. *et al. Trypanosoma brucei*, *T. congolense* and *T. vivax* infections in horses on a farm in Kenya. *Tropical Animal Health and Production* 26, 95-101 (1994). https://doi.org/10.1007/bf02239908

373 Kitron, U. *et al.* Spatial analysis of the distribution of tsetse flies in the Lambwe Valley, Kenya, using Landsat TM satellite imagery and GIS. *Journal of Animal Ecology*, 371-380 (1996). https://doi.org/10.2307/5883

374 Krafsur, E. S., Marquez, J. G. & Ouma, J. O. Structure of some East African *Glossina fuscipes fuscipes* populations. *Medical and Veterinary Entomology* 22, 222-227 (2008). https://doi.org/10.1111/j.1365-2915.2008.00739.x

375 Kulohoma, B. W. *et al.* Prevalence of trypanosomes associated with drug resistance in Shimba Hills, Kwale County, Kenya. *BMC Research Notes* 13, 234 (2020). https://doi.org/10.1186/s13104-020-05077-3

376 Kyorku, C., Brightwell, R. & Dransfield, R. D. Traps and odour baits for the tsetse fly, *Glossina longipennis* (Diptera: Glossinidae). *Bulletin of Entomological Research* 80, 405-415 (1990). https://doi.org/10.1017/S0007485300050665

377 Lako, G. T. Cost of Tsetse Trapping Using the NG2G Trap: A Case Study in Kenya. *International Journal of Tropical Insect Science* 18, 319-324 (1998). https://doi.org/10.1017/S1742758400018543

378 Lindh, J. M. *et al.* Optimizing the Colour and Fabric of Targets for the Control of the Tsetse Fly *Glossina fuscipes fuscipes*. *PLOS Neglected Tropical Diseases* 6 (2012). https://doi.org/10.1371/journal.pntd.0001661

379 Lindh, J. M. & Lehane, M. J. The tsetse fly *Glossina fuscipes fuscipes* (Diptera: *Glossina*) harbours a surprising diversity of bacteria other than symbionts. *Antonie van Leeuwenhoek* 99, 711-720 (2011). https://doi.org/10.1007/s10482-010-9546-x

380 Lindh, J. M., Torr, S. J., Vale, G. A. & Lehane, M. J. Improving the Cost-Effectiveness of Artificial Visual Baits for Controlling the Tsetse Fly *Glossina fuscipes fuscipes*. *PLOS Neglected Tropical Diseases* 3 (2009). https://doi.org/10.1371/journal.pntd.0000474

381 Löhr, K. F. *et al.* Investigation of the efficacy of flumethrin pour-on for the control of high tsetse and trypanosomiasis challenge in Kenya. *Tropical Medicine and Parasitology: Official Organ of Deutsche Tropenmedizinische Gesellschaft and of Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ)* 42, 131-134 (1991).

382 Madubunyi, L. C., Hassanali, A., Ouma, W., Nyarango, D. & Kabii, J. Chemoecological role of mammalian urine in host location by tsetse, *Glossina* spp. (Diptera: Glossinidae). *Journal of Chemical Ecology* 22, 1187-1199 (1996). https://doi.org/10.1007/BF02027954

383 Madubunyi, L. C. Bloodmeal evacuation from the midgut of *Glossina pallidipes* in relation to tsetse foraging activity and trappability. *Ecological Entomology* 20, 146-152 (1995). https://dx.doi.org/10.1111/j.1365-2311.1995.tb00440.x

384 Makumi, J. N., Stevenson, P. & Green, C. H. Control of *Glossina longipennis* (Diptera : Glossinidae) by insecticide-treated targets at Galana Ranch, Kenya, and confirmation of the role of *G. longipennis* as a vector of cattle trypanosomiasis. *Bulletin of Entomological Research* 90, 397-406 (2000). https://dx.doi.org/10.1017/S0007485300000535

385 Makumi, J. N., Green, C. & Baylis, M. Activity patterns in *Glossina longipennis*: a field study using different sampling methods. *Medical and Veterinary Entomology* 12, 399-406 (1998). https://doi.org/10.1046/j.1365-2915.1998.00125.x

386 Makumi, J. N., Green, C. H. & Baylis, M. The role of cattle as hosts of *Glossina longipennis* at Galana Ranch, south-eastern Kenya. *Medical and Veterinary Entomology* 10, 331-336 (1996). https://doi.org/10.1111/j.1365-2915.1996.tb00753.x

387 Manangwa, O. *et al.* Genetic diversity of *Glossina fuscipes fuscipes* along the shores of Lake Victoria in Tanzania and Kenya: implications for management. *Parasites & Vectors* 10 (2017). https://doi.org/10.1186/s13071-017-2201-x

388 Maniania, N. K., Ekesi, S., Odulaja, A., Okech, M. A. & Nadel, D. J. Prospects of a fungus-contamination device for the control of tsetse fly *Glossina fuscipes fuscipes*. *Biocontrol Science and Technology* 16, 129-139 (2006). https://doi.org/10.1080/09583150500258503

389 Masiga, D. K. *et al.* Growth and mortality in sheep and goats under high tsetse challenge in Kenya. *Tropical Animal Health and Production* 34, 489-501 (2002). https://doi.org/10.1023/a:1021241220575

390 Mbahin, N. *et al.* Parasitological Prevalence of Bovine Trypanosomosis in Kubo Division of Kwale County of Coastal: Baseline Survey. *American Journal of Animal and Veterinary Sciences* 8 (2013). https://doi.org/10.3844/ajavsp.2013.28.36

391 Mbewe, N. J. *et al.* Responses of *Glossina fuscipes fuscipes* to visually attractive stationary devices baited with 4-methylguaiacol and certain repellent compounds in waterbuck odour. *PLOS Neglected Tropical Diseases* 13 (2019). https://doi.org/10.1371/journal.pntd.0007510

392 Mbewe, N. J. *et al.* Sticky small target: an effective sampling tool for tsetse fly *Glossina fuscipes fuscipes* Newstead, 1910. *Parasites & Vectors* 11 (2018). https://doi.org/10.1186/s13071-018-2840-6

393 Mbewe, N. J. *et al.* Effects of vector control on the population structure of tsetse (*Glossina fuscipes fuscipes*) in western Kenya. *Acta Tropica* 179, 1-9 (2018). https://doi.org/10.1016/j.actatropica.2017.12.015

394 Medina Munoz, M., Pollio, A. R., White, H. L. & Rio, R. V. M. Into the Wild: Parallel Transcriptomics of the Tsetse-*Wigglesworthia* Mutualism within Kenyan Populations. *Genome Biology and Evolution* 9, 2276-2291 (2017). https://doi.org/10.1093/gbe/evx175

395 Mihok, S. The development of a multipurpose trap (the Nzi) for tsetse and other biting flies. *Bulletin of Entomological Research* 92, 385-403 (2002). https://doi.org/10.1079/BER2002186

396 Mihok, S. *et al.* Attractiveness of black rhinoceros (*Diceros bicornis*) to tsetse flies (*Glossina* spp) (Diptera: Glossinidae) and other biting flies. *Bulletin of Entomological Research* 86, 33-41 (1996). https://doi.org/10.1017/s0007485300052172

397 Mihok, S. *et al.* Trypanosomiasis and the conservation of black rhinoceros (*Diceros bicornis*) at the Ngulia Rhino sanctuary, Tsavo West National park, Kenya. *African Journal of Ecology* 30, 103-115 (1992). www.rhinoresourcecenter.com/pdf_files/130/1300835400.pdf

398 Mkunza, F., Olaho, W. M. & Powell, C. N. Partial protection against natural trypanosomiasis after vaccination with a flagellar pocket antigen from *Trypanosoma brucei rhodesiense*. *Vaccine* 13, 151-154 (1995). https://doi.org/10.1016/0264-410X(95)93128-V

399 Mochabo, M. O. K., Changasi, R. E., Muriuki, G., Godiah, L. M. & Karanja, S. M. Parasitology Tsetse and Livestock Disease Situation in a Ranch and Surrounding Farms of Makueni District, Kenya. *Kenya Veterinarian* 34 (2010). https://doi.org/10.4314/kenvet.v34i1.68393

400 Mohamed-Ahmed, M. M. & Mihok, S. Responses of *Glossina fuscipes fuscipes* (Diptera : Glossinidae) and other Diptera to carbon dioxide in linear and dense forests. *Bulletin of Entomological Research* 89, 177-184 (1999). https://doi.org/10.1017/s0007485399000267

401 Mohamed-Ahmed, M. M. & Wynholds, Y. Effects of vegetation and weather on trap catches of *Glossina fuscipes fuscipes* near Lake Victoria, Kenya. *Entomologia Experimentalis et Applicata* 85, 231-236 (1997). https://doi.org/10.1046/j.1570-7458.1997.00253.x

402 Mohamed-Ahmed, M. M. & Odulaja, A. Diel activity patterns and host preferences of *Glossina fuscipes fuscipes* (Diptera: Glossinidae) along the shores of Lake Victoria, Kenya. *Bulletin of Entomological Research* 87, 179-186 (1997). https://doi.org/10.1017/s0007485300027334

403 Mramba, F. *et al.* Standardizing Visual Control Devices for Tsetse Flies: East African Species *Glossina swynnertoni*. *PLOS Neglected Tropical Diseases* 7 (2013). https://doi.org/10.1371/journal.pntd.0002063

404 Muhigwa, J. B. B., Saini, R. K. & Hassanali, A. Effects of fly abundance on catch index of traps for *Glossina fuscipes fuscipes* (Diptera: Glossinidae). *Journal of Medical Entomology* 35, 148-152 (1998). https://doi.org/10.1093/jmedent/35.2.148

405 Muturi, C. N. *et al.* Tracking the Feeding Patterns of Tsetse Flies (*Glossina* Genus) by Analysis of Bloodmeals Using Mitochondrial Cytochromes Genes. *PLOS ONE* 6 (2011). https://doi.org/10.1371/journal.pone.0017284

406 Mwangi, E. K., Stevenson, P., Gettinby, G., Reid, S. W. J. & Murray, M. Susceptibility to trypanosomosis of three *Bos indicus* cattle breeds in areas of differing tsetse fly challenge. *Veterinary Parasitology* 79, 1-17 (1998). https://doi.org/10.1016/s0304-4017(98)00147-2

407 Ndegwa, P. N., Mihok, S. & Oyieke, F. A. Habitat preferences and activity patterns of *Glossina swynnertoni* Austen (Diptera: Glossinidae) in Aitong, Masai Mara, Kenya. *International Journal of Tropical Insect Science* 21, 113-122 (2001). https://doi.org/10.1017/S1742758400020166

408 Ndegwa, P. N. & Mihok, S. Development of odour-baited traps for *Glossina swynnertoni* (Diptera: Glossinidae). *Bulletin of Entomological Research* 89, 255-261 (1999). https://doi.org/10.1017/s0007485399000371

409 Ngari, N. N. *et al.* Developing a national atlas to support the progressive control of tsetse-transmitted animal trypanosomosis in Kenya. *Parasites & Vectors* 13 (2020). https://doi.org/10.1186/s13071-020-04156-5

410 Njiru, Z. K., Makumi, J. N., Okoth, S., Ndungu, J. M. & Gibson, W. C. Identification of trypanosomes in *Glossina pallidipes* and *G. longipennis* in Kenya. *Infection, Genetics and Evolution* 4, 29-35 (2004). https://doi.org/10.1016/j.meegid.2003.11.004

411 Nthiwa, D. M., Odongo, D. O., Ochanda, H., Khamadi, S. & Gichimu, B. M. *Trypanosoma* Infection Rates in *Glossina* Species in Mtito Andei Division, Makueni County, Kenya. *Journal of Parasitology Research* 2015, 607432 (2015). https://doi.org/10.1155/2015/607432

412 Odulaja, A., Mihok, S. & Abu-Zinid, I. M. The magnitude of site and time interaction effect in tsetse fly (Diptera: Glossinidae) trap catches. *Bulletin of Entomological Research* 88, 59-64 (1998). https://doi.org/10.1017/s0007485300041559

413 Odulaja, A. & Mohamed-Ahmed, M. M. Estimation of the efficiency of the biconical trap for *Glossina fuscipes fuscipes* along the lake Victoria shore, Kenya. *Entomologia Experimentalis et Applicata* 82, 19-24 (1997). https://doi.org/10.1046/j.1570-7458.1997.00109.x

414 Ohaga, S. O., Kokwaro, E. D., Ndiege, I. O., Hassanali, A. & Saini, R. K. Livestock farmers' perception and epidemiology of bovine trypanosomosis in Kwale District, Kenya. *Preventive Veterinary Medicine* 80, 24-33 (2007). https://doi.org/10.1016/j.prevetmed.2007.01.007

415 Okeyo, W. A. *et al.* Genetic Differentiation of *Glossina pallidipes* Tsetse Flies in Southern Kenya. *The American Journal of Tropical Medicine and Hygiene* 99, 945-953 (2018). https://doi.org/10.4269/ajtmh.18-0154

416 Okeyo, W. A. *et al.* Temporal genetic differentiation in *Glossina pallidipes* tsetse fly populations in Kenya. *Parasites & Vectors* 10 (2017). https://doi.org/10.1186/s13071-017-2415-y

417 Olaide, O. Y. *et al.* Zebra skin odor repels the savannah tsetse fly, *Glossina pallidipes* (Diptera: Glossinidae). *PLOS Neglected Tropical Diseases* 13 (2019). https://doi.org/10.1371/journal.pntd.0007460

418 Ouma, J. O. *et al.* Genetic diversity and population structure of *Glossina pallidipes* in Uganda and western Kenya. *Parasites & Vectors* 4, 122 (2011). https://doi.org/10.1186/1756-3305-4-122

419 Ouma, J. O., Marquez, J. G. & Krafsur, E. S. Microgeographical breeding structure of the tsetse fly, *Glossina pallidipes* in south-western Kenya. *Medical and Veterinary Entomology* 20, 138-149 (2006). https://doi.org/10.1111/j.1365-2915.2006.00609.x

420 Ouma, J. O. *et al.* Comparative sensitivity of dot-ELISA, PCR and dissection method for the detection of trypanosome infections in tsetse flies (Diptera: Glossinidae). *Acta Tropica* 75, 315-321 (2000). https://doi.org/10.1016/s0001-706x(00)00065-6

421 Owaga, M. L. A., Okelo, R. O. & Chaudhury, M. F. B. Diel activity pattern of the tsetse fly *Glossina austeni* Newstead (Diptera: Glossinidae) in the field and in the laboratory. *International Journal of Tropical Insect Science* 14, 701-705 (1993). https://doi.org/10.1017/S1742758400018154

422 Paynter, Q. & Brady, J. Flight behaviour of tsetse flies in thick bush (*Glossina pallidipes* (Diptera: Glossinidae)). *Bulletin of Entomological Research* 82, 513-516 (1992). https://doi.org/10.1017/S0007485300042590

423 Rajendram, G. F. Electrophoretic study of enzymes from a *Glossina fuscipes fuscipes* Newstead population from Western Kenya. *The Canadian Entomologist* 123, 295-298 (1991). https://doi.org/10.4039/Ent123295-2

424 Saini, R. K. *et al.* Protecting cows in small holder farms in East Africa from tsetse flies by mimicking the odor profile of a non-host bovid. *PLOS Neglected Tropical Diseases* 11 (2017). https://doi.org/10.1371/journal.pntd.0005977

425 Sasaki, H., Kangethe, E. K. & Kaburia, H. F. A. Blood meal sources of *Glossina pallidipes* and *G. longipennis* (Diptera: Glossinidae) in Nguruman, Southwest Kenya. *Journal of Medical Entomology* 32, 390-393 (1995). https://doi.org/10.1093/jmedent/32.3.390

426 Stiles, J. K., Otieno, L. H., Chaudhury, M. F. B. & Moloo, S. K. Upsurge of the tsetse fly *Glossina swynnertoni* at Nguruman, Kenya. *Medical and Veterinary Entomology* 8, 199-200 (1994). https://doi.org/10.1111/j.1365-2915.1994.tb00164.x

427 Tirados, I. *et al.* Tsetse Control and Gambian Sleeping Sickness; Implications for Control Strategy. *PLOS Neglected Tropical Diseases* 9 (2015). https://doi.org/10.1371/journal.pntd.0003822

428 Wamiti, L. G. *et al. Metarhizium anisopliae* infection reduces *Trypanosoma congolense* reproduction in *Glossina fuscipes fuscipes* and its ability to acquire or transmit the parasite. *BMC Microbiology* 18 (2018). https://doi.org/10.1186/s12866-018-1277-6

429 Wamwiri, F. N. *et al. Wolbachia*, *Sodalis* and trypanosome co-infections in natural populations of *Glossina austeni* and *Glossina pallidipes*. *Parasites & Vectors* 6 (2013). https://doi.org/10.1186/1756-3305-6-232

430 Wamwiri, F. N., Nkwengulila, G. & Clausen, P. H. Hosts of *Glossina fuscipes fuscipes* and *G. pallidipes* in areas of western Kenya with endemic sleeping sickness, as determined using an egg-yolk (IgY) ELISA. *Annals of Tropical Medicine and Parasitology* 101, 225-232 (2007). https://doi.org/10.1179/136485907x156979

431 Gondwe, N. *et al.* Distribution and Density of Tsetse Flies (Glossinidae: Diptera) at the Game/People/Livestock Interface of the Nkhotakota Game Reserve Human Sleeping Sickness Focus in Malawi. *EcoHealth* 6, 260-265 (2009). https://doi.org/10.1007/s10393-009-0252-y

432 Musaya, J. *et al.* Polymerase chain reaction identification of *Trypanosoma brucei rhodesiense* in wild tsetse flies from Nkhotakota Wildlife Reserve, Malawi. *Malawi Medical Journal* 29, 11-15 (2017). https://dx.doi.org/10.4314/mmj.v29i1.3

433 Nakamura, Y. *et al.* Genetic diversity and population structure of *Glossina morsitans morsitans* in the active foci of human African trypanosomiasis in Zambia and Malawi. *PLOS Neglected Tropical Diseases* 13 (2019). https://doi.org/10.1371/journal.pntd.0007568

434 Nambala, P. *et al.* Comparative evaluation of dry and liquid RIME LAMP in detecting trypanosomes in dead tsetse flies. *Onderstepoort Journal of Veterinary Research* 85 (2018). https://doi.org/10.4102/ojvr.v85i1.1543

435 Nayupe, S. F. *et al.* The use of molecular technology to investigate trypanosome infections in tsetse flies at Liwonde Wild Life Reserve. *Malawi Medical Journal* 31, 233-237 (2019). https://doi.org/10.4314/mmj.v31i4.3

436 Bass, B., Bagayoko, M., Traore, D. & Kone, F. Prospections des glossines et autres mouches piqueuses dans les cercles de Sikasso et Kadiolo au Mali en prélude à une campagne de suppression. *Bulletin of Animal Health and Production in Africa* 62, 213-224 (2014). [Cited 15 January 2024.] http://repository.au-ibar.org/bitstream/handle/123456789/480/BAHPA_62-3.pdf?sequence=1&isAllowed=y

437 Bocoum, Z. *et al.* African Animal Trypanosomiasis (TAA) in the Zone of Project Management Sustainable Livestock Endemic (Progebe) Mali: Results of Entomological and Parasitological Surveys. *Journal of Community Medicine & Health Education* 2 (2012). https://doi.org/10.4172/2161-0711.1000186

438 Bouyer, J. *et al.* Mapping landscape friction to locate isolated tsetse populations that are candidates for elimination. *Proceedings of the National Academy of Sciences of the United States* 112, 14575-14580 (2015). https://doi.org/10.1073/pnas.1516778112

439 Diarra, B. *et al.* A national atlas of tsetse and African animal trypanosomosis in Mali. *Parasites & Vectors* 12 (2019). https://doi.org/10.1186/s13071-019-3721-3

440 Diarra, B. *et al.* Field Evaluation of the Prophylactic Effect of an Isometamidium Sustained-Release Device against Trypanosomiasis in Cattle. *Antimicrobial Agents and Chemotherapy* 42, 1012-1014 (1998). https://doi.org/10.1128/aac.42.5.1012

441 Djiteye, A. *et al.* Essai de lutte contre *Glossina palpalis gambiensis* (Vanderplank, 1949) à l'aide de pièges et d'écrans imprégnés de deltaméthrine en zone soudanienne au Mali. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 51, 37-45 (1998). https://doi.org/10.19182/remvt.9650

442 Djiteye, A. *et al.* Variations saisonnières de la densité apparente et du taux d'infection par *Trypanosoma* spp. de *Glossina palpalis gambiensis* (Vanderplank, 1949) en zone soudanienne au Mali. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 50, 133-137 (1997). https://doi.org/10.19182/remvt.9584

443 Hoppenheit, A. *et al.* Multiple host feeding in *Glossina palpalis gambiensis* and *Glossina tachinoides* in southeast Mali. *Medical and Veterinary Entomology* 27, 222-225 (2013). https://doi.org/10.1111/j.1365-2915.2012.01046.x

444 Hoppenheit, A. *et al.* Host preference of tsetse: an important tool to appraise the Nagana risk of cattle in the cotton zone of Mali. *Wiener klinische Wochenschrift* 122, 81-86 (2010). https://doi.org/10.1007/s00508-010-1443-9

445 Marquez, J. G., Vreysen, M. J. B., Robinson, A. S., Bado, S. & Krafsur, E. S. Mitochondrial diversity analysis of *Glossina palpalis gambiensis* from Mali and Senegal. *Medical and Veterinary Entomology* 18, 288-295 (2004). https://doi.org/10.1111/j.0269-283X.2004.00508.x

446 Mungube, E. O. *et al.* Detection of multiple drug-resistant *Trypanosoma congolense* populations in village cattle of south-east Mali. *Parasites & Vectors* 5 (2012). https://doi.org/10.1186/1756-3305-5-155

447 Mungube, E. O. *et al.* Best-bet integrated strategies for containing drug-resistant trypanosomes in cattle. *Parasites & Vectors* 5 (2012). https://doi.org/10.1186/1756-3305-5-164

448 Vreysen, M. J. B. *et al.* Release-Recapture Studies Confirm Dispersal of *Glossina palpalis gambiensis* between River Basins in Mali. *PLOS Neglected Tropical Diseases* 7 (2013). https://doi.org/10.1371/journal.pntd.0002022

449 Fermino, B. R. *et al.* Shared species of crocodilian trypanosomes carried by tabanid flies in Africa and South America, including the description of a new species from caimans, *Trypanosoma kaiowa* n. sp. *Parasites & Vectors* 12 (2019). https://doi.org/10.1186/s13071-019-3463-2

450 Garcia, H. A. *et al.* Remarkable richness of trypanosomes in tsetse flies (*Glossina morsitans morsitans* and *Glossina pallidipes*) from the Gorongosa National Park and Niassa National Reserve of Mozambique revealed by fluorescent fragment length barcoding (FFLB). *Infection Genetics and Evolution* 63, 370-379 (2018). https://doi.org/10.1016/j.meegid.2017.07.005

451 Mulandane, F. C. *et al.* Evaluation of the relative roles of the Tabanidae and Glossinidae in the transmission of trypanosomosis in drug resistance hotspots in Mozambique. *Parasites & Vectors* 13 (2020). https://doi.org/10.1186/s13071-020-04087-1

452 Ouma, J. O., Marquez, J. G. & Krafsur, E. S. Patterns of genetic diversity and differentiation in the tsetse fly *Glossina morsitans morsitans* Westwood populations in East and southern Africa. *Genetica* 130, 139-151 (2007). https://doi.org/10.1007/s10709-006-9001-0

453 Sigauque, I., Moiana, M. & Jamal, S. The distribution of tsetse (Diptera: Glossinidae) and bovine trypanosomosis in the Matutuine District, Maputo Province, Mozambique. *Onderstepoort Journal of Veterinary Research* (2000). https://repository.up.ac.za/bitstream/handle/2263/19417/26sigauque2000.pdf?sequence=1&isAllowed=y

454 Wohlford, D. L., Krafsur, E. S., Griffiths, N. T., Marquez, J. G. & Baker, M. D. Genetic differentiation of some *Glossina morsitans morsitans* populations. *Medical and Veterinary Entomology* 13, 377-385 (1999). https://doi.org/10.1046/j.1365-2915.1999.00185.x

455 Rouamba, J., Salissou, A., Sakandé, H., Jamonneau, V. & Courtin, F. Identification des Villages à Risque (IVR): pour un état des lieux de la Trypanosomiase Humaine Africaine au Niger. *Confins* 42 (2019). https://doi.org/10.4000/confins.22982

456 Abubakar, A. *et al.* Population Dynamics of Tsetse flies at Salt Lick B and Guruntun Areas of Yankari National Park Bauchi State Nigeria. *Current Research Journal of Biological Sciences* 8, 15-17 (2016). https://dx.doi.org/10.19026/crjbs.8.2690

457 Ahmed, A. B. High trypanosome infections in *Glossina palpalis palpalis* Robineau-Desvoidy 1830 in southern Kaduna State, Nigeria. *Science World Journal* 2 (2007). https://doi.org/10.4314/swj.v2i2.51725

458 Ahmed, A. B., Okiwelu, S. N. & Dede, P. M. Experimental estimation of challenge of a natural population of *Glossina palpalis palpalis* RD (Diptera: Glossinidae) on cattle in the southern Guinea Savanna, Nigeria. *Science World Journal* 1 (2006). https://doi.org/10.4314/swj.v1i1.51688

459 Ahmed, A. B. A peridomestic population of the tsetse fly *Glossina palpalis palpalis* Robineau-Desvoidy, 1830 (Diptera: Glossinidae) at Kontagora town, Niger state, Nigeria. *Entomología y Vectores* 11, 599-610 (2004). https://dx.doi.org/10.1590/S0328-03812004000400004

460 Ajibade, W. A. & Agbede, S. A. Tsetse fly species diversity in Kainji lake national park, Nigeria. *African Journal of Agricultural Research* 3, 753-758 (2008). www.internationalscholarsjournals.com/articles/tsetse-fly-species-diversity-in-kainji-lake-national-park-nigeria.pdf

461 Daniel, A. D., Dadah, A. J., Kalejaiye, J. O. & Dalhatu, A. D. Prevalence of bovine trypanosomiasis in Gongola State of Northern Nigeria. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 46, 571-574 (1993). https://doi.org/10.19182/remvt.9411

462 Dede, P. M. *et al.* Current tsetse and trypanosomosis situation on Jos Plateau, Nigeria. Epizootiological factors that may enhance disease transmission and spread. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 58 (2005). https://revues.cirad.fr/index.php/REMVT/article/download/9937/9931/9938

463 Enwezor, F. N. C., Shaida, S., Omoogun, G. A., Umoh, J. U. & Esievo, K. N. Assessment of tsetse situation in the Kachia Grazing Reserve, northwest, Nigeria. *Bulletin of Animal Health and Production in Africa* 57, 369-371 (2009). https://dx.doi.org/10.4314/bahpa.v57i4.51684

464 Idehen, C. O. *et al.* Prevalence of African trypanosomosis in cattle and sheep in Bassa local government area of Plateau State, Nigeria. *Sokoto Journal of Veterinary Sciences* 16, 11-17 (2018). https://dx.doi.org/10.4314/sokjvs.v16i3.2

465 Isaac, C. *et al.* Molecular identification of different trypanosome species and subspecies in tsetse flies of northern Nigeria. *Parasites & Vectors* 9 (2016). https://doi.org/10.1186/s13071-016-1585-3

466 Isaac, C., Igbinosa, I. B. & Nmorsi, O. P. G. The ecology of *Glossina palpalis* in Abraka, Nigeria. *European Journal of Experimental Biology* 1, 37-43 (2011). www.pelagiaresearchlibrary.com/european-journal-of-experimental-biology/vol1-iss3/EJEB-2011-1-3-37-43.pdf

467 Kalu, A. U. & Uzoigwe, R. N. Tsetse fly and trypanosomosis on the Jos Plateau: observations on outbreaks in Barkin Ladi local government area. *Tropical Veterinarian* 14, 114-126 (1996).

468 Kalu, A. U. Acute trypanosomosis in a sedentary herd onthe tsetse-free Jos plateau, Nigeria. *British Veterinary Journal* 152, 477-479 (1996). https://doi.org/10.1016/S0007-1935(96)80042-X

469 Kalu, A. U. & Lawani, F. A. Observations on the epidemiology of ruminant trypanosomosis in Kano State, Nigeria. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 49, 213-218 (1996). [Cited 15 January 2024.] https://revues.cirad.fr/index.php/REMVT/article/download/9515/9509/9516

470 Kalu, A. U., Uzoukwu, M. & Ikeme, M. Prevalence of tsetse fly and ruminant trypanosomosis in Katsina-Ala Local Government Area, Nigeria. *Roumanian archives of microbiology and immunology* 55, 341-352 (1996).

471 Karshima, S. N., Ajogi, I. & Mohammed, G. Eco-epidemiology of porcine trypanosomosis in Karim Lamido, Nigeria: prevalence, seasonal distribution, tsetse density and infection rates. *Parasites & Vectors* 9 (2016). https://doi.org/10.1186/s13071-016-1732-x

472 Karshima, S. N., Lawal, I. A. & Okubanjo, O. O. Feeding Patterns and Xenomonitoring of Trypanosomes among Tsetse Flies around the Gashaka-Gumti National Park in Nigeria. *Journal of Parasitology Research* 2016, 1591037 (2016). https://doi.org/10.1155/2016/1591037

473 Karshima, S. N., Ajogi, I., Mohammed, G. & Lawal, A. I. A survey for biting flies in three local government areas of Taraba State, Nigeria. *Sokoto Journal of Veterinary Sciences* 9, 36-38 (2011). www.ajol.info/index.php/sokjvs/article/view/71593

474 Mbaya, A. W., Ahmed, T. & Igbokwe, I. O. Current survey of trypanosomosis among livestock and wildlife in the arid region of Northeastern, Nigeria. *Bulletin of Animal Health and Production in Africa* 61, 323-330 (2013). www.ajol.info/index.php/bahpa/article/view/105265

475 Mbaya, A. W., Ibrahim, U. I. & Apagu, S. T. Trypanosomosis of the dromedary camel (*Camelus dromedarius*) and its vectors in the tsetse-free arid zone of North Eastern, Nigeria. *Nigerian Veterinary Journal* 31 (2010). www.ajol.info/index.php/nvj/article/view/68975

476 Mbaya, A. W., Mohammed Aliyu, M., Okwudiri Nwosu, C. & Isa Ibrahim, U. Captive wild animals as potential reservoirs of haemo and ectoparasitic infections of man and domestic animals in the aridregion of Northeastern Nigeria. *Veterinarski arhiv* 78, 429-440 (2008). https://hrcak.srce.hr/en/file/45410

477 Obaloto, O. B. *et al.* Survey of animal trypanosomosis and biting flies in parts of Alkaleri local government area of Bauchi State, Nigeria. *Journal of Biology, Agriculture and Healthcare* 5, 16-19 (2015). www.iiste.org/Journals/index.php/JBAH/article/view/22309/23140

478 Odeniran, P. O. *et al.* Morphological, Molecular Identification and Distribution of Trypanosome-Transmitting Dipterans from Cattle Settlements in Southwest Nigeria. *Acta Parasitologica* 66, 116-128 (2020). https://doi.org/10.1007/s11686-020-00260-9

479 Odeniran, P. O., Macleod, E. T., Ademola, I. O. & Welburn, S. C. Suspected resistance of *Trypanosoma* species to diminazene aceturate on a cattle farm in Nigeria. *Tropical Animal Health and Production* 51, 2091-2094 (2019). https://doi.org/10.1007/s11250-019-01902-5

480 Odeniran, P. O., Macleod, E. T., Ademola, I. O. & Welburn, S. C. Endosymbionts interaction with trypanosomes in Palpalis group of *Glossina* captured in southwest Nigeria. *Parasitology International* 70, 64-69 (2019). https://doi.org/https://doi.org/10.1016/j.parint.2019.01.011

481 Odeniran, P. O., Macleod, E. T., Ademola, I. O. & Welburn, S. C. Molecular identification of bloodmeal sources and trypanosomes in *Glossina* spp., *Tabanus* spp. and *Stomoxys* spp. trapped on cattle farm settlements in southwest Nigeria. *Medical and Veterinary Entomology* 33, 269-281 (2019). https://doi.org/10.1111/mve.12358

482 Odeniran, P. O. & Ademola, I. O. Alighting and Feeding Behavior of Trypanosome-Transmitting Vectors on Cattle in Nigeria. *Journal of Medical Entomology* 55, 1594-1601 (2018). https://doi.org/10.1093/jme/tjy139

483 Ogedegbe, A. B. O. & Rotimi, J. A survey of Tsetse flies (*Glossina* spp) in the Niger Delta area, southern Nigeria. *African Journal of Environment, Pollution and Health* (2006).

484 Ogunsanmi, A. O., Ikeda, B. O. & Akpavie, S. O. Effects of management, season, vegetation zone and breed on the prevalence of bovine trypanosomiasis in southwestern Nigeria. *Israel Journal of Veterinary Medicine* 55, 69-73 (2000).

485 Ohaeri, C. C. & Eluwa, M. C. Parasitism data of *Glossina palpalis* and *G. tachinoides* (Diptera: Glossinidae) by trypanosome species in parts of Abia State, Nigeria. *Veterinary Science Development* 1, e17 (2011). https://doi.org/10.4081/vsd.2011.3521

486 Ohaeri, C. C. & Eluwa, M. C. The population structure and physiological status of tsetse flies in Abia State, Nigeria. *Journal of Animal and Veterinary Advances* (2007). http://docsdrive.com/pdfs/medwelljournals/javaa/2007/513-516.pdf

487 Okoh, K. E. *et al.* Trypanosomes infection in field-captured tsetse flies of the subgenus: *Nemorhina* in Southern Guinea Savanna Zone of Nigeria. *Current Research Journal of Biological Sciences* 4, 713-716 (2012). [Cited 15 January 2024.] www.airitilibrary.com/Article/Detail/20410778-201211-201508180050-201508180050-713-716

488 Okoh, K. E., Ndams, I. S., Kogi, E. & Vajime, C. G. Catch composition of tsetse flies (*Glossina*: Glossinidae). *American Journal of Applied Sciences* 8, 1067 (2011). https://thescipub.com/pdf/ajassp.2011.1067.1072.pdf

489 Oluwafemi, R. A., Ilemobade, A. A. & Laseinda, E. A. Prevalence Of Tsetse Fly And Bovine Trypanosomosis In The Biological Control Of Tsetse Fly Project (Bicot) Within Afia Local Government Area Of Nasarawa State, Nigeria. *Journal Of Agriculture and Social Research (JASR)* 8, 8-12 (2008). [Cited 15 January 2024.] www.ajol.info/index.php/jasr/article/view/2879

490 Oluwafemi, R. A., Ilemobade, A. A. & Laseinde, E. A. O. The impact of African animal trypanosomosis and tsetse on the livelihood and wellbeing of cattle and their owners in the BICOT study area of Nigeria. *Scientific Research and Essay* 2, 380-383 (2007). https://academicjournals.org/article/article1380274520_Oluwafemi%20et%20al.pdf

491 Omonona, A. O., Abioye, S. A., Odeniran, P. O. & Ademola, I. O. Distribution of tsetse flies and its *Trypanosoma* species infection in Old Oyo National Park, Nigeria. *The Zoologist* 18, 33-38 (2020). www.ajol.info/index.php/tzool/article/download/205657/193928

492 Omoogun, G. A. & Akinboade, O. A. Tsetse and Bovine Trypanosomosis Incidence at Egbe in the Derived Savanna Zone of Nigeria. *International Journal of Tropical Insect Science* 20, 215-219 (2000). https://doi.org/10.1017/S1742758400019664

493 Omoogun, G. A., Onyiah, J. A. & Shaida, S. S. An improved tsetse trap for *Glossina tachinoides* in Nigeria, the Nitse trap. *International Journal of Tropical Insect Science* 15, 529-534 (1994). https://doi.org/10.1017/S1742758400015927

494 Onyekwelu, K. C. *et al.* Prevalence of trypanosome infection in tsetse flies from Oji River and Emene axis of Enugu State, Nigeria: A preliminary report. *Tropical Parasitology* 7, 98-102 (2017). [Cited 16 January 2024.] www.ncbi.nlm.nih.gov/pmc/articles/pmid/29114487

495 Onyekwelu, K. C. *et al.* Molecular identification of trypanosomes in tsetse flies trapped from Onicha Ugbo in delta state of Nigeria. *Biomedical Research-India* 28, 5463-5467 (2017). www.alliedacademies.org/download.php?download=articles/molecular-identification-of-trypanosomes-in-tsetse-flies-trapped-from-onicha-ugbo-in-delta-state-of-nigeria.pdf

496 Shamaki, B. U. *et al.* Survey of African animal trypanosomiasis and biting flies in Alkaleri and Toro Local Government Areas of Bauchi State, Nigeria. *The Journal of Protozoology Research* 20, 51-58 (2010). https://doi.org/10.32268/jprotozoolres.20.1_51

497 Shamaki, B. U. *et al.* A wet season survey of animal trypanosomosis in Shongom local government area of Gombe state. Nigeria. *The Journal of Protozoology Research* 19, 1-6 (2009). https://doi.org/10.32268/jprotozoolres.19.2_1

498 Usman, S. B. *et al.* Epidemiological Survey of Animal trypanosomiasis in Kaltungo Local Government Area Gombe State Nigeria. *The Journal of Protozoology Research* 18, 96-105 (2008). https://doi.org/10.32268/jprotozoolres.18.2_96

499 Yusuf, A. B. *et al.* Surveillance for tsetse and trypanosomosis in Bagudo local government area north-western Nigeria. *IOSR Journal of Agriculture and Veterinary Science* 8, 43-48 (2015). www.iosrjournals.org/iosr-javs/papers/vol8-issue7/Version-3/H08734348.pdf

500 Mihok, S., Otieno, L. H. & Tarimo, C. S. Trypanosome infection rates in tsetse flies (Diptera: Glossinidae) and cattle during tsetse control operations in the Kagera River region of Rwanda. *Bulletin of Entomological Research* 82, 361-367 (1992). https://doi.org/10.1017/S0007485300041158

501 Bassene, M. D. *et al.* Competitiveness and survival of two strains of *Glossina palpalis gambiensis* in an urban area of Senegal. *PLOS Neglected Tropical Diseases* 11 (2017). https://doi.org/10.1371/journal.pntd.0006172

502 Bouyer, J. *et al.* Stratified entomological sampling in preparation for an area-wide integrated pest management program: the example of *Glossina palpalis gambiensis* (Diptera: Glossinidae) in the Niayes of Senegal. *Journal of medical entomology* 47, 543-552 (2010). https://dx.doi.org/10.1603/ME09149

503 Dehoux, J. P., Diaw, M. & Buldgen, A. Observation d'une flambée de trypanosomose équine due à *Trypanosoma vivax* en zone urbaine au Sénégal. *Tropicultura* 14, 35-36 (1996). www.tropicultura.org/text/v14n1/35.pdf

504 Fall, A., Diack, A., Diaite, A., Seye, M. & d'Ieteren, G. D. M. Tsetse challenge, trypanosome and helminth infection in relation to productivity of village Ndama cattle in Senegal. *Veterinary Parasitology* 81, 235-247 (1999). https://doi.org/10.1016/s0304-4017(98)00213-1

505 Solano, P. *et al.* Population Genetics as a Tool to Select Tsetse Control Strategies: Suppression or Eradication of *Glossina palpalis gambiensis* in the Niayes of Senegal. *PLOS Neglected Tropical Diseases* 4 (2010). https://doi.org/10.1371/journal.pntd.0000692

506 de Beer, C. J. *et al.* An update of the tsetse fly (Diptera: Glossinidae) distribution and African animal trypanosomosis prevalence in north-eastern KwaZulu-Natal, South Africa. *Onderstepoort Journal of Veterinary Research* 83 (2016). https://doi.org/10.4102/ojvr.v83i1.1172

507 Esterhuizen, J. & Van den Bossche, P. Protective netting, an additional method for the integrated control of livestock trypanosomosis in KwaZulu-Natal Province, South Africa. *Onderstepoort Journal of Veterinary Research* 73, 319-321 (2006). https://journals.co.za/doi/epdf/10.10520/EJC86265

508 Esterhuizen, J., Kappmeier Green, K., Nevill, E. M. & Van Den Bossche, P. Selective use of odour-baited, insecticide-treated targets to control tsetse flies *Glossina austeni* and *G. brevipalpis* in South Africa. *Medical and Veterinary Entomology* 20, 464-469 (2006). https://doi.org/10.1111/j.1365-2915.2006.00650.x

509 Esterhuizen, J., Green, K. K., Marcotty, T. & Van den Bossche, P. Abundance and distribution of the tsetse flies, *Glossina austeni* and *Glossina brevipalpis*, in different habitats in South Africa. *Medical and Veterinary Entomology* 19, 367-371 (2005). https://doi.org/10.1111/j.1365-2915.2005.00582.x

510 Gillingwater, K., Mamabolo, M. V. & Majiwa, P. A. O. Prevalence of mixed *Trypanosoma congolense* infections in livestock and tsetse in KwaZulu-Natal, South Africa. *Journal of the South African Veterinary Association* 81, 219-223 (2010). https://doi.org/10.10520/EJC99908

511 Kappmeier Green, K. & Venter, G. J. Evaluation and improvement of sticky traps as monitoring tools for *Glossina austeni* and *G. brevipalpis* (Diptera: Glossinidae) in north-eastern KwaZulu-Natal, South Africa. *Bulletin of Entomological Research* 97, 545-553 (2007). https://doi.org/10.1017/s0007485307005238

512 Kappmeier, K. Diurnal activity patterns of *Glossina brevipalpis* and *G. austeni* (Diptera : Glossinidae) in South Africa, with reference to season and meteorological factors. *Onderstepoort Journal of Veterinary Research* 67, 179-+ (2000). [Cited 16 January 2024.] https://repository.up.ac.za/bitstream/handle/2263/19419/28kappmeier2000.pdf?sequence=1&isAllowed=y

513 Kappmeier, K. A newly developed odour-baited "H trap" for the live collection of *Glossina brevipalpis* and *Glossina austeni* (Diptera : Glossinidae) in South Africa. *Onderstepoort Journal of Veterinary Research* 67, 15-26 (2000). [Cited 16 January 2024.] https://repository.up.ac.za/bitstream/handle/2263/19024/2kappmeier2000.pdf?sequence=1&isAllowed=y

514 Kappmeier, K. & Nevill, E. M. Evaluation of a proposed odour-baited target to control the tsetse flies *Glossina brevipalpis* and *Glossina austeni* (Diptera : Glossinidae) in South Africa. *Onderstepoort Journal of Veterinary Research* 66, 327-332 (1999). [Cited 16 January 2024.] https://repository.up.ac.za/bitstream/handle/2263/20156/40kappmeier1999.pdf?sequence=1&isAllowed=y

515 Kappmeier, K. & Nevill, E. M. Evaluation of conventional odour attractants for *Glossina brevipalpis* and *Glossina austeni* (Diptera : Glossinidae) in South Africa. *Onderstepoort Journal of Veterinary Research* 66, 307-316 (1999). [Cited 16 January 2024.] https://repository.up.ac.za/bitstream/handle/2263/20157/38kappmeier1999.pdf?sequence=1&isAllowed=y

516 Kappmeier, K. & Nevill, E. M. Evaluation of coloured targets for the attraction of *Glossina brevipalpis* and *Glossina austeni* (Diptera : Glossinidae) in South Africa. *Onderstepoort Journal of Veterinary Research* 66, 291-305 (1999). [Cited 16 January 2024.] https://repository.up.ac.za/bitstream/handle/2263/20158/37kappmeier1999.pdf?sequence=1&isAllowed=y

517 Latif, A. A., Ntantiso, L. & de Beer, C. African animal trypanosomosis (nagana) in northern KwaZulu-Natal, South Africa: Strategic treatment of cattle on a farm in endemic area. *Onderstepoort Journal of Veterinary Research* 86 (2019). https://doi.org/10.4102/ojvr.v86i1.1639

518 Mamabolo, M. V., Ntantiso, L., Latif, A. & Majiwa, P. A. O. Natural infection of cattle and tsetse flies in South Africa with two genotypic groups of *Trypanosoma congolense*. *Parasitology* 136, 425-431 (2009). https://doi.org/10.1017/s0031182009005587

519 Motloang, M., Masumu, J., Mans, B., van den Bossche, P. & Latif, A. Vector competence of *Glossina austeni* and *Glossina brevipalpis* for *Trypanosoma congolense* in KwaZulu-Natal, South Africa. *Onderstepoort Journal of Veterinary Research* 79 (2012). https://doi.org/10.4102/ojvr.v79i1.353

520 Ntantiso, L., de Beer, C., Marcotty, T. & Latif, A. A. Bovine trypanosomosis prevalence at the edge of Hluhluwe-iMfolozi Park, KwaZulu-Natal, South Africa. *Onderstepoort Journal of Veterinary Research* 81 (2014). https://doi.org/10.4102/ojvr.v81i1.762

521 Van den Bossche, P., Chitanga, S., Masumu, J., Marcotty, T. & Delespaux, V. Virulence in *Trypanosoma congolense* Savannah subgroup. A comparison between strains and transmission cycles. *Parasite Immunology* 33, 456-460 (2011). https://dx.doi.org/10.1111/j.1365-3024.2010.01277.x

522 Abila, P. P. *et al.* High Levels of Genetic Differentiation between Ugandan *Glossina fuscipes fuscipes* Populations Separated by Lake Kyoga. *PLOS Neglected Tropical Diseases* 2 (2008). https://doi.org/10.1371/journal.pntd.0000242

523 Joja, L. L. & Okoli, U. A. Trapping the vector: community action to curb sleeping sickness in southern Sudan. *American Public Health Association* 91, 1583-1585 (2001). https://doi.org/10.2105/ajph.91.10.1583

524 Lukaw, Y. S., Mohammed, Y. O., Abdelrahman, M. M., Jaja, L. K. & Ochi, E. B. Preliminary study on population structure, infection rate and habitats of *Glossina fuscipes fuscipes* (Diptera: Glossinidae) in Western Equatoria State South Sudan. *IJISET-International Journal of Innovative Science, Engineering & Technology* 3, 226-235 (2016). http://ijiset.com/vol3/v3s5/IJISET_V3_I5_31.pdf

525 Mohammed, Y. O., Elmali, K. H., Mohammed-Ahmed, M. M. & Elrayah, I. Factors influencing the sero-prevalence of *Trypanosoma brucei gambiense* sleeping sickness in Juba District, Central Equatorial State, Southern Sudan. *Journal of Public Health and Epidemiology* 2, 100-108 (2010). https://academicjournals.org-www.academicjournals.org/article/article1379407709_Mohammed%20et%20al.pdf

526 Mohammed, Y. O., Mohamed-Ahmed, M. M., Lubna, T. K. & Rayah, I. E. E. Detection of *Trypanosoma brucei gambiense* and *T. b. rhodesiense* in *Glossina fuscipes fuscipes* (Diptera: Glossinidae) and *Stomoxys* flies using the polymerase chain reaction (PCR) technique in southern Sudan. *African Journal of Biotechnology* 9, 6408-6412 (2010). [Cited 16 January 2024.] www.ajol.info/index.php/ajb/article/view/92278

527 Mohammed, Y. O., Mohammed-Ahmed, M. M., El Malik, K. H. & El Rayah, I. E. Distribution pattern of *Glossina fuscipes fuscipes* (Diptera: Glossinidae) in Bahr el Jebel State, southern Sudan. *International Journal of Tropical Insect Science* 27, 210-215 (2008). https://doi.org/10.1017/S1742758407872390

528 Abdalla, M. A., Amel, O. B. & Seham, E. S. Seasonal prevalence of bovine trypanosomosis in Abubugar district, central Sudan. *Journal of Veterinary Science and Animal Husbandry* 47, 1-5 (2008).

529 Ahmed, S. K. *et al.* An atlas of tsetse and bovine trypanosomosis in Sudan. *Parasites & Vectors* 9 (2016). https://doi.org/10.1186/s13071-016-1485-6

530 Basheer, M. A. *et al.* Detection of *Trypanozoon* trypanosomes infections on *Glossina fuscipes fuscipes* (Diptera: Glossinidae) using polymerase chain reaction (PCR) technique in the Blue Nile State, Sudan. *African Journal of Biotechnology* 12, 89-95 (2013). https://dx.doi.org/10.5897/AJB12.1856

531 Mohamed-Ahmed, M. M. & El Rayah, I. E. Spatial distribution of tsetse flies in the Blue Nile State, Sudan. *Journal of Veterinary Medicine and Animal Health* 4, 140-145 (2012). www.internationalscholarsjournals.com/articles/spatial-distribution-of-tsetse-flies-in-the-blue-nile-state-sudan.pdf

532 Rahman, A. H. Observations on the trypanosomosis problem outside the tsetse belts of Sudan. *Revue Scientifique et Technique (International Office of Epizootics)* 24, 965-972 (2005).

533 Dao, B., Hendrickx, G., Sidibé, I., Belem, A. M. G. & De La Rocque, S. Impact de la sécheresse et de la dégradation des aires protégées sur la répartition des trypanosomoses bovines et de leurs vecteurs dans le bassin versant de l'Oti au nord du Togo. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 61, 153-160 (2008). https://doi.org/10.19182/remvt.9982

534 Hendrickx, G. *et al.* A systematic approach to area-wide tsetse distribution and abundance maps. *Bulletin of Entomological Research* 89, 231-244 (1999). https://doi.org/10.1017/s0007485399000358

535 Talaki, E., Dao, B., Kulo, A. & N'feidé, T. Enquêtes entomologique et parasitologique sur les trypanosomoses bovines à la Station d'Avétonou/ITRA, au Togo. *Animal Health and Production* 61, 33-38 (2013). [Cited 16 January 2024.] www.ajol.info/index.php/bahpa/article/view/105100

536 Abila, P. P. *et al.* Evaluation of the cost-effectiveness of pyramidal, modified pyramidal and monoscreen traps for the control of the tsetse fly, *Glossina fuscipes fuscipes*, in Uganda. *Journal of Insect Science* 7, 47 (2007). https://doi.org/10.1673/031.007.4701

537 Aksoy, E. *et al.* Analysis of Multiple Tsetse Fly Populations in Uganda Reveals Limited Diversity and Species-Specific Gut Microbiota. *Applied and Environmental Microbiology* 80, 4301-4312 (2014). https://doi.org/10.1128/AEM.00079-14

538 Alam, U. *et al.* Implications of Microfauna-Host Interactions for Trypanosome Transmission Dynamics in *Glossina fuscipes fuscipes* in Uganda. *Applied and Environmental Microbiology* 78, 4627-4637 (2012). https://doi.org/10.1128/AEM.00806-12

539 Bonomi, A. *et al.* Polyandry Is a Common Event in Wild Populations of the Tsetse Fly *Glossina fuscipes fuscipes* and May Impact Population Reduction Measures. *PLOS Neglected Tropical Diseases* 5, e1190 (2011). https://doi.org/10.1371/journal.pntd.0001190

540 Cunningham, L. J. *et al.* Evidence of the absence of human African trypanosomiasis in two northern districts of Uganda: Analyses of cattle, pigs and tsetse flies for the presence of *Trypanosoma brucei gambiense*. *PLOS Neglected Tropical Diseases* 14 (2020). https://doi.org/10.1371/journal.pntd.0007737

541 Cunningham, L. J. *et al.* Illuminating the Prevalence of *Trypanosoma brucei s.l.* in *Glossina* Using LAMP as a Tool for Xenomonitoring. *PLOS Neglected Tropical Diseases* 10 (2016). https://doi.org/10.1371/journal.pntd.0004441

542 Echodu, R. *et al.* Genetically Distinct *Glossina fuscipes fuscipes* Populations in the Lake Kyoga Region of Uganda and Its Relevance for Human African Trypanosomiasis. *BioMed Research International* 2013, 614721 (2013). https://doi.org/10.1155/2013/614721

543 Echodu, R. *et al.* Temporal stability of *Glossina fuscipes fuscipes* populations in Uganda. *Parasites & Vectors* 4 (2011). https://doi.org/10.1186/1756-3305-4-19

544 Enyaru, J. C., Odiit, M., Gashumba, J. K., Carasco, J. F. & Rwendeire, A. J. Characterization by isoenzyme electrophoresis of *Trypanozoon* stocks from sleeping sickness endemic areas of south-east Uganda. *Bulletin of the World Health Organization* 70, 631-636 (1992). https://apps.who.int/iris/bitstream/handle/10665/261539/PMC2393361.pdf

545 Gloria-Soria, A. *et al.* Patterns of Genome-Wide Variation in *Glossina fuscipes fuscipes* Tsetse Flies from Uganda. *G3 Genes|Genomes|Genetics* 6, 1573-1584 (2016). https://doi.org/10.1534/g3.116.027235

546 Hide, G., Welburn, S. C., Tait, A. & Maudlin, I. Epidemiological relationships of *Trypanosoma brucei* stocks from South East Uganda: evidence for different population structures in human infective and non-human infective isolates. *Parasitology* 109 (Pt 1), 95-111 (1994). https://doi.org/10.1017/S0031182000077805

547 Hyseni, C. *et al.* The population structure of *Glossina fuscipes fuscipes* in the Lake Victoria basin in Uganda: implications for vector control. *Parasites & Vectors* 5, 1-14 (2012). https://doi.org/10.1186/1756-3305-5-222

548 Kato, A. B. *et al.* Mitochondrial DNA sequence divergence and diversity of *Glossina fuscipes fuscipes* in the Lake Victoria basin of Uganda: implications for control. *Parasites & Vectors* 8 (2015). https://doi.org/10.1186/s13071-015-0984-1

549 Katunguka-Rwakishaya, E. & Kabagambe, E. K. Tsetse survey in Mukono district, south-east Uganda: Population structure distribution and blood meal status. *Tropical Animal Health and Production* 28, 151-157 (1996). https://doi.org/10.1007/bf02299567

550 Lancien, J. Lutte contre la maladie du sommeil dans le sud-est Ouganda par piégeage des Glossines. *Annales de la Société belge de médecine tropicale* 71, 35-47 (1991). http://lib.itg.be/open/ASBMT/1991/1991asbm0s35.pdf

551 Magona, J. W. *et al.* Implications of the re-invasion of Southeast Uganda by *Glossina pallidipes* on the epidemiology of bovine trypanosomosis. *Veterinary Parasitology* 128, 1-9 (2005). https://doi.org/10.1016/j.vetpar.2004.10.020

552 Magona, J. W., Mayende, J. S. P., Okiria, R. & Okuna, N. M. Protective efficacy of isometamidium chloride and diminazene aceturate against natural *Trypanosoma brucei*, *Trypanosoma congolense* and *Trypanosoma vivax* infections in cattle under a suppressed tsetse population in Uganda. *Onderstepoort Journal of Veterinary Research* 71, 231-237 (2004). https://ojvr.org/index.php/ojvr/article/download/265/245

553 Magona, J. W., Greiner, M. & Mehlitz, D. Impact of tsetse control on the age-specific prevalence of trypanosomosis in village cattle in southeast Uganda. *Tropical Animal Health and Production* 32, 87-98 (2000). https://doi.org/10.1023/a:1005278619023

554 Magona, J. W. *et al.* Control of tsetse and animal trypanosomosis using a combination of tsetse-trapping, pour-on and chemotherapy along the Uganda-Kenya border. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 51, 311-315 (1998). https://revues.cirad.fr/index.php/REMVT/article/download/9614/9608/9615

555 Magona, J. W., Katabazi, W., Olaho-Mukani, W., Mayende, J. S. P. & Walubengo, J. Haemorrhagic *Trypanosoma vivax* Outbreak in Cattle in Mbale and Tororo Districts in Eastern Uganda. *The Journal of Protozoology Research* 7, 48-53 (1997). https://doi.org/10.32268/jprotozoolres.7.2_48

556 Mugenyi, A., Wardrop, N. A., Atkinson, P. M., Torr, S. J. & Welburn, S. C. Tsetse Fly (*G.f. fuscipes*) Distribution in the Lake Victoria Basin of Uganda. *PLOS Neglected Tropical Diseases* 9 (2015). https://doi.org/10.1371/journal.pntd.0003705

557 Muhanguzi, D. *et al.* Improvements on Restricted Insecticide Application Protocol for Control of Human and Animal African Trypanosomiasis in Eastern Uganda. *PLOS Neglected Tropical Diseases* 8 (2014). https://doi.org/10.1371/journal.pntd.0003284

558 Ogwal, L. M., Kalyebi, A. & Kaddu, J. B. The diurnal activity, movement and trypanosome infection rates of *Glossina fuscipes fuscipes* (Diptera: Glossinidae) in Buvuma Island, Lake Victoria, Uganda. *Insect Science* 14, 477-484 (2007). https://doi.org/10.1111/j.1744-7917.2007.00176.x

559 Okiria, R., Okuna, N. M., Magona, J. W. & Mayende, J. S. P. Sustainability of tsetse control by subsequent treatment of 10% of a previously treated Ugandan cattle population with 1% w/v deltamethrin. *Tropical Animal Health and Production* 34, 105-114 (2002). https://doi.org/10.1023/a:1014239305328

560 Okoth, J. O. Description of a mono-screen trap for *Glossina fuscipes fuscipes* Newstead in Uganda. *Annals of Tropical Medicine & Parasitology* 85, 309-314 (1991). https://doi.org/10.1080/00034983.1991.11812566

561 Opiro, R. *et al.* Genetic diversity and population structure of the tsetse fly *Glossina fuscipes fuscipes* (Diptera: Glossinidae) in Northern Uganda: Implications for vector control. *PLOS Neglected Tropical Diseases* 11 (2017). https://doi.org/10.1371/journal.pntd.0005485

562 Opiro, R. *et al.* Evidence of temporal stability in allelic and mitochondrial haplotype diversity in populations of *Glossina fuscipes fuscipes* (Diptera: Glossinidae) in northern Uganda. *Parasites & Vectors* 9 (2016). https://doi.org/10.1186/s13071-016-1522-5

563 Otim, C. P. *et al.* Disease and vector constraints affecting cattle production in pastoral communities of Ssembabule district, Uganda. *Livestock Research for Rural Development* 16 (2004). [Cited 16 January 2024.] www.lrrd.cipav.org.co/lrrd16/5/otim16035.htm

564 Saarman, N. P. *et al.* The population genomics of multiple tsetse fly (*Glossina fuscipes fuscipes*) admixture zones in Uganda. *Molecular Ecology* 28, 66-85 (2018). https://doi.org/10.1111/mec.14957

565 Schneider, D. I. *et al.* Spatio-temporal distribution of *Spiroplasma* infections in the tsetse fly (*Glossina fuscipes fuscipes*) in northern Uganda. *PLOS Neglected Tropical Diseases* 13 (2019). https://doi.org/10.1371/journal.pntd.0007340

566 Stanton, M. C., Esterhuizen, J., Tirados, I., Betts, H. & Torr, S. J. The development of high resolution maps of tsetse abundance to guide interventions against human African trypanosomiasis in northern Uganda. *Parasites & Vectors* 11 (2018). https://doi.org/10.1186/s13071-018-2922-5

567 Waiswa, C. *et al. Glossina fuscipes fuscipes* in the trypanosomiasis endemic areas of south eastern Uganda: Apparent density, trypanosome infection rates and host feeding preferences. *Acta Tropica* 99, 23-29 (2006). https://doi.org/10.1016/j.actatropica.2006.06.005

568 Adams, E. R. *et al.* New *Trypanosoma* (*Duttonella*) *vivax* genotypes from tsetse flies in East Africa. *Parasitology* 137, 641-650 (2009). https://doi.org/10.1017/s0031182009991508

569 Adams, E. R., Hamilton, P. B., Malele, II & Gibson, W. C. The identification, diversity and prevalence of trypanosomes in field caught tsetse in Tanzania using ITS-1 primers and fluorescent fragment length barcoding. *Infection Genetics and Evolution* 8, 439-444 (2008). https://doi.org/10.1016/j.meegid.2007.07.013

570 Adams, E. R., Malele, I. I., Msangi, A. R. & Gibson, W. C. Trypanosome identification in wild tsetse populations in Tanzania using generic primers to amplify the ribosomal RNA ITS-1 region. *Acta Tropica* 100, 103-109 (2006). https://doi.org/10.1016/j.actatropica.2006.10.002

571 Auty, H. K. *et al.* Using Molecular Data for Epidemiological Inference: Assessing the Prevalence of *Trypanosoma brucei rhodesiense* in Tsetse in Serengeti, Tanzania. *PLOS Neglected Tropical Diseases* 6 (2012). https://doi.org/10.1371/journal.pntd.0001501

572 Daffa, J., Byamungu, M., Nsengwa, G., Mwambembe, E. & Mleche, W. Tsetse distribution in Tanzania: 2012 status. *Tanzania Veterinary Journal* 28, 1-11 (2013). [Cited 16 January 2024.] www.ajol.info/index.php/tvj/article/view/98452

573 Fox, R. G. R., Mmbando, S. O., Fox, M. S. & Wilson, A. Effect on herd health and productivity of controlling tsetse and trypanosomosis by applying deltamethrin to cattle. *Tropical Animal Health and Production* 25, 203-214 (1993). https://doi.org/10.1007/BF02250869

574 Gooding, R. H., Mbise, S., Macha, P. & Rolseth, B. M. Genetic Variation in a Tanzanian Population of *Glossina swynnertoni* (Diptera: Glossinidae). *Journal of Medical Entomology* 30, 489-492 (1993). https://doi.org/10.1093/jmedent/30.2.489

575 Goossens, B., Mbwambo, H., Msangi, A., Geysen, D. & Vreysen, M. Trypanosomosis prevalence in cattle on Mafia Island (Tanzania). *Veterinary Parasitology* 139, 74-83 (2006). https://doi.org/10.1016/j.vetpar.2006.02.022

576 Haji, I. J., Malele, I. & Namangala, B. Occurrence of haemoparasites in cattle in Monduli district, northern Tanzania. *Onderstepoort Journal of Veterinary Research* 81 (2014). https://doi.org/10.4102/ojvr.v81i1.843

577 Kasilagila, G. Studies on trap effectiveness of tsetse flies (*Glossina* spp. (Diptera : Glossinidae)) in the Tanga Region of north eastern Tanzania. *Acta Tropica* 87, 385-392 (2003). https://doi.org/10.1016/s0001-706x(03)00138-4

578 Kimaro, E. G., Toribio, J., Gwakisa, P. & Mor, S. M. Occurrence of trypanosome infections in cattle in relation to season, livestock movement and management practices of Maasai pastoralists in Northern Tanzania. *Veterinary Parasitology- Regional Studies and Reports* 12, 91-98 (2018). https://doi.org/10.1016/j.vprsr.2018.02.007

579 Lehane, M. J., Msangi, A. R., Whitaker, C. J. & Lehane, S. M. Grouping of trypanosome species in mixed infections in *Glossina pallidipes*. *Parasitology* 120, 583-592 (2000). https://doi.org/10.1017/s0031182099005983

580 Lord, J. S. *et al.* Assessing the effect of insecticide-treated cattle on tsetse abundance and trypanosome transmission at the wildlife-livestock interface in Serengeti, Tanzania. *PLOS Neglected Tropical Diseases* 14 (2020). https://doi.org/10.1371/journal.pntd.0008288

581 Lord, J. S. *et al.* Geostatistical models using remotely-sensed data predict savanna tsetse decline across the interface between protected and unprotected areas in Serengeti, Tanzania. *Journal of Applied Ecology* 55, 1997-2007 (2018). https://doi.org/10.1111/1365-2664.13091

582 Luziga, C. *et al.* A tsetse *Glossina pallidipes* harbors the pathogenic trypanosomes circulating in Liwale district, Tanzania. *Veterinary Parasitology: Regional Studies and Reports* 9, 93-97 (2017). https://doi.org/10.1016/j.vprsr.2017.06.002

583 Malele, I. I. *et al.* Bacterial diversity obtained by culturable approaches in the gut of *Glossina pallidipes* population from a non sleeping sickness focus in Tanzania: preliminary results. *BMC Microbiology* 18 (2018). https://doi.org/10.1186/s12866-018-1288-3

584 Malele, I. I. *et al.* Comparative performance of traps in catching tsetse flies (Diptera: Glossinidae) in Tanzania. *Onderstepoort Journal of Veterinary Research* 83 (2016). https://doi.org/10.4102/ojvr.v83i1.1057

585 Malele, I. I. *et al.* Prevalence of SGHV among tsetse species of economic importance in Tanzania and their implication for SIT application. *Journal of Invertebrate Pathology* 112, S133-S137 (2013). https://doi.org/10.1016/j.jip.2012.07.018

586 Malele, I. I. *et al.* Multiple *Trypanosoma* infections are common amongst *Glossina* species in the new farming areas of Rufiji district, Tanzania. *Parasites & Vectors* 4 (2011). https://doi.org/10.1186/1756-3305-4-217

587 Malele, I. I. *et al. Glossina* dynamics in and around the sleeping sickness endemic Serengeti ecosystem of northwestern Tanzania. *Journal of Vector Ecology* 32, 263-268 (2007). https://doi.org/10.3376/1081-1710(2007)32[263:GDIAAT]2.0.CO;2

588 Malele, I. I. *et al.* The use of specific and generic primers to identify trypanosome infections of wild tsetse flies in Tanzania by PCR. *Infection, Genetics and Evolution* 3, 271-279 (2003). https://doi.org/10.1016/S1567-1348(03)00090-X

589 Malulu, D. *et al.* The PCR Identification of Trypanosomes Isolated from Cattle and *Glossina* spp. in Wildlife-Human-animal Interface of Meatu District, North-Eastern Tanzania. *Journal of Advanced Veterinary Research* 9, 64-68 (2019). [Cited 16 January 2024.] www.advetresearch.com/index.php/AVR/article/view/355/312

590 Manangwa, O. *et al.* Detecting Wahlund effects together with amplification problems: Cryptic species, null alleles and short allele dominance in *Glossina pallidipes* populations from Tanzania. *Molecular Ecology Resources* 19, 757-772 (2019). https://doi.org/10.1111/1755-0998.12989

591 Manangwa, O. *et al.* Distribution and population size of *Glossina fuscipes fuscipes* (tsetse flies) along the Lake Victoria, for trypanosomiasis management in Tanzania. *Livestock Research for Rural Development* 27, 31 (2015). [Cited 16 January 2024.] http://lrrd.cipav.org.co/lrrd27/2/mana27031.htm

592 Marquez, J. G., Malele, II, Ouma, J. O. & Krafsur, E. S. *Glossina swynnertoni* (Diptera : Glossinidae): effective population size and breeding structure estimated by mitochondrial diversity. *Bulletin of Entomological Research* 96, 353-360 (2006). https://doi.org/10.1079/ber2006435

593 Msangi, A. R., Whitaker, C. J. & Lehane, M. J. Factors influencing the prevalence of trypanosome infection of Glossina pallidipes on the Ruvu flood plain of Eastern Tanzania. *Acta Tropica* 70, 143-155 (1998). https://doi.org/10.1016/s0001-706x(98)00013-8

594 Nagagi, Y. P., Temba, V. & Komba, E. V. The efficacy of ZeroFly® Screen, insecticide incorporated screen, against nuisance and biting flies on cattle kept under zero grazing system in the Northern Zone of Tanzania. *Livestock Research for Rural Development* 29, 3 (2017). [Cited 16 January 2024.] www.lrrd.org/lrrd29/3/naga29054.html

595 Ngonyoka, A. *et al.* Patterns of tsetse abundance and trypanosome infection rates among habitats of surveyed villages in Maasai steppe of northern Tanzania. *Infectious Diseases of Poverty* 6, 126 (2017). https://doi.org/10.1186/s40249-017-0340-0

596 Ngonyoka, A. *et al.* Variation of tsetse fly abundance in relation to habitat and host presence in the Maasai Steppe, Tanzania. *Journal of Vector Ecology* 42, 34-43 (2017). https://doi.org/10.1111/jvec.12237

597 Nnko, H. J. *et al.* Seasonal variation of tsetse fly species abundance and prevalence of trypanosomes in the Maasai Steppe, Tanzania. *Journal of Vector Ecology* 42, 24-33 (2017). https://doi.org/10.1111/jvec.12236

598 Salekwa, L. P. *et al.* Relative abundance of tsetse fly species and their infection rates in Simanjiro, Northern Tanzania. *Livestock Research for Rural Development* 26, 213 (2014). [Cited 16 January 2024.] www.lrrd.cipav.org.co/lrrd26/12/sale26213.htm

599 Sasaki, H. & Nishida, T. Notes on the flies associated with wild chimpanzees at Mahale Mountains National Park, Tanzania, East Africa. *Medical Entomology and Zoology* 50, 151-155 (1999). www.jstage.jst.go.jp/article/mez/50/2/50_KJ00000825149/_pdf

600 Simwango, M. *et al.* Molecular prevalence of trypanosome infections in cattle and tsetse flies in the Maasai Steppe, northern Tanzania. *Parasites & Vectors* 10 (2017). https://doi.org/10.1186/s13071-017-2411-2

601 Sindato, C. *et al.* Seasonal epidemiological variation of human African trypanosomiasis in Babati District, Tanzania. *Tanzania Journal of Health Research* 9, 136-139 (2007). [Cited 16 January 2024.] www.ajol.info/index.php/thrb/article/download/14317/2681

602 Vreysen, M. J. B. Principles of area-wide integrated tsetse fly control using the sterile insect technique. *Médecine tropicale* 61, 397-410 (2001). http://revuemedecinetropicale.com/397-411_-_vreysen.pdf

603 Vreysen, M. J. B. & Saleh, K. M. Long-term sampling of gamma sterilised male *Glossina austeni* (Diptera: Glossinidae) with sticky panels on Unguja Island (Zanzibar). *Acta Tropica* 80, 29-37 (2001). https://doi.org/10.1016/s0001-706x(01)00143-7

604 Vreysen, M. J. B. *et al. Glossina austeni* (Diptera: Glossinidae) Eradicated on the Island of Unguja, Zanzibar, Using the Sterile Insect Technique. *Journal of Economic Entomology* 93, 123-135 (2000). https://doi.org/10.1603/0022-0493-93.1.123

605 Vreysen, M. J. B., Saleh, K. M., Khamis, I. S. & Mramba, F. An evaluation of insecticide-impregnated screens against *Glossina austeni* (Diptera: Glossinidae) on Unguja Island of Zanzibar. *International Journal of Tropical Insect Science* 19, 75-84 (1999). https://doi.org/10.1017/S1742758400016611

606 Vreysen, M. J. B. & Khamis, I. S. Notes on the Ecology of a Natural *Glossina austeni* (Diptera: Glossinidae) Population in the Jozani Forest, Unguja Island of Zanzibar. *International Journal of Tropical Insect Science* 19, 99-108 (1999). https://doi.org/10.1017/S1742758400019354

607 Vreysen, M. J. B., Zhu, Z. R. & Saleh, K. M. Field responses of *Glossina austeni* to sticky panels on Unguja Island, Zanzibar. *Medical and Veterinary Entomology* 12, 407-416 (1998). https://doi.org/10.1046/j.1365-2915.1998.00129.x

608 Vreysen, M. J. B., Khamis, I. S. & VanderVloedt, A. M. V. Evaluation of sticky panels to monitor populations of *Glossina austeni* (Diptera: Glossinidae) on Unguja island of Zanzibar. *Bulletin of Entomological Research* 86, 289-296 (1996). https://doi.org/10.1017/s0007485300052585

609 Alderton, S. *et al.* A Multi-Host Agent-Based Model for a Zoonotic, Vector-Borne Disease. A Case Study on Trypanosomiasis in Eastern Province, Zambia. *PLOS Neglected Tropical Diseases* 10, e0005252 (2016). https://doi.org/10.1371/journal.pntd.0005252

610 Dennis, J. W. *et al. Sodalis glossinidius* prevalence and trypanosome presence in tsetse from Luambe National Park, Zambia. *Parasites & Vectors* 7 (2014). https://doi.org/10.1186/1756-3305-7-378

611 Ducheyne, E. *et al.* The impact of habitat fragmentation on tsetse abundance on the plateau of eastern Zambia. *Preventive Veterinary Medicine* 91, 11-18 (2009). https://doi.org/10.1016/j.prevetmed.2009.05.009

612 Gaithuma, A. K. *et al.* A single test approach for accurate and sensitive detection and taxonomic characterization of Trypanosomes by comprehensive analysis of internal transcribed spacer 1 amplicons. *PLOS Neglected Tropical Diseases* 13 (2019). https://doi.org/10.1371/journal.pntd.0006842

613 Knols, B. G. J., Willemse, L. U. C., Flint, S. & Mate, A. A trial to control the tsetse fly, *Glossina morsitans centralis*, with low densities of odour-baited targets in west Zambia. *Medical and Veterinary Entomology* 7, 161-169 (1993). https://doi.org/10.1111/j.1365-2915.1993.tb00670.x

614 Konnai, S. *et al.* Detection of *Trypanosoma brucei* in Field-Captured Tsetse Flies and Identification of Host Species Fed on by the Infected Flies. *Vector borne and zoonotic diseases (Larchmont, N.Y.)* 8, 565-573 (2008). https://doi.org/10.1089/vbz.2007.0223

615 Kubi, C., Billiouw, M. & Van den Bossche, P. Age prevalence of trypanosomal infections in female *Glossina morsitans morsitans* (Diptera : Glossinidae) on the plateau area of eastern Zambia. *Onderstepoort Journal of Veterinary Research* 74, 223-229 (2007). [Cited 16 January 2024.] www.ojvr.org/index.php/ojvr/article/view/125/120

616 Laohasinnarong, D. *et al.* Studies of trypanosomiasis in the Luangwa valley, north-eastern Zambia. *Parasites & Vectors* 8 (2015). https://doi.org/10.1186/s13071-015-1112-y

617 Mbewe, N. J., Mweempwa, C., Guya, S. & Wamwiri, F. N. Microbiome frequency and their association with trypanosome infection in male *Glossina morsitans centralis* of Western Zambia. *Veterinary Parasitology* 211, 93-98 (2015). https://doi.org/10.1016/j.vetpar.2015.04.027

618 Mekata, H. *et al.* Prevalence and Source of Trypanosome Infections in Field-Captured Vector Flies (*Glossina pallidipes*) in Southeastern Zambia. *Journal of Veterinary Medical Science* 70, 923-928 (2008). https://doi.org/10.1292/jvms.70.923

619 Mwandiringana, E., Gori, E., Nyengerai, T. & Chidzwondo, F. Polymerase chain reaction (PCR) detection of mixed trypanosome infection and blood meal origin in field-captured tsetse flies from Zambia. *African Journal of Biotechnology* 11, 14490-14497 (2012). https://doi.org/10.5897/AJB12.2134

620 Mweempwa, C., Mbewe, N. J. & De Deken, R. Wing length of tsetse caught by stationary and mobile sampling methods. *Acta Tropica* 204 (2020). https://doi.org/10.1016/j.actatropica.2020.105333

621 Mweempwa, C. *et al.* Impact of habitat fragmentation on tsetse populations and trypanosomosis risk in Eastern Zambia. *Parasites & Vectors* 8 (2015). https://doi.org/10.1186/s13071-015-1018-8

622 Sedda, L. *et al.* A Bayesian Geostatistical Moran Curve Model for Estimating Net Changes of Tsetse Populations in Zambia. *PLOS ONE* 9 (2014). https://doi.org/10.1371/journal.pone.0096002

623 Van den Bossche, P. & Hargrove, J. W. Seasonal variation in nutritional levels of male tsetse flies *Glossina morsitans morsitans* (Diptera: Glossinidae) caught using fly-rounds and electric screens. *Bulletin of Entomological Research* 89, 381-387 (1999). https://doi.org/10.1017/s0007485399000516

624 Van den Bossche, P. & Duchateau, L. The effect of deltamethrin pour-on applied to cattle on the transmission of bovine trypanosomosis. *Revue d'élevage et de médecine vétérinaire des pays tropicaux* 51, 123-126 (1998). https://revues.cirad.fr/index.php/REMVT/article/download/9637/9631/0

625 Van den Bossche, P. The control of *Glossina morsitans morsitans* (Diptera: Glossinidae) in a settled area in Petauke District (Eastern Province, Zambia) using odour-baited targets. *Onderstepoort Journal of Veterinary Research* 64, 251-257 (1997). [Cited 16 January 2024.] http://repository.up.ac.za/bitstream/handle/2263/20755/38vandenbossche1997.pdf?sequence=1&isAllowed=y

626 Van den Bossche, P. & Staak, C. The importance of cattle as a food source for *Glossina morsitans morsitans* in Katete district, Eastern Province, Zambia. *Acta Tropica* 65, 105-109 (1997). https://doi.org/10.1016/S0001-706X(97)00658-X

627 Woolhouse, M. E. J., Bealby, K., McNamara, J. J. & Silutongwe, J. Trypanosome infections of the tsetse fly *Glossina pallidipes* in the Luangwa Valley, Zambia. *International Journal for Parasitology* 24, 987-993 (1994). https://doi.org/10.1016/0020-7519(94)90164-3

628 Ziba, M. M., Mukunyandela, C., Siziya, S., Chipipa, J. S. & Mwannza, L. A comparison of three types of "M" traps for sampling tsetse fly (Diptera: Glossinidae) populations at South Luangwa Game Management Area, Zambia. *The Central African Journal of Medicine* 40, 212-217 (1994). https://core.ac.uk/download/pdf/286042757.pdf

629 Ackley, S. F. & Hargrove, J. W. A dynamic model for estimating adult female mortality from ovarian dissection data for the tsetse fly *Glossina pallidipes* Austen sampled in Zimbabwe. *PLOS Neglected Tropical Diseases* 11 (2017). https://doi.org/10.1371/journal.pntd.0005813

630 Barclay, H. J., Hargrove, J. W. & van den Driessche, P. Estimating tsetse fertility: daily averaging versus periodic larviposition. *Medical and Veterinary Entomology* 34, 27-33 (2020). https://doi.org/10.1111/mve.12399

631 Chikowore, G. *et al.* A pilot study to delimit tsetse target populations in Zimbabwe. *PLOS Neglected Tropical Diseases* 11 (2017). https://doi.org/10.1371/journal.pntd.0005566

632 Gibson, G. Do tsetse flies 'see' zebras? A field study of the visual response of tsetse to striped targets. *Physiological Entomology* 17, 141-147 (1992). https://doi.org/10.1111/j.1365-3032.1992.tb01191.x

633 Groenendijk, C. A. The response of tsetse flies to artificial baits in relation to age, nutritional and reproductive state. *Entomologia Experimentalis et Applicata* 78, 335-340 (1996). https://doi.org/10.1111/j.1570-7458.1996.tb00798.x

634 Hargrove, J. *et al.* Wing length and host location in tsetse (*Glossina* spp.): implications for control using stationary baits. *Parasites & Vectors* 12 (2019). https://doi.org/10.1186/s13071-018-3274-x

635 Hargrove, J. W., Muzari, M. O. & English, S. How maternal investment varies with environmental factors and the age and physiological state of wild tsetse *Glossina pallidipes* and *Glossina morsitans morsitans*. *Royal Society Open Science* 5, 171739 (2018). https://doi.org/10.1098/rsos.171739

636 Hargrove, J. W. & Muzari, M. O. Artificial Warthog Burrows Used to Sample Adult and Immature Tsetse (*Glossina* spp) in the Zambezi Valley of Zimbabwe. *PLOS Neglected Tropical Diseases* 9 (2015). https://doi.org/10.1371/journal.pntd.0003565

637 Hargrove, J. W. Reproductive abnormalities in tsetse flies in Zimbabwe. *Entomologia Experimentalis et Applicata* 92, 89-99 (1999). https://doi.org/10.1046/j.1570-7458.1999.00528.x

638 Hargrove, J. W. Nutritional levels of female tsetse *Glossina pallidipes* from artificial refuges. *Medical and Veterinary Entomology* 13, 150-164 (1999). https://doi.org/10.1046/j.1365-2915.1999.00152.x

639 Hargrove, J. W. Lifetime changes in the nutritional characteristics of female tsetse *Glossina pallidipes* caught in odour-baited traps. *Medical and Veterinary Entomology* 13, 165-176 (1999). https://doi.org/10.1046/j.1365-2915.1999.00153.x

640 Hargrove, J. W. & Langley, P. A. A field trial of pyriproxyfen-treated targets as an alternative method for controlling tsetse (Diptera: Glossinidae). *Bulletin of Entomological Research* 83, 361-368 (1993). https://doi.org/10.1017/S0007485300029254

641 Lall, G. K. *et al.* Amplified fragment length polymorphism (AFLP) analysis of closely related wild and captive tsetse fly (*Glossina morsitans morsitans*) populations. *Parasites & Vectors* 3, 47 (2010). https://doi.org/10.1186/1756-3305-3-47

642 Matawa, F., Murwira, A., Zengeya, F. M. & Atkinson, P. M. Modelling the spatial-temporal distribution of tsetse (*Glossina pallidipes*) as a function of topography and vegetation greenness in the Zambezi Valley of Zimbabwe. *Applied Geography* 76, 198-206 (2016). https://doi.org/10.1016/j.apgeog.2016.09.008

643 Matawa, F., Murwira, K. S. & Shereni, W. Modelling the distribution of suitable *Glossina* spp. habitat in the north western parts of Zimbabwe using remote sensing and climate data. *Geoinformatics & Geostatistics: An Overview*, 1-9 (2013). http://dx.doi.org/10.4172/2327-4581.S1-016

644 Mhindurwa, A. Field observations of tsetse flies (*Glossina* spp. (Diptera: Glossinidae)) with new odour-baited trapping devices. *Bulletin of Entomological Research* 84, 529-532 (1994). https://doi.org/10.1017/S0007485300032776

645 Muzari, M. O. Odour-baited targets as invasion barriers for tsetse flies (Diptera : Glossinidae): a field trial in Zimbabwe. *Bulletin of Entomological Research* 89, 73-77 (1999). https://doi.org/10.1017/s0007485399000097

646 Muzari, M. O. & Hargrove, J. W. The design of target barriers for tsetse flies, *Glossina* spp. (Diptera: Glossinidae). *Bulletin of Entomological Research* 86, 579-583 (1996). https://doi.org/10.1017/s0007485300039377

647 Santer, R. D., Vale, G. A., Tsikire, D. & Torr, S. J. Optimising targets for tsetse control: Taking a fly's-eye-view to improve the colour of synthetic fabrics. *PLOS Neglected Tropical Diseases* 13 (2019). https://doi.org/10.1371/journal.pntd.0007905

648 Scoones, I. *et al.* People, Patches, and Parasites: The Case of Trypanosomiasis in Zimbabwe. *Human Ecology* 45, 643-654 (2017). https://doi.org/10.1007/s10745-017-9929-y

649 Shereni, W., Anderson, N. E., Nyakupinda, L. & Cecchi, G. Spatial distribution and trypanosome infection of tsetse flies in the sleeping sickness focus of Zimbabwe in Hurungwe District. *Parasites & Vectors* 9 (2016). https://doi.org/10.1186/s13071-016-1879-5

650 Thakersi, H. New records of tsetse flies in Eastern Zimbabwe. *Transactions of the Zimbabwe Scientific Association* 66, 30-34 (1992).

651 Thakersi, H. Records of the tsetse fly *Glossina pallidipes* in the north-eastern region of Zimbabwe. *Transactions of the Zimbabwe Scientific Association* 65, 20-23 (1991).

652 Torr, S. J., Chamisa, A., Mangwiro, T. N. C. & Vale, G. A. Where, When and Why Do Tsetse Contact Humans? Answers from Studies in a National Park of Zimbabwe. *PLOS Neglected Tropical Diseases* 6, e1791 (2012). https://doi.org/10.1371/journal.pntd.0001791

653 Torr, S. J., Chamisa, A., Vale, G. A., Lehane, M. J. & Lindh, J. M. Responses of tsetse flies, *Glossina morsitans morsitans* and *Glossina pallidipes*, to baits of various size. *Medical and Veterinary Entomology* 25, 365-369 (2011). https://doi.org/10.1111/j.1365-2915.2011.00947.x

654 Torr, S. J., Prior, A., Wilson, P. J. & Schofield, S. Is there safety in numbers? The effect of cattle herding on biting risk from tsetse flies. *Medical and veterinary entomology* 21, 301-311 (2007). https://doi.org/10.1111/j.1365-2915.2007.00705.x

655 Torr, S. J., Maudlin, I. & Vale, G. A. Less is more: restricted application of insecticide to cattle to improve the cost and efficacy of tsetse control. *Medical and Veterinary Entomology* 21, 53-64 (2007). https://doi.org/10.1111/j.1365-2915.2006.00657.x

656 Torr, S. J., Mangwiro, T. N. C. & Hall, D. R. The effects of host physiology on the attraction of tsetse (Diptera: Glossinidae) and *Stomoxys* (Diptera: Muscidae) to cattle. *Bulletin of Entomological Research* 96, 71-84 (2006). https://doi.org/10.1079/ber2005404

657 Torr, S. J. & Mangwiro, T. N. C. Interactions between cattle and biting flies: effects on the feeding rate of tsetse. *Medical and Veterinary Entomology* 14, 400-409 (2000). https://doi.org/10.1046/j.1365-2915.2000.00257.x

658 Torr, S. J. & Hargrove, J. W. Behaviour of tsetse (Diptera : Glossinidae) during the hot season in Zimbabwe: the interaction of micro-climate and reproductive status. *Bulletin of Entomological Research* 89, 365-379 (1999). https://doi.org/10.1017/s0007485399000504

659 Torr, S. J. & Hargrove, J. W. Factors affecting the landing and feeding responses of the tsetse fly *Glossina pallidipes* to a stationary ox. *Medical and Veterinary Entomology* 12, 196-207 (1998). https://doi.org/10.1046/j.1365-2915.1998.00105.x

660 Torr, S. J., Hall, D. R. & Smith, J. L. Responses of tsetse flies (Diptera: Glossinidae) to natural and synthetic ox odours. *Bulletin of Entomological Research* 85, 157-166 (1995). https://doi.org/10.1017/s000748530005210x

661 Torr, S. J. Responses of tsetse flies (Diptera: Glossinidae) to warthog (*Phacochoerus aethiopicus* Pallas). *Bulletin of Entomological Research* 84, 411-419 (1994). https://doi.org/10.1017/S0007485300032545

662 Vale, G. A., Hargrove, J. W., Cullis, N. A., Chamisa, A. & Torr, S. J. Efficacy of Electrocuting Devices to Catch Tsetse Flies (Glossinidae) and Other Diptera. *PLOS Neglected Tropical Diseases* 9 (2015). https://doi.org/10.1371/journal.pntd.0004169

663 Vale, G. A. *et al.* Factors Affecting the Propensity of Tsetse Flies to Enter Houses and Attack Humans Inside: Increased Risk of Sleeping Sickness in Warmer Climates. *PLOS Neglected Tropical Diseases* 7 (2013). https://doi.org/10.1371/journal.pntd.0002193

664 Vale, G. A., Hall, D. R., Chamisa, A. & Torr, S. J. Towards an Early Warning System for Rhodesian Sleeping Sickness in Savannah Areas: Man-Like Traps for Tsetse Flies. *PLOS Neglected Tropical Diseases* 6 (2012). https://doi.org/10.1371/journal.pntd.0001978

665 Vale, G. A. Visual responses of tsetse flies (Diptera: Glossinidae) to odour-baited targets. *Bulletin of Entomological Research* 83, 277-289 (1993). https://doi.org/10.1017/S0007485300034775

666 Vale, G. A. Responses of tsetse flies (Diptera: Glossinidae) to odour-baited trees. *Bulletin of Entomological Research* 81, 323-331 (1991). https://doi.org/10.1017/S0007485300033605

667 Warnes, M. L. *et al.* Evaluation of insecticide-treated cattle as a barrier to re-invasion of tsetse to cleared areas in northeastern Zimbabwe. *Medical and Veterinary Entomology* 13, 177-184 (1999). https://doi.org/10.1046/j.1365-2915.1999.00148.x

668 Woolhouse, M. E. J., McNamara, J. J., Hargrove, J. W. & Bealby, K. A. Distribution and abundance of trypanosome (subgenus *Nannomonas*) infections of the tsetse fly *Glossina pallidipes* in southern Africa. *Molecular Ecology* 5, 11-18 (1996). https://doi.org/10.1111/j.1365-294X.1996.tb00287.x

669 Woolhouse, M. E. J., Hargrove, J. W. & McNamara, J. J. Epidemiology of trypanosome infections of the tsetse fly *Glossina pallidipes* in the Zambezi Valley. *Parasitology* 106, 479-485 (1993). https://doi.org/10.1017/S0031182000076770

Annex 2

Journals and publishers of the scientific papers used as sources to develop the atlas

Table 42 shows the number of papers used for the atlas by journal, while Table 43 provides the summary by publisher.

TABLE 42
Scientific publications used as sources for the atlas of tsetse flies by journal (period 1990–2020)

Journal	Papers (No.)
PLOS Neglected Tropical Diseases	59
Parasites & Vectors	45
Medical and Veterinary Entomology	38
Bulletin of Entomological Research	36
Acta Tropica	32
Revue d'élevage et de médecine vétérinaire des pays tropicaux	24
Onderstepoort Journal of Veterinary Research	22
Infection, Genetics and Evolution	20
Veterinary Parasitology	18
Parasite	15
Tropical Animal Health and Production	13
Journal of Veterinary Medicine and Animal Health	11
Parasitology	11
Bulletin of Animal Health and Production in Africa	10
BMC Microbiology	9
Journal of Medical Entomology	8
International Journal of Tropical Insect Science	7
Ethiopian Veterinary Journal	7
Livestock Research for Rural Development	6
Others*	278
Total	**669**

*Journals with fewer than six papers.

TABLE 43
Scientific publications used as sources for the atlas of tsetse flies by publisher (period 1990–2020)

Publisher	Papers (No.)
Elsevier	94
BioMed Central	64
PLOS	60
Cambridge University Press	55
CIRAD	24
Blackwell Science Ltd	21
Royal Entomological Society	18
Academic Journals	18
Springer	17
IDOSI	14
Onderstepoort Veterinary Research Institute	13
PRINCEPS Editions	10
Interafrican Bureau for Animal Resources	10
AOSIS	9
Ethiopian Veterinary Association	8
Blackwell Publishing Ltd	7
Kluwer Academic Publishers	7
Springer Nature	7
CIPAV	6
Entomological Society of America	6
Others*	201
Total	**669**

*Publishers with fewer than six papers.

Annex 3
Structure of the atlas database

SOURCES

1. SOURCE_ID: unique numeric identifier of the source paper (primary key).
2. FIRST_AUTHOR: surname of the first author.
3. INITIALS: initials of the first author.
4. AUTHORS: full list of authors.
5. TITLE: title of the paper.
6. YEAR: year of publication of the paper.
7. JOURNAL: name of the journal that published the paper.
8. PUBLISHER: name of the journal's publisher.
9. LANGUAGE: language of the paper.
10. FILE_NAME: standardized name of the PDF file (e.g. Adam_et_al_2012.pdf).
11. EXTERNAL_LINK: uniform resource locator (URL) for the paper, if available. If the Document Object Identifier (DOI) is available for the paper, it is used to generate a permanent URL (e.g. http://dx.doi.org/10.1016/j.rvsc.2011.04.004).
12. ACCESS_DATE: date when the paper was obtained/downloaded/provided.
13. ACCESS_TYPE: way in which FAO accessed the paper (e.g. "Open", "FAO subscription", "Inter-library loan", "Provided by Author", etc.)
14. AT_DATA: "Yes" identifies papers that provided data on animal trypanosomosis distribution.
15. TSETSE_DISTRIBUTION_DATA: "Yes" identifies papers that provided data on tsetse distribution.
16. TSETSE_INFECTION_DATA: "Yes" identifies papers that provided data on trypanosomal infection in tsetse flies.
17. COUNTRY: country (or countries) for which the paper provided data.
18. NOTES: note or comments on the paper that are relevant for the atlas' development.

GEOGRAPHICAL DATA

1. LOCATION_ID: unique numeric identifier of the study site (primary key).
2. SOURCE_ID: numeric identifier of the source paper that provided the site (foreign key for the table "Sources").
3. COUNTRY: country where the site is located.
4. LOCATION_NAME: name of the site where the study was conducted. As a rule, the name as reported in the paper is recorded. Alternative spellings may be recorded in the field "LOCATION_NOTES" (see number 11).
5. ADMIN1: name of the first subnational administrative unit where the site is located (as reported in the paper).
6. ADMIN2: name of the second subnational administrative unit where the site is located (as reported in the paper).
7. ADMIN3: name of the third subnational administrative unit where the site is located (as reported in the paper).
8. LAT: latitude of the study site in decimal degrees (datum: WGS84).
9. LONG: longitude of the study site in decimal degrees (datum: WGS84).
10. GEO_SOURCE: source of geographical coordinates or methodology of geopositioning. The source can be the paper itself or one of the many available gazetteers. The methodology may be an estimation of the geographical coordinates in a GIS using information or maps provided in the paper.
11. LOCATION_NOTES: includes additional information or details on any decision made in the process of georeferencing. This should help users understand the process.
12. AREA: surface of the surveyed area (km^2).

13. AREA_TYPE_TSETSE: Categorized surface of the area that was surveyed for tsetse distribution (km^2). This was based on the field "AREA", if available, or estimated in GIS using narrative information contained in the paper. Ten categories are contemplated:
    - ≤ 10 km^2
    - >10 km^2 and ≤ 25 km^2
    - >25 km^2 and ≤ 100 km^2
    - >100 km^2 and ≤ 500 km^2
    - >500 km^2 and ≤ 1 000 km^2
    - > 1 000 km^2 and ≤ 5 000 km^2
    - > 5 000 km^2 and ≤ 10 000 km^2
    - > 10 000 km^2 and ≤ 50 000 km^2
    - > 50 000 km^2 and ≤ 100 000 km^2
    - > 100 000 km^2

TSETSE DISTRIBUTION

1. TSETSE_ID: unique numeric identifier of each record in the table. If more than one tsetse species/subspecies is detected in a survey, each tsetse species/subspecies in that survey will be assigned a different TSETSE_ID.
2. SURVEY_ID: numeric identifier of the survey.
3. LOCATION_ID: numeric identifier of the site where the survey was carried out (extracted from the corresponding field in the table "Geo_data").
4. SOURCE_ID: numeric identifier of the source containing the data recorded for the present survey (extracted from the corresponding field in the table "Sources").
5. MONTH_ST: starting month of the survey.
6. YEAR_ST: starting year of the survey.
7. MONTH_EN: ending month of the survey.
8. YEAR_EN: ending year of the survey.
9. TRAP_TYPE: type of trap.
10. TRAP_ATTR: odour attractant used in the traps.
11. TRAP_NUMBER: number of traps deployed in the surveyed site.
12. TRAP_TIME: duration of trapping (in days).
13. TRAP_NOTES: details on the strategy of trap deployment (e.g. in which habitats were traps deployed? At what hours of the day were the traps operated?)
14. SPECIES: name of the species of tsetse.
15. SUBSPECIES: name of the subspecies of tsetse.
16. ASSUMED_SUBSPECIES: "Yes" identifies records for which the subspecies was not indicated in the paper and was inferred from the geographical location and historical distribution maps.
17. OUTLIER: "Yes" identifies records for which the species or subspecies was reported outside its historical distribution.
18. FLIES_PRESENCE_ABSENCE: "Yes" identifies records for which the species or subspecies was detected. "No" identifies the records for which it was not.
19. FLIES_NUMBER: number of flies caught.
20. FLIES_APPARENT_DENSITY: number of flies/trap/day.
21. OTHER_SPECIES: presence of information on other species/subspecies in the same survey. "Yes" indicated that other species/subspecies were detected in the same survey. "No" indicated that no other species/subspecies was detected in the survey. "No data" means the source does not indicate whether other species were detected in the same survey. This field enables extraction of absence data at the species/subspecies level from the database.
22. TSETSE_INTERVENTIONS: reports what interventions against tsetse were ongoing in the study area at the time of the survey, or in the recent past prior to the survey.
23. LONGITUDINAL: describes whether data were extracted from a longitudinal study.
24. NOTES: includes all important additional information as reported in the source paper.

Annex 4

Tsetse distribution maps at the country level

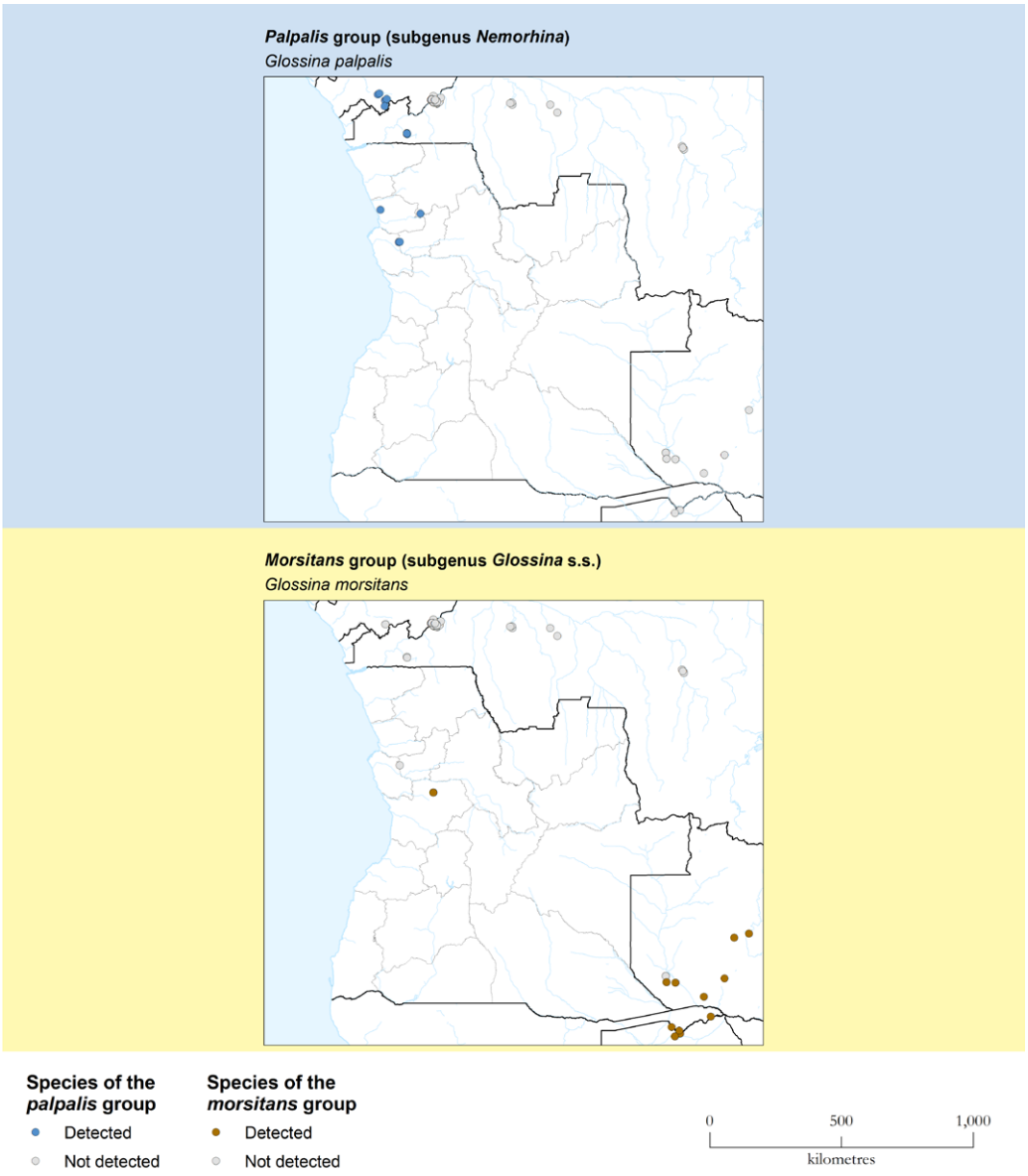
ANGOLA

FIGURE A.1
Geographic distribution of tsetse flies (genus *Glossina*) in Angola as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

ANGOLA

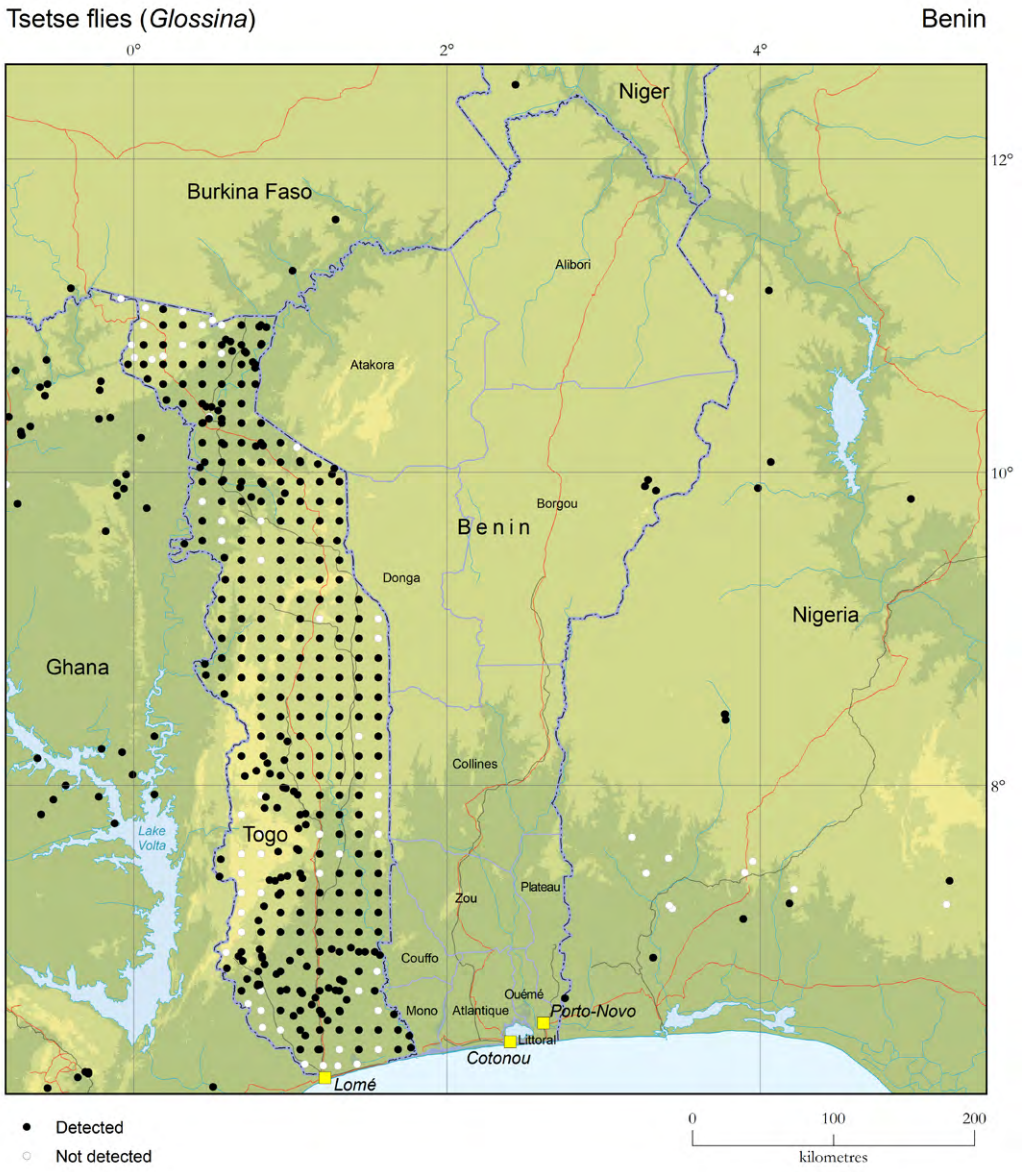
FIGURE A.2
Geographic distribution of the *Glossina* species in Angola as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

BENIN

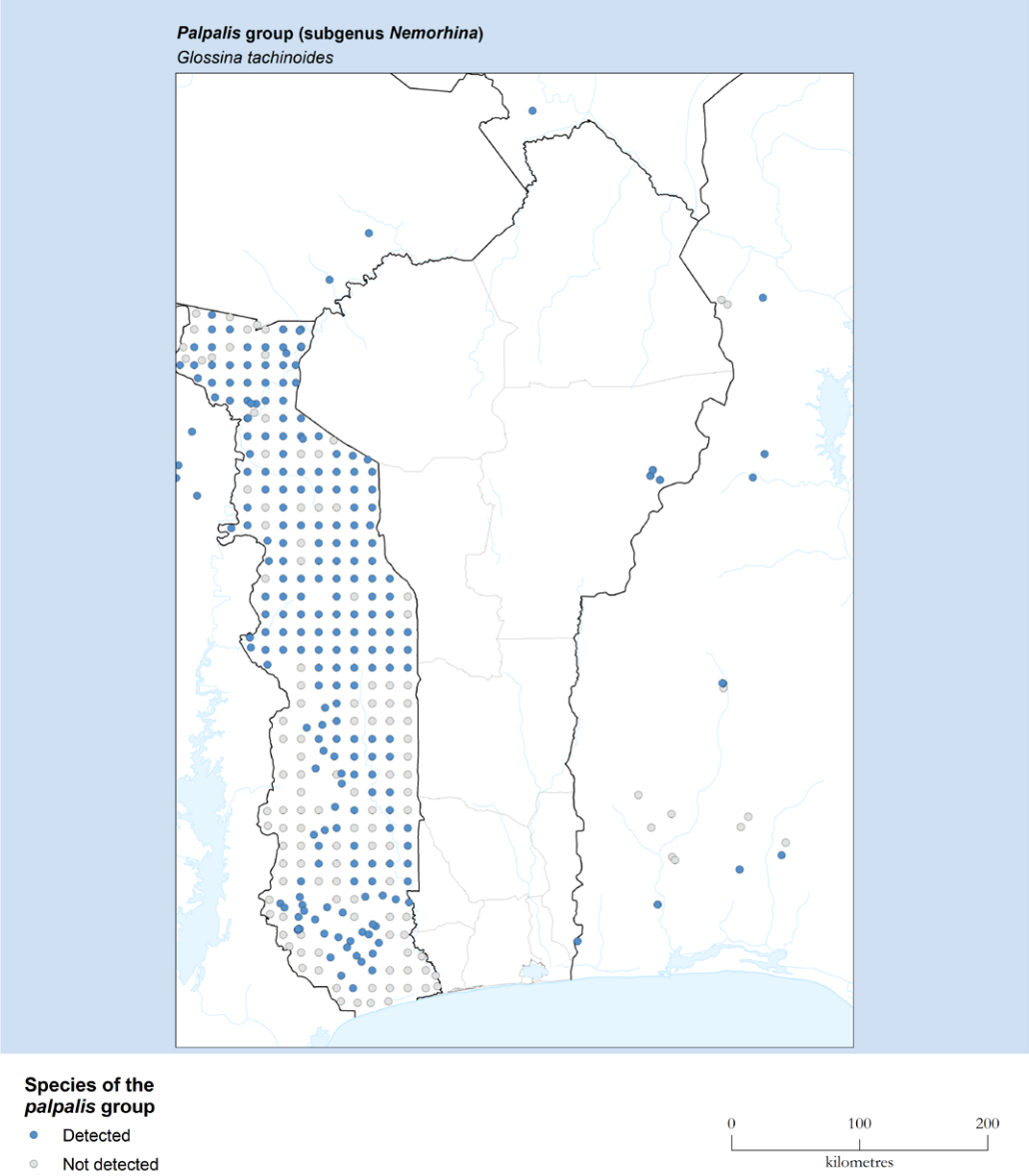
FIGURE A.3
Geographic distribution of tsetse flies (genus *Glossina*) in Benin as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

BENIN

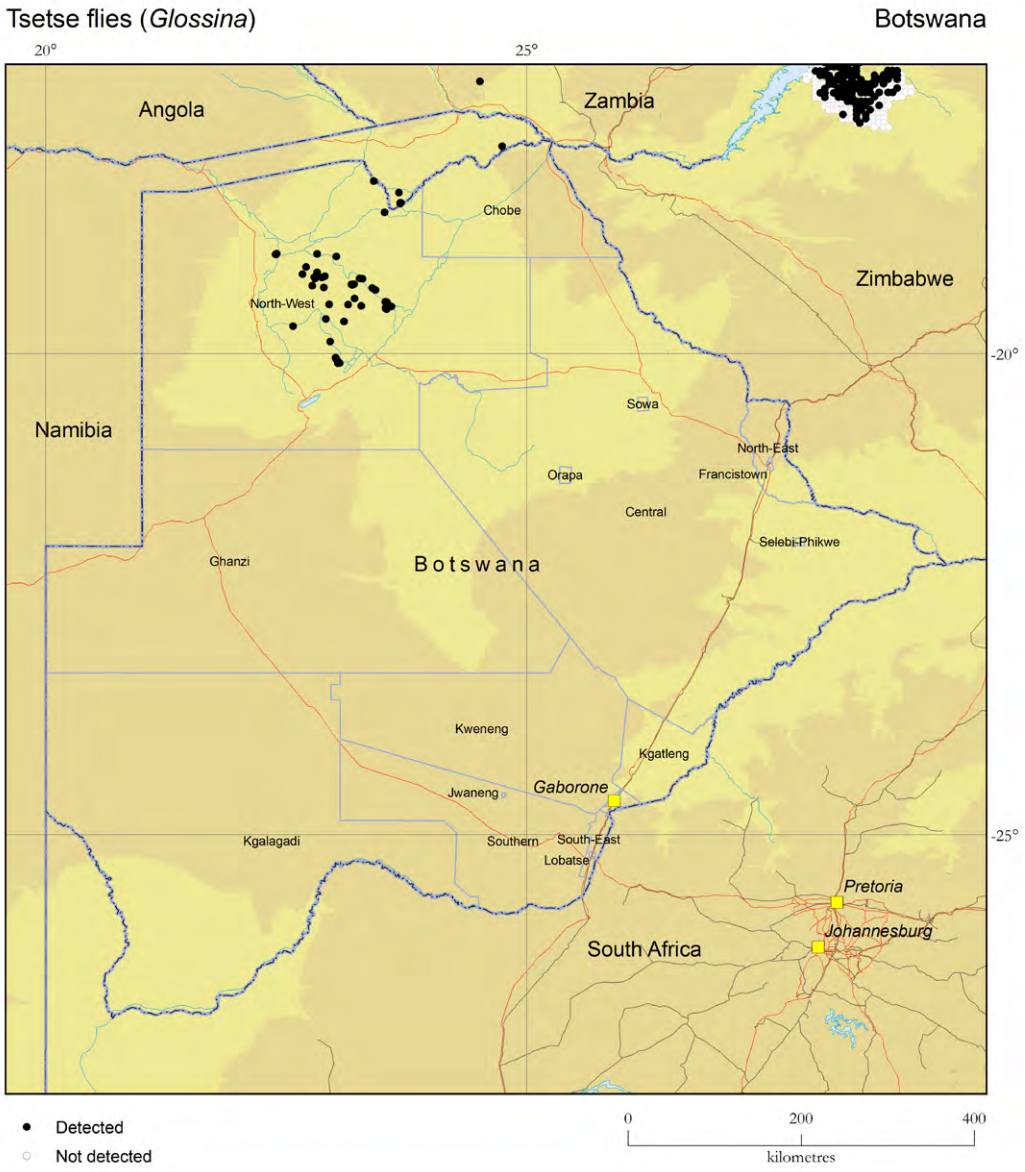
FIGURE A.4
Geographic distribution of *Glossina tachinoides* in Benin as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

BOTSWANA

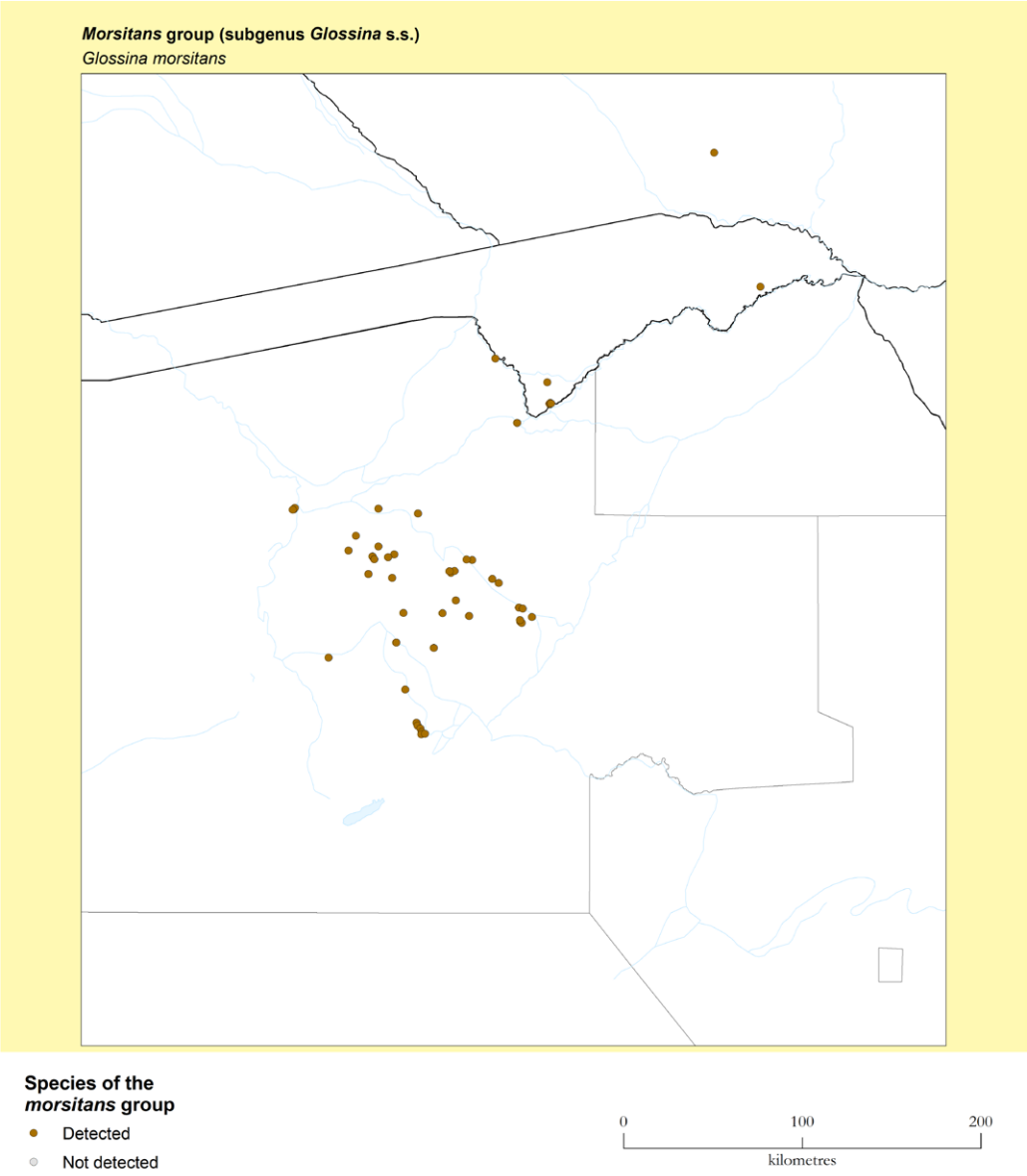
FIGURE A.5
Geographic distribution of tsetse flies (genus *Glossina*) in Botswana as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

BOTSWANA

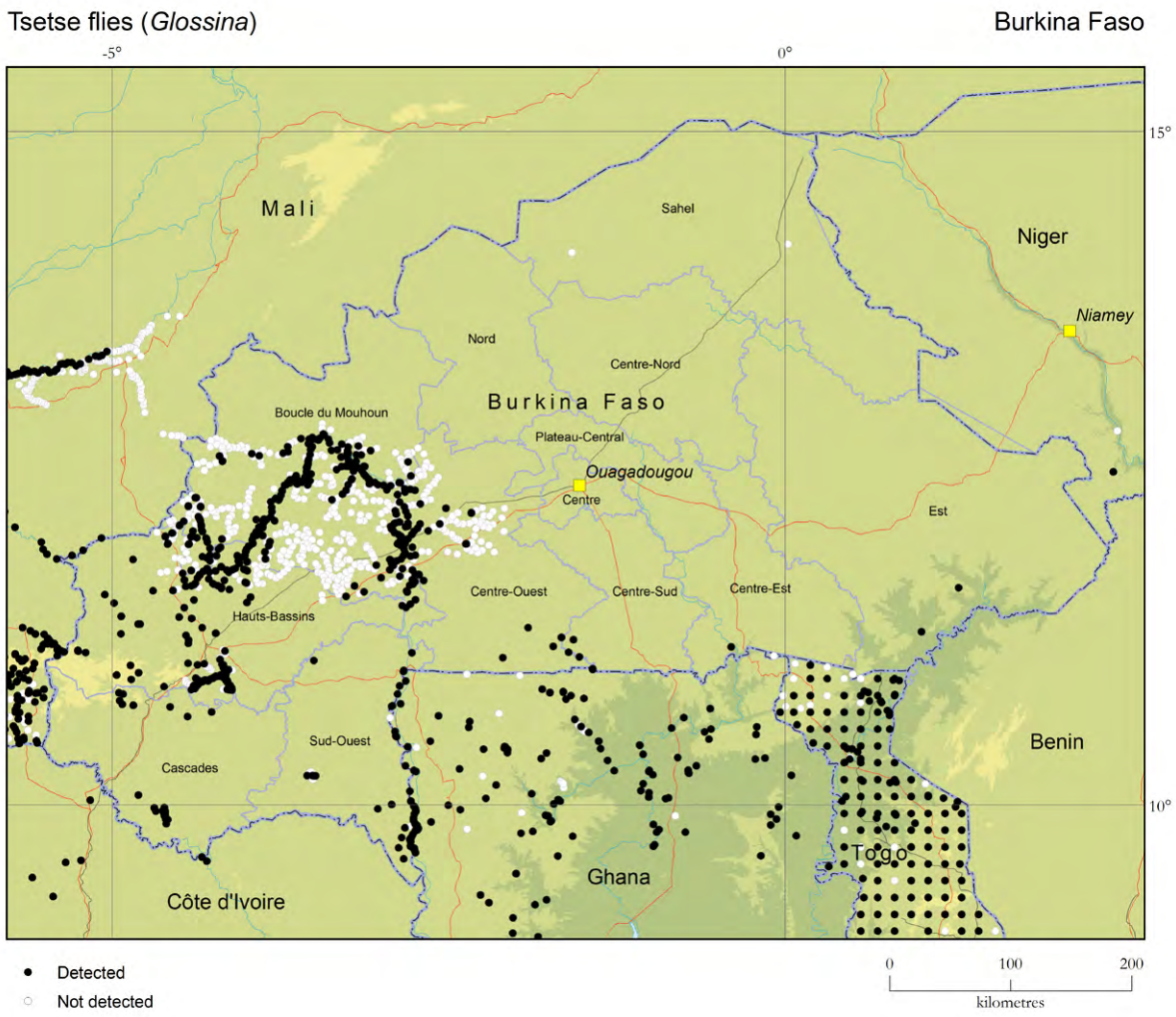
FIGURE A.6
Geographic distribution of *Glossina morsitans* in Botswana as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

BURKINA FASO

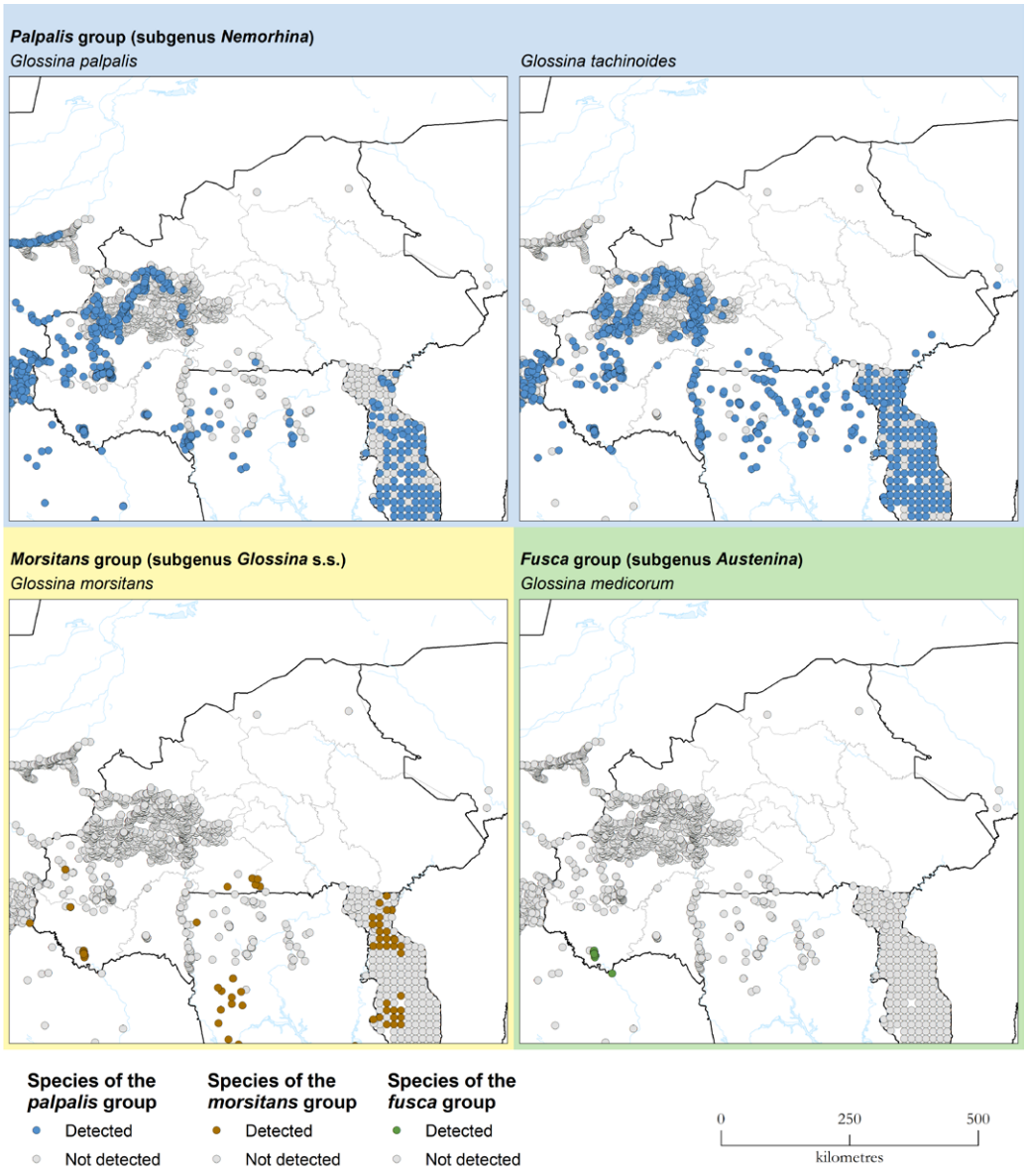
FIGURE A.7
Geographic distribution of tsetse flies (genus *Glossina*) in Burkina Faso as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

BURKINA FASO

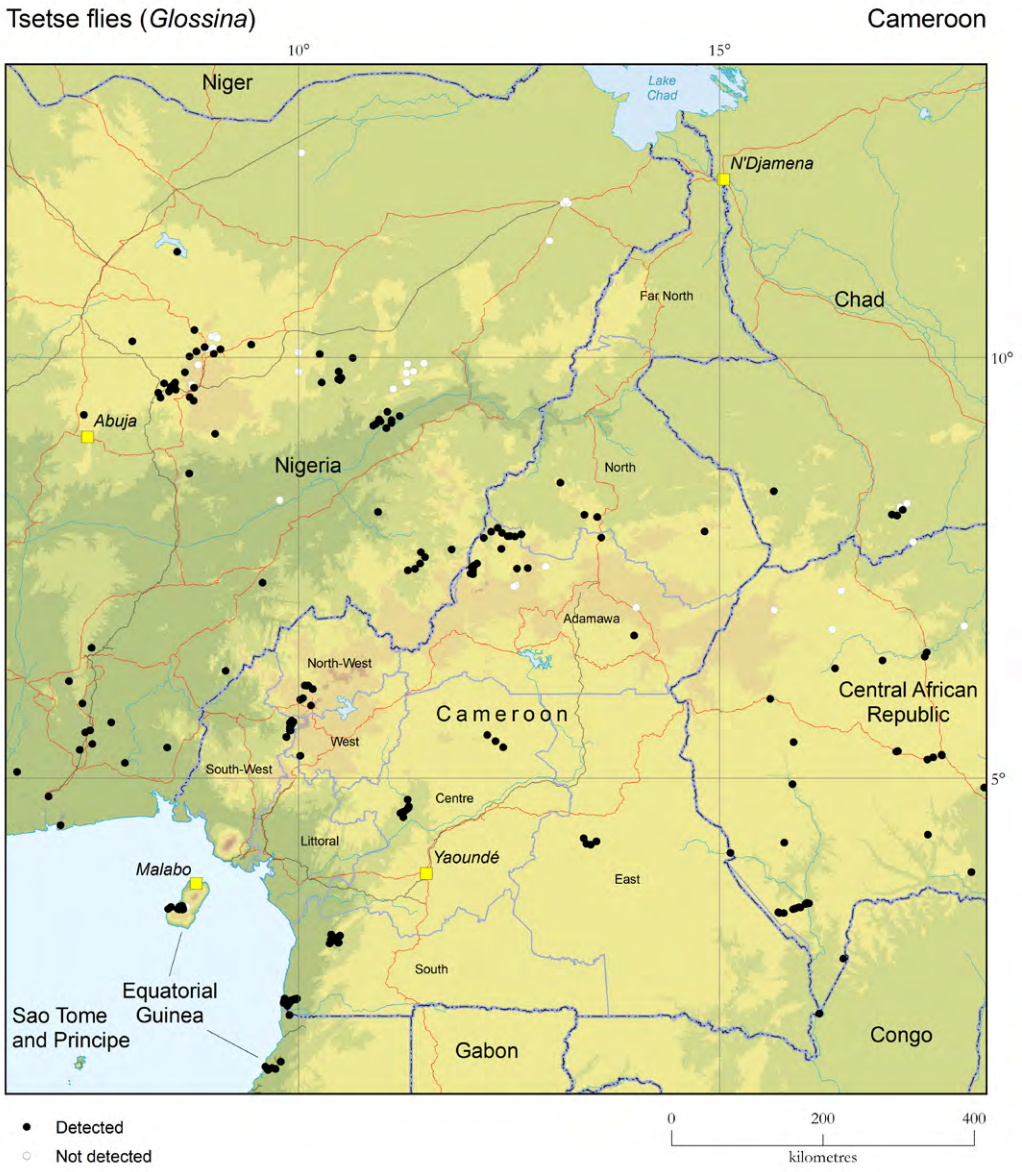
FIGURE A.8
Geographic distribution of the *Glossina* species in Burkina Faso as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

CAMEROON

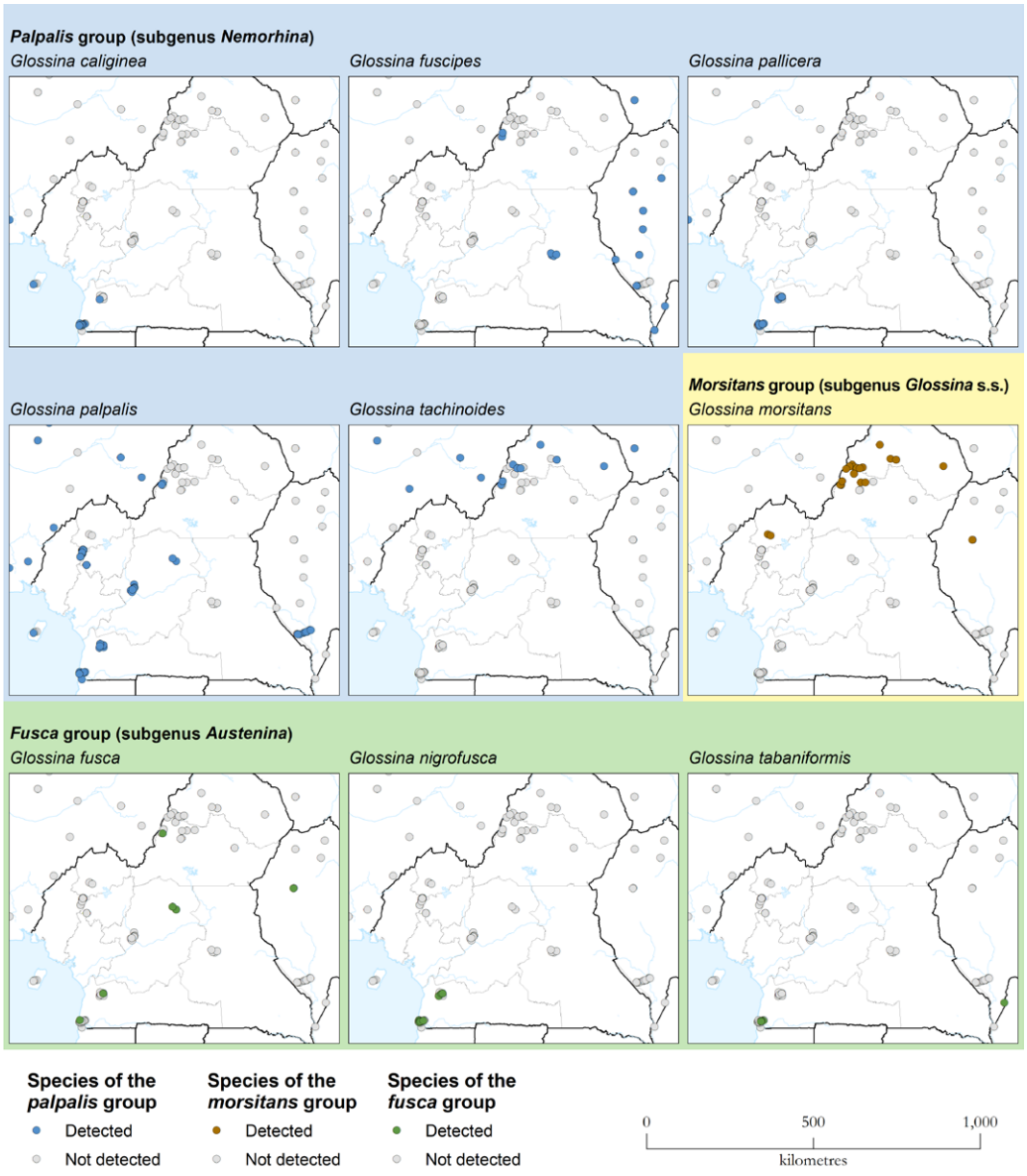
FIGURE A.9
Geographic distribution of tsetse flies (genus *Glossina*) in Cameroon as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

CAMEROON

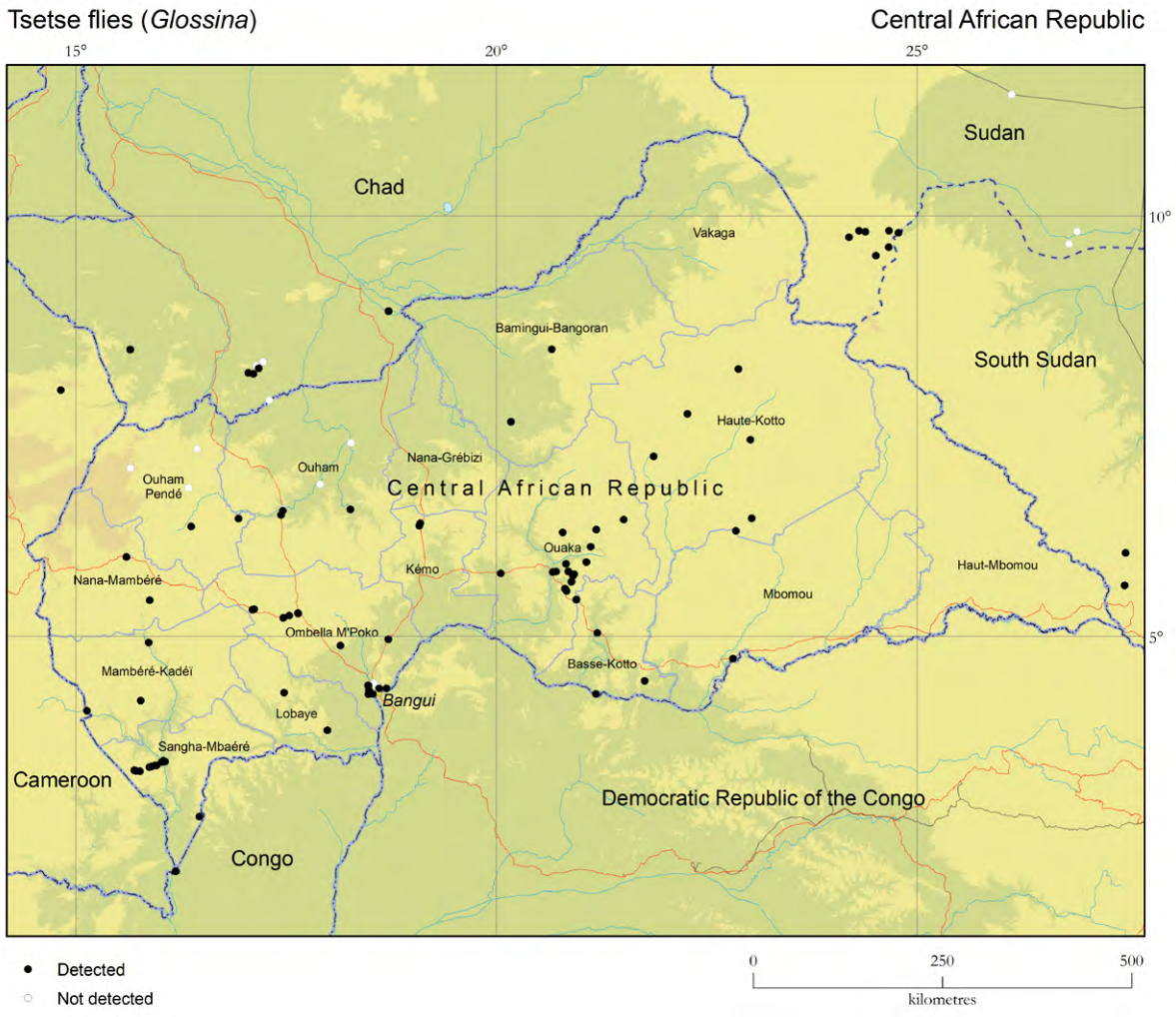
FIGURE A.10
Geographic distribution of the *Glossina* species in Cameroon as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

CENTRAL AFRICAN REPUBLIC

FIGURE A.11
Geographic distribution of tsetse flies (genus *Glossina*) in the Central African Republic as reported in scientific papers (publication period: 1990–2020)

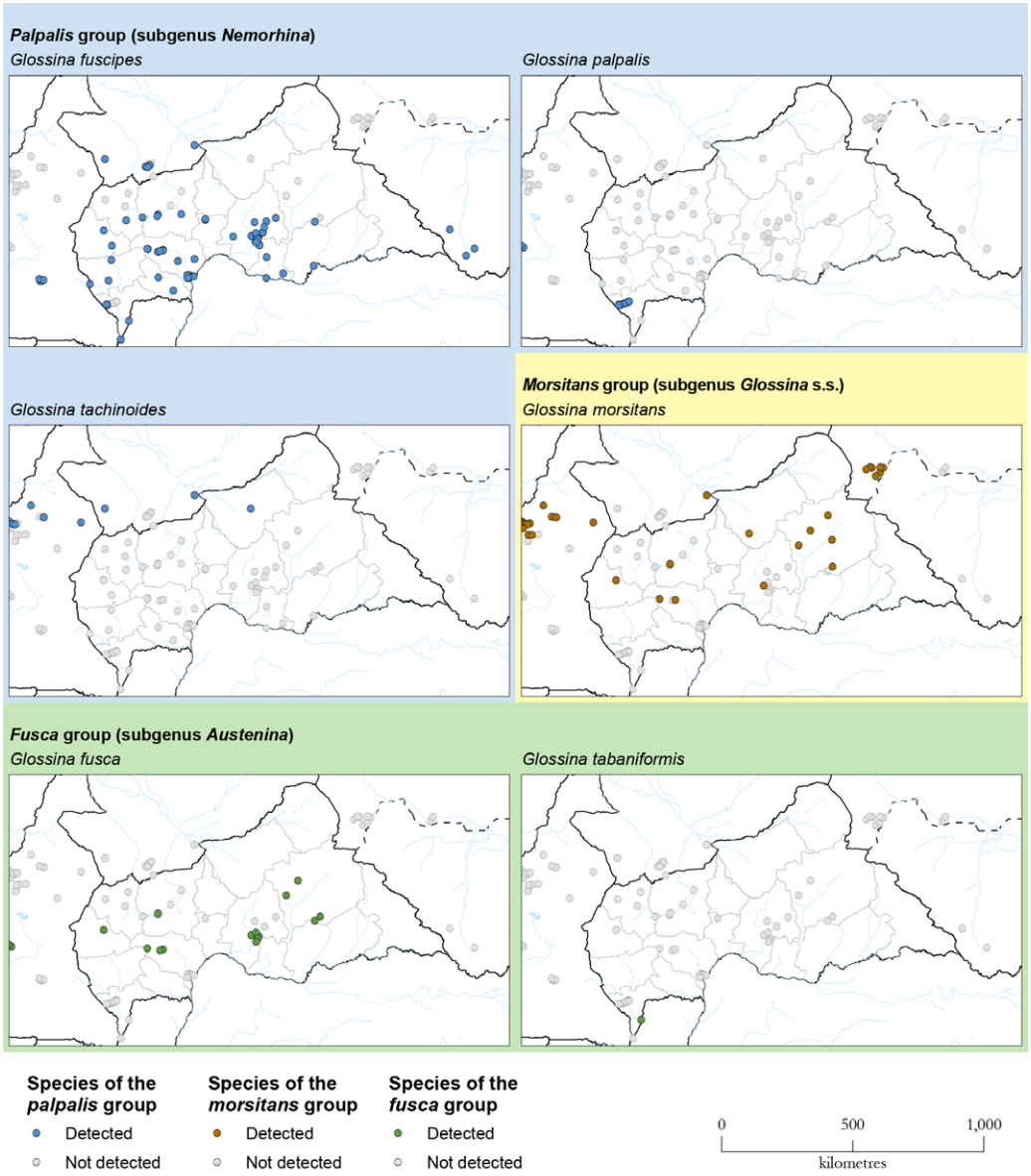


Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

CENTRAL AFRICAN REPUBLIC

FIGURE A.12
Geographic distribution of *Glossina* species in the Central African Republic as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

CHAD

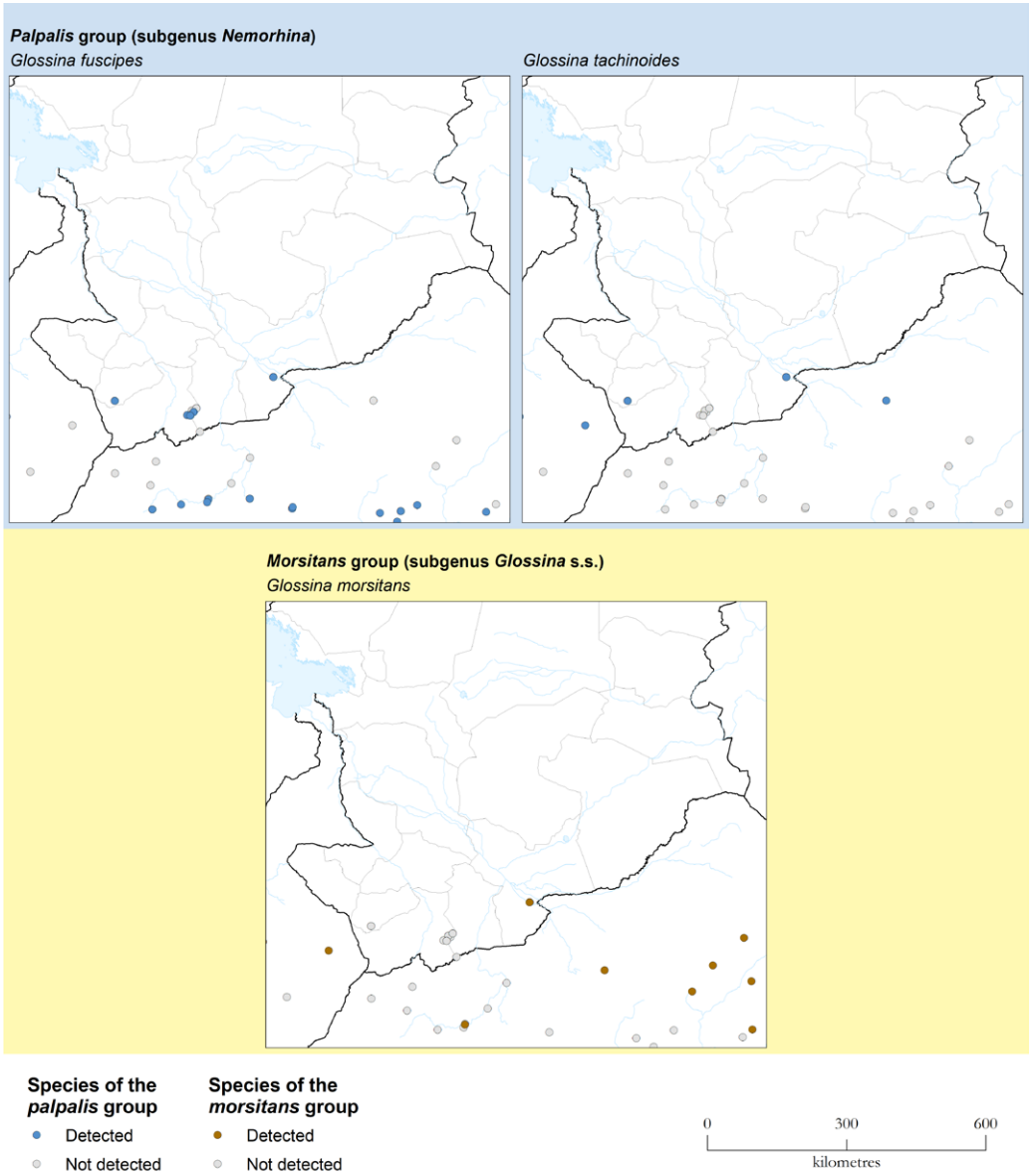
FIGURE A.13
Geographic distribution of tsetse flies (genus *Glossina*) in Chad as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined.

CHAD

FIGURE A.14
Geographic distribution of the *Glossina* species in Chad as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

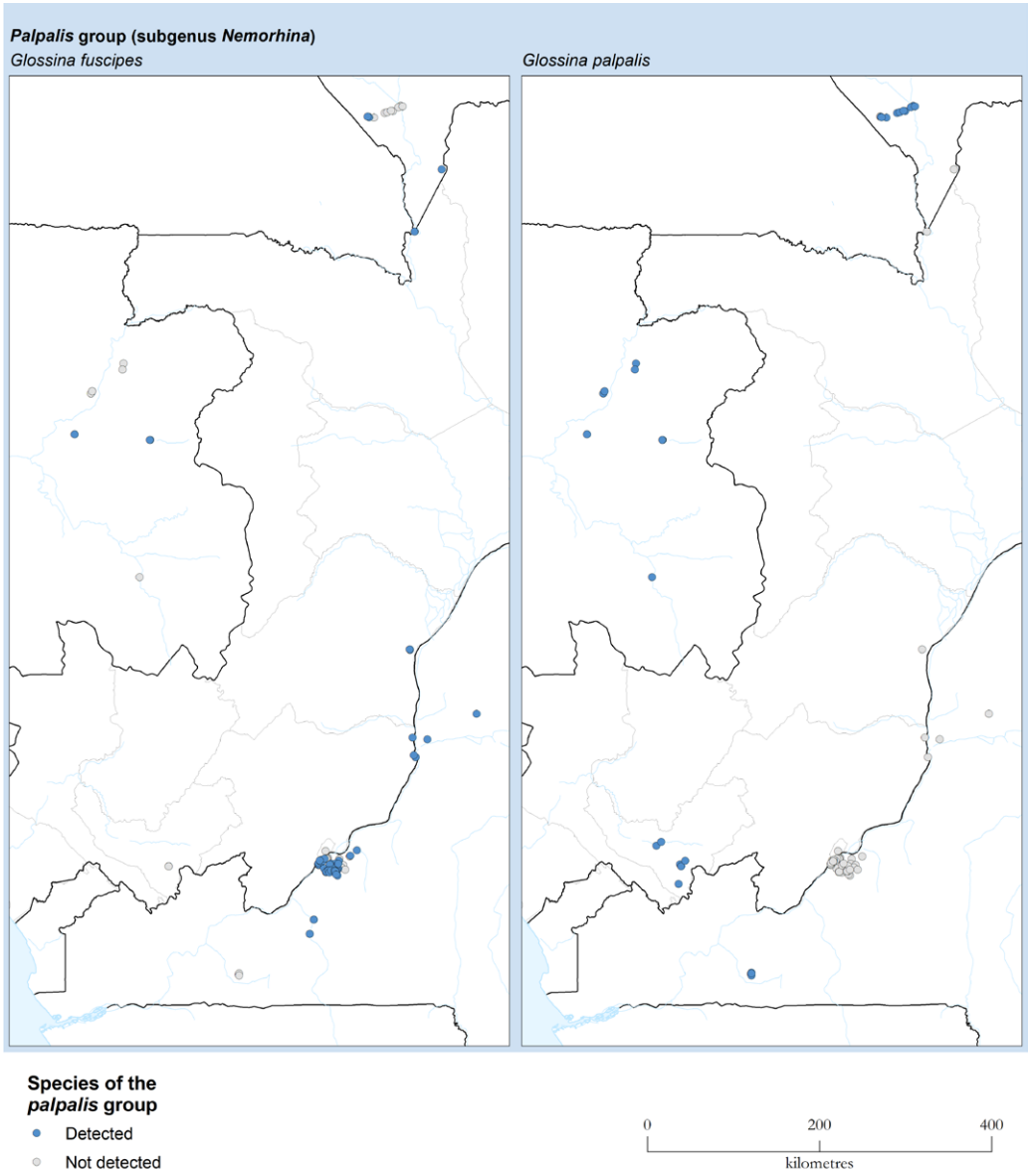
CONGO

FIGURE A.15
Geographic distribution of tsetse flies (genus *Glossina*) in the Congo as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

CONGO

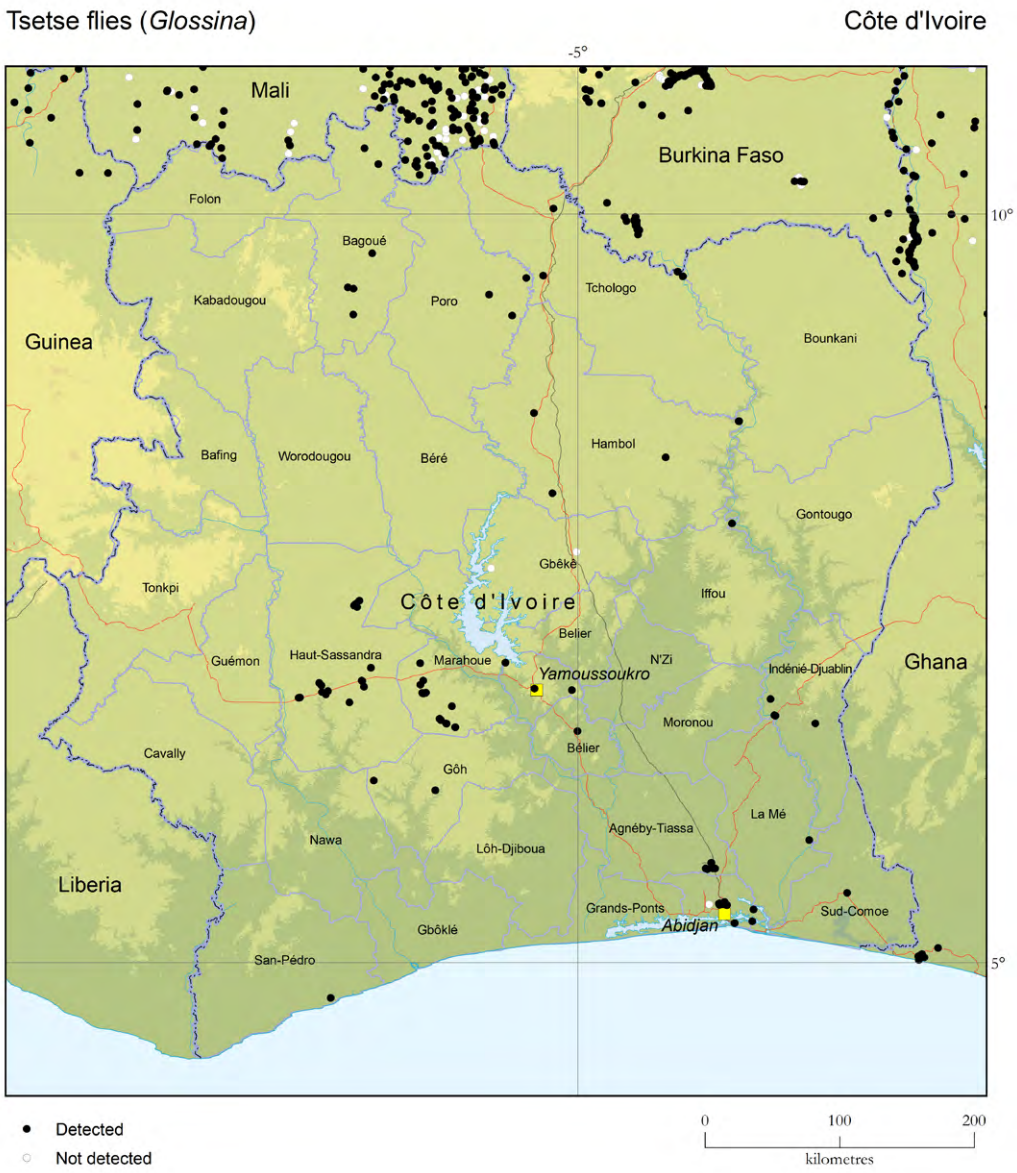
FIGURE A.16
Geographic distribution of the *Glossina* species in the Congo as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

CÔTE D'IVOIRE

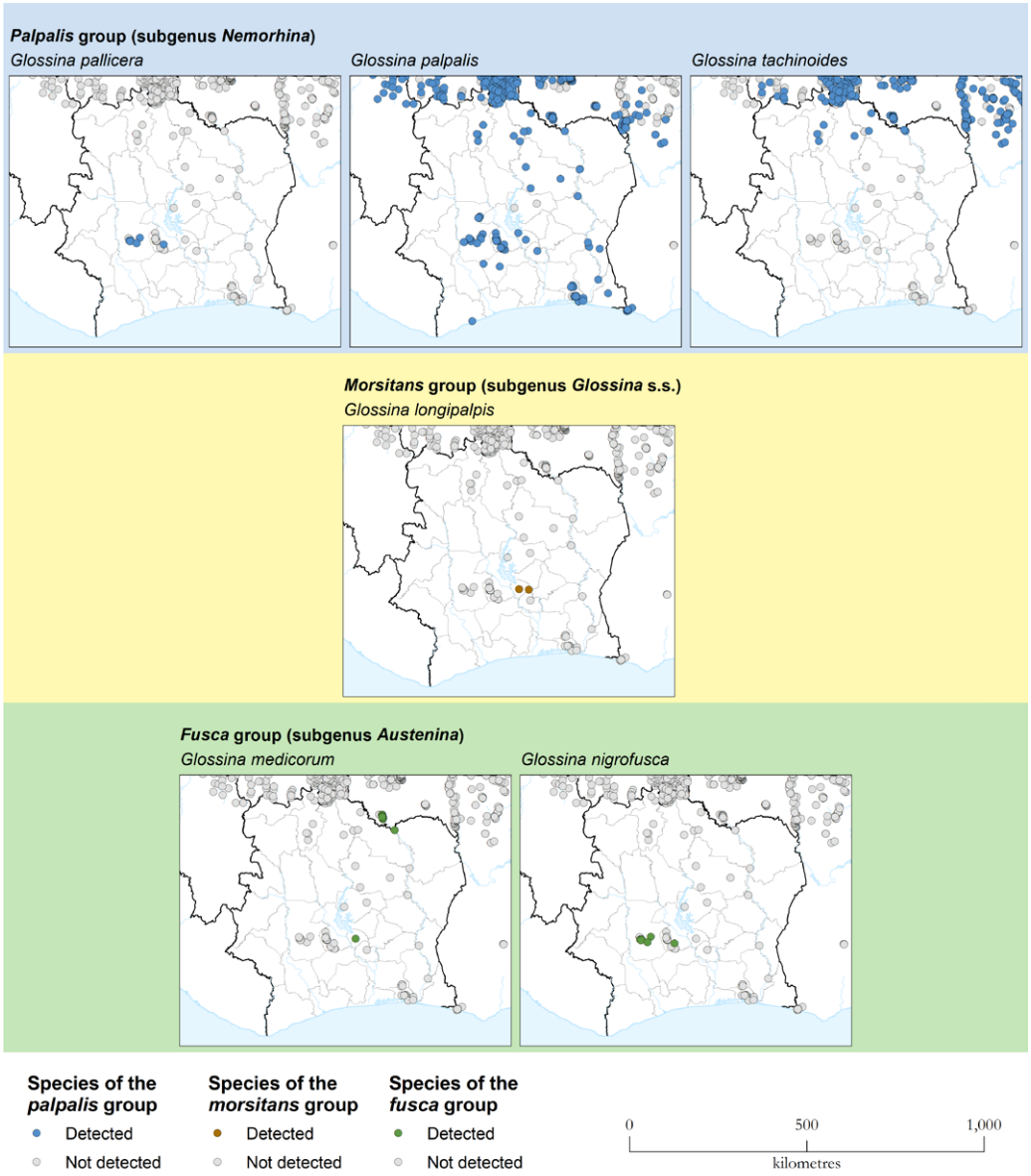
FIGURE A.17
Geographic distribution of tsetse flies (genus *Glossina*) in Côte d'Ivoire as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

CÔTE D'IVOIRE

FIGURE A.18
Geographic distribution of the *Glossina* species in Côte d'Ivoire as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

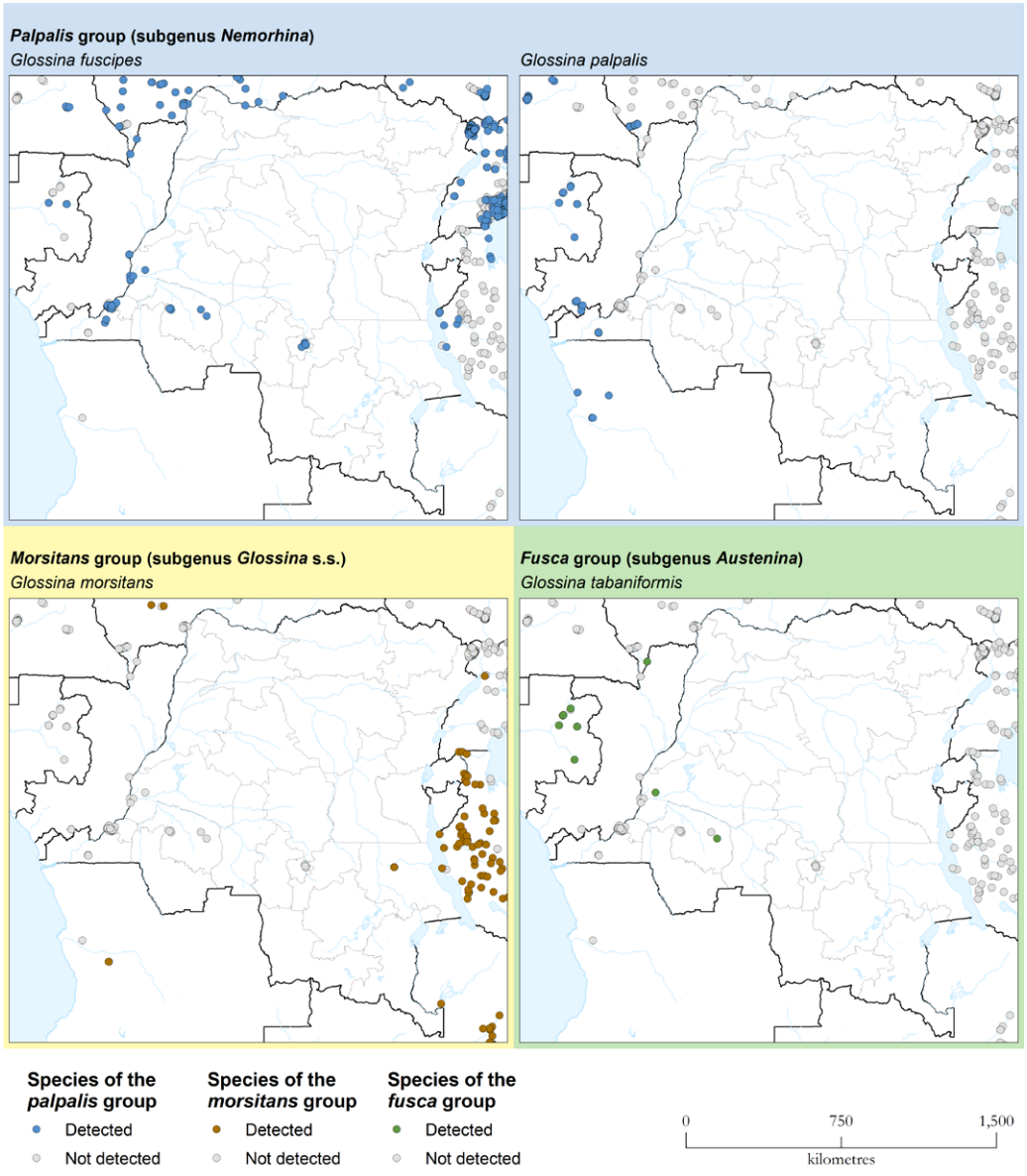
DEMOCRATIC REPUBLIC OF THE CONGO

FIGURE A.19
Geographic distribution of tsetse flies (genus *Glossina*) in the Democratic Republic of the Congo as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

DEMOCRATIC REPUBLIC OF THE CONGO

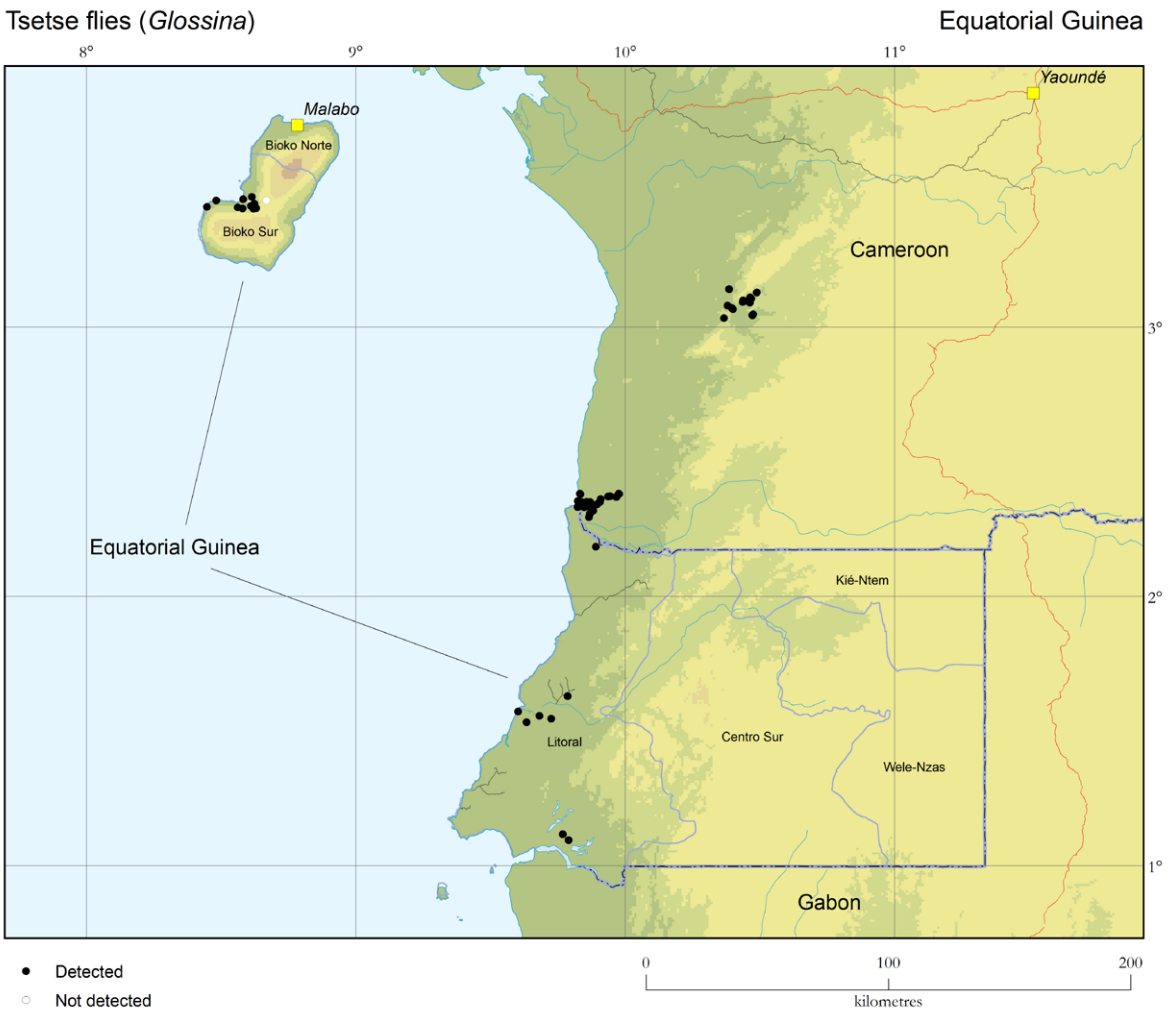
FIGURE A.20
Geographic distribution of the *Glossina* species in the Democratic Republic of the Congo as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

EQUATORIAL GUINEA

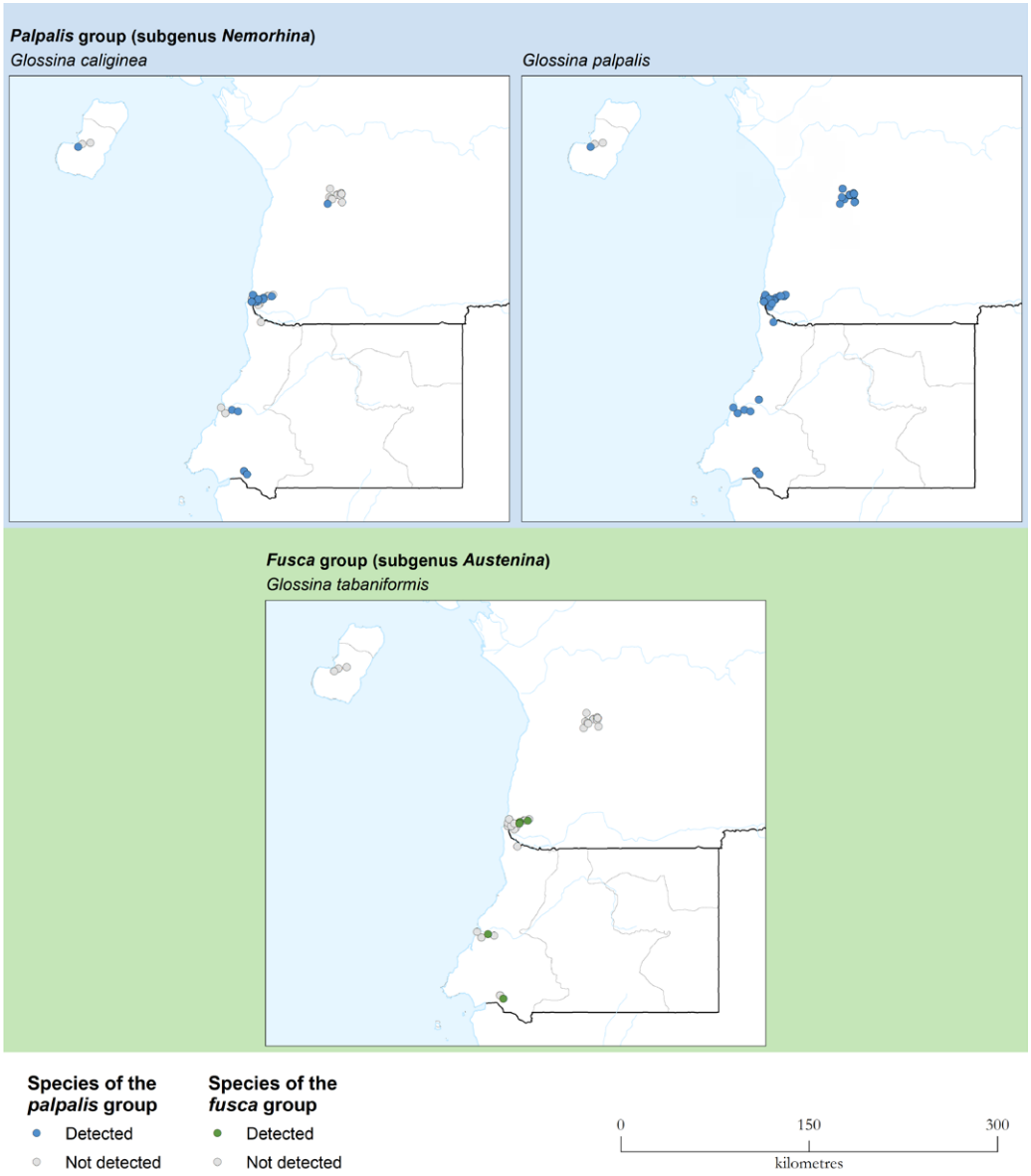
FIGURE A.21
Geographic distribution of tsetse flies (genus *Glossina*) in Equatorial Guinea as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

EQUATORIAL GUINEA

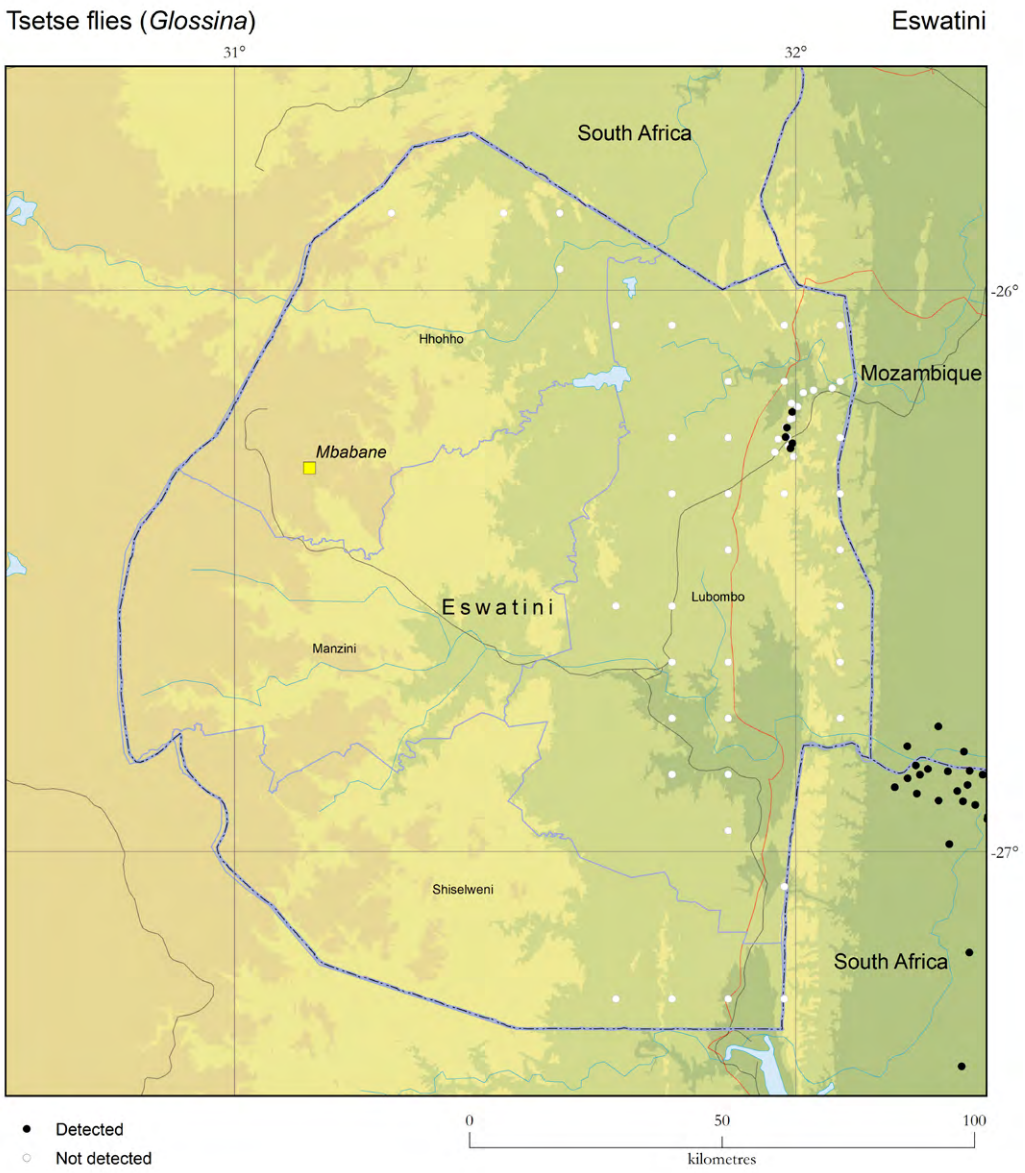
FIGURE A.22
Geographic distribution of the *Glossina* species in Equatorial Guinea as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

ESWATINI

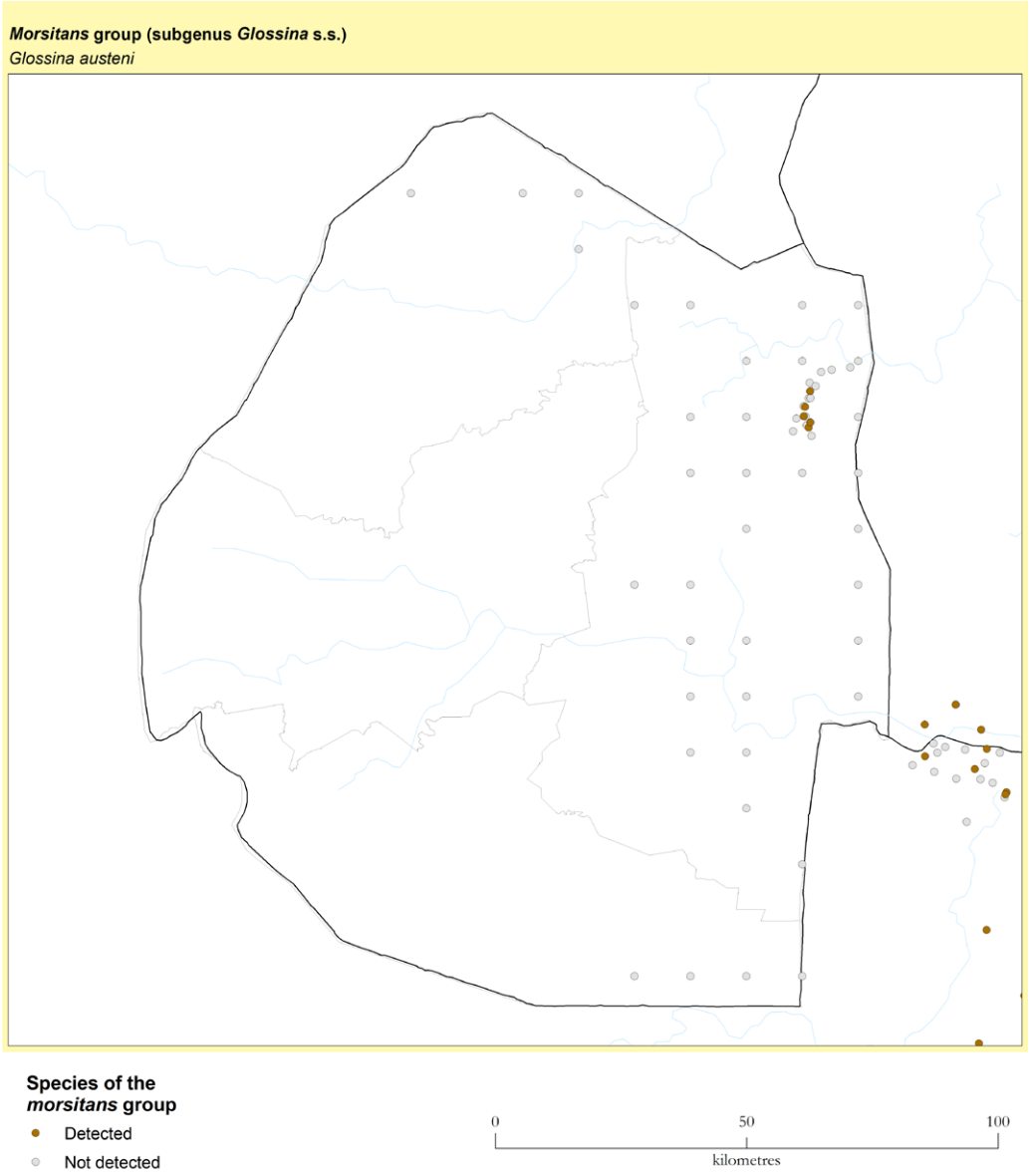
FIGURE A.23
Geographic distribution of tsetse flies (genus *Glossina*) in Eswatini as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

ESWATINI

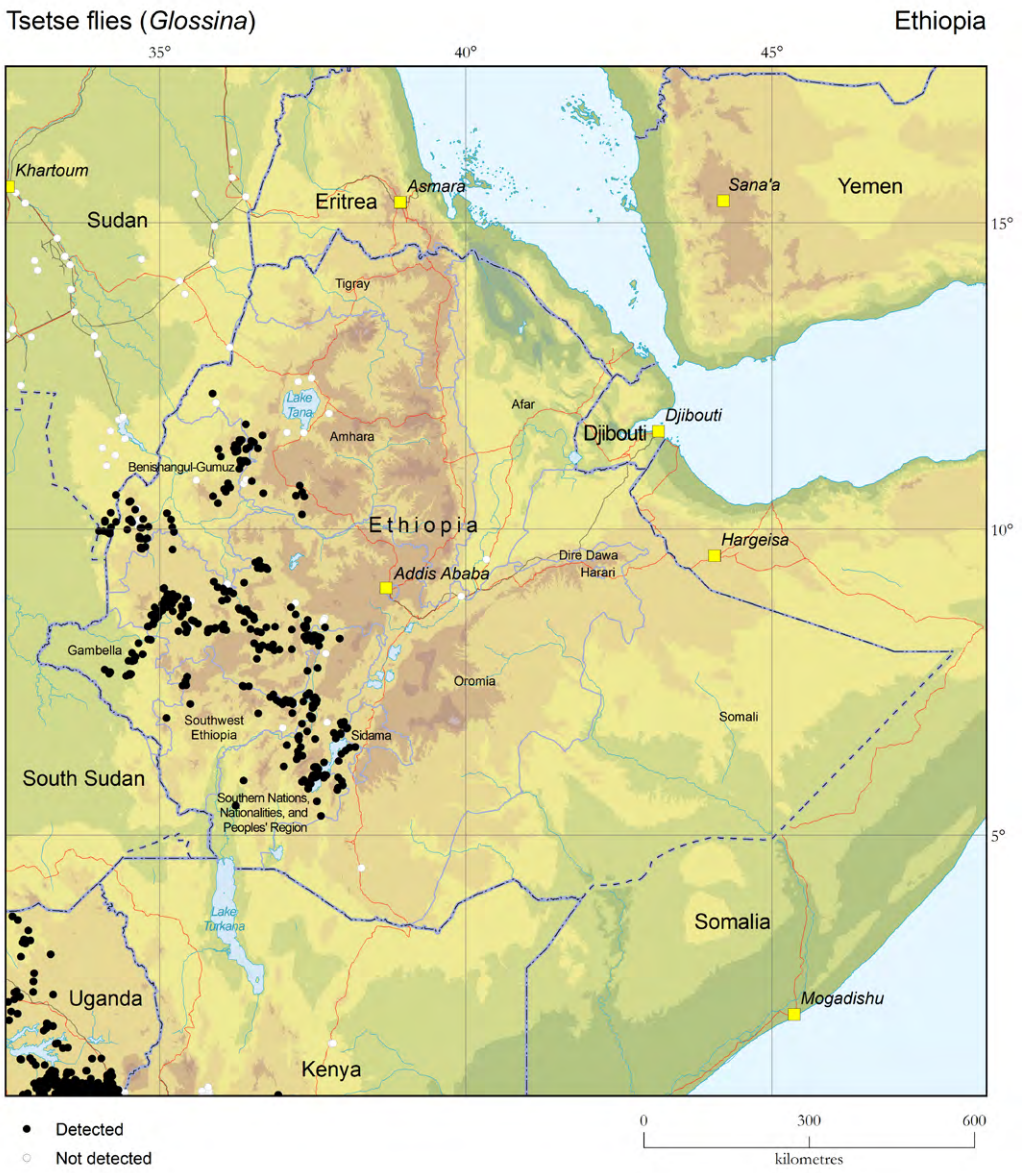
FIGURE A.24
Geographic distribution of *Glossina austeni* in Eswatini as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

ETHIOPIA

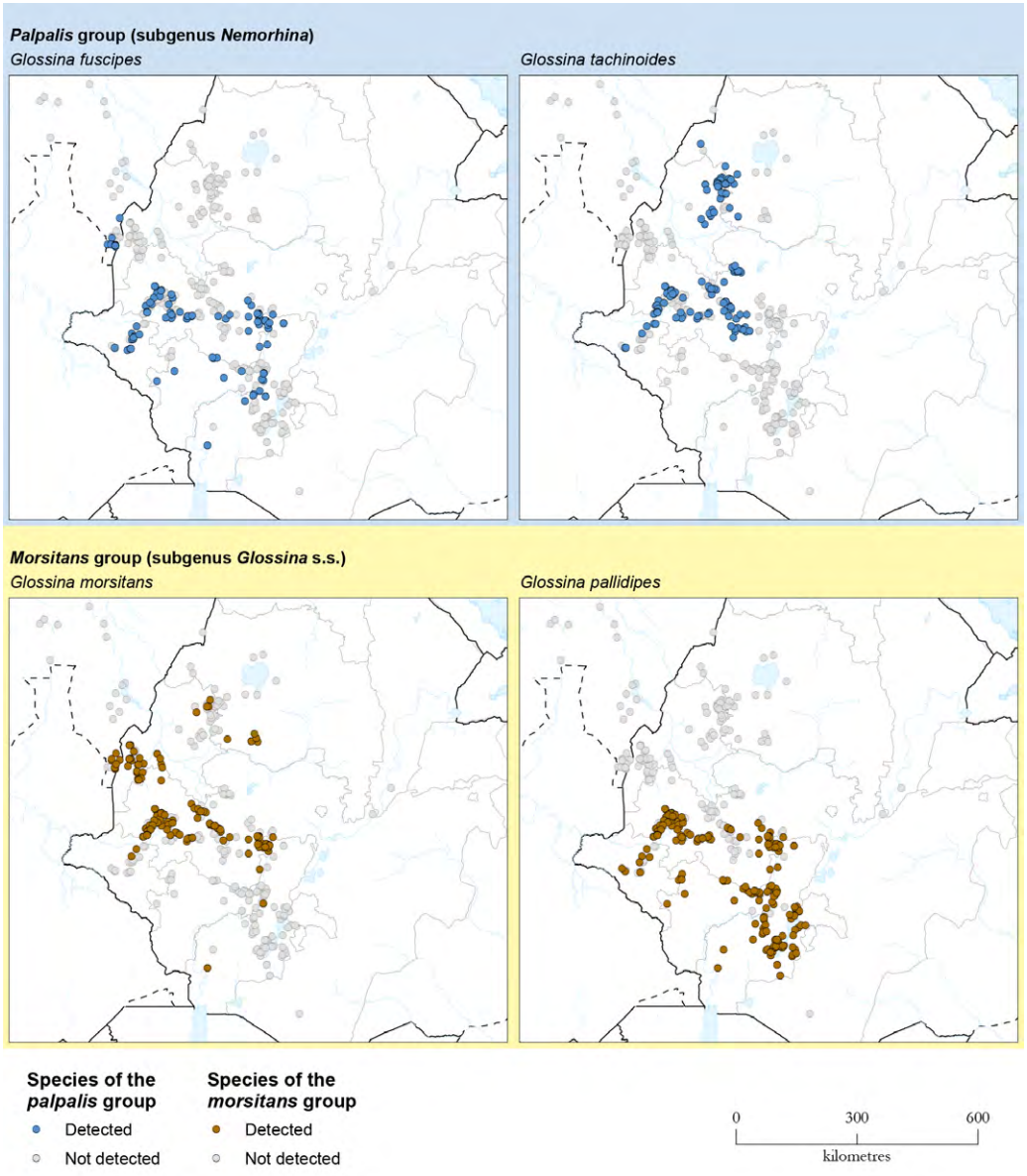
FIGURE A.25
Geographic distribution of tsetse flies (genus *Glossina*) in Ethiopia as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

ETHIOPIA

FIGURE A.26
Geographic distribution of the *Glossina* species in Ethiopia as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

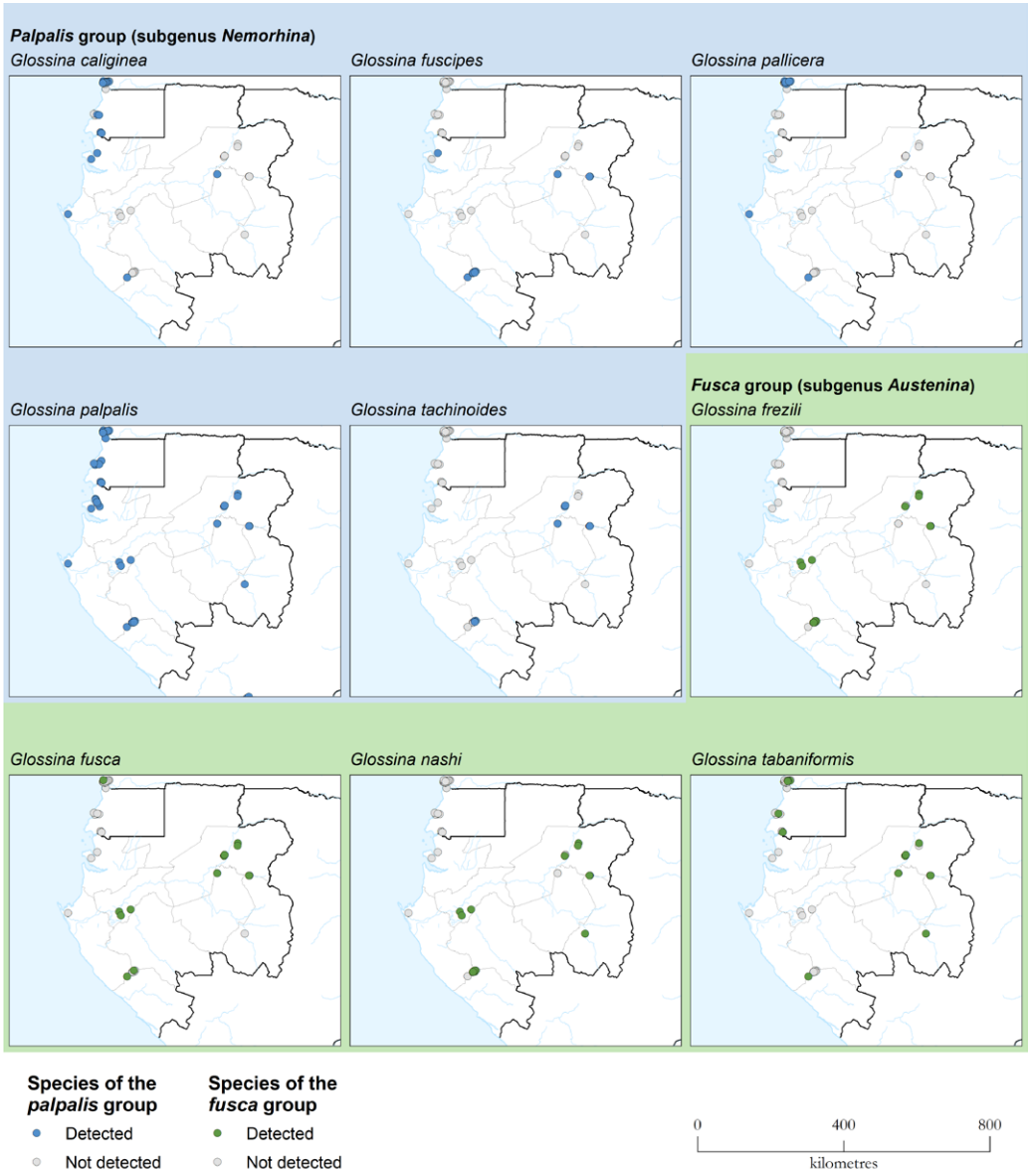
GABON

FIGURE A.27
Geographic distribution of tsetse flies (genus *Glossina*) in Gabon as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

GABON

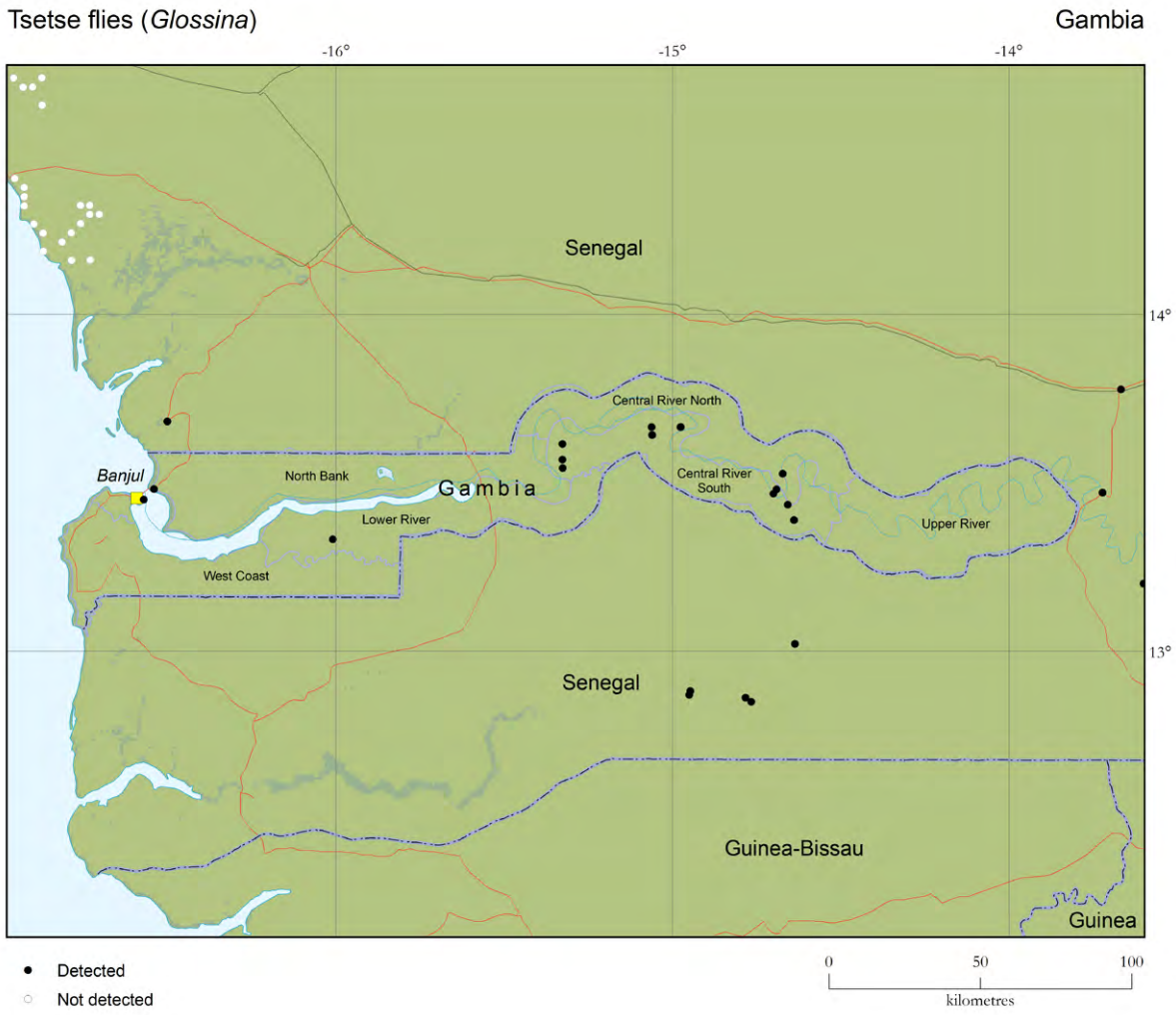
FIGURE A.28
Geographic distribution of the *Glossina* species in Gabon as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

GAMBIA

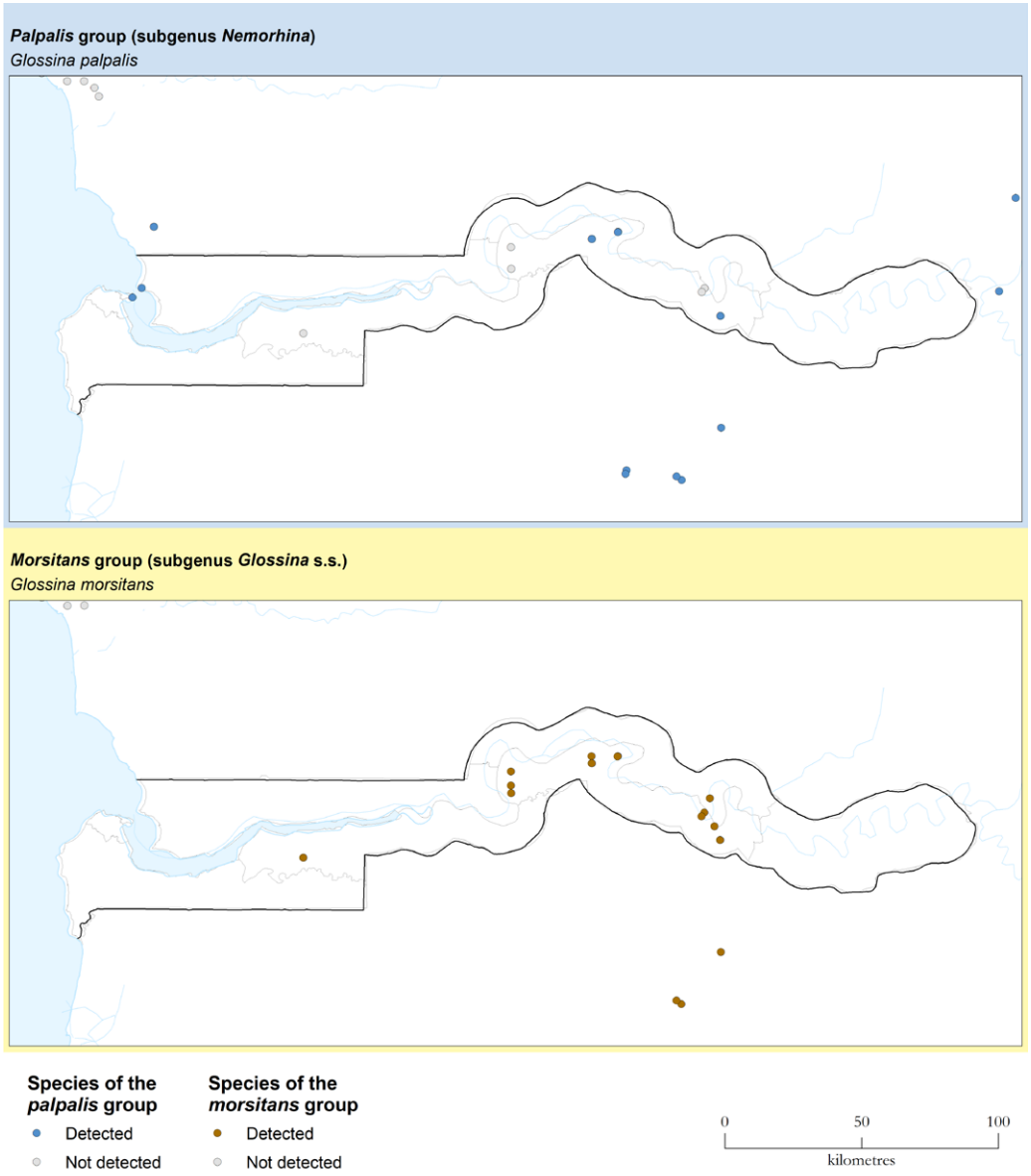
FIGURE A.29
Geographic distribution of tsetse flies (genus *Glossina*) in the Gambia as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

GAMBIA

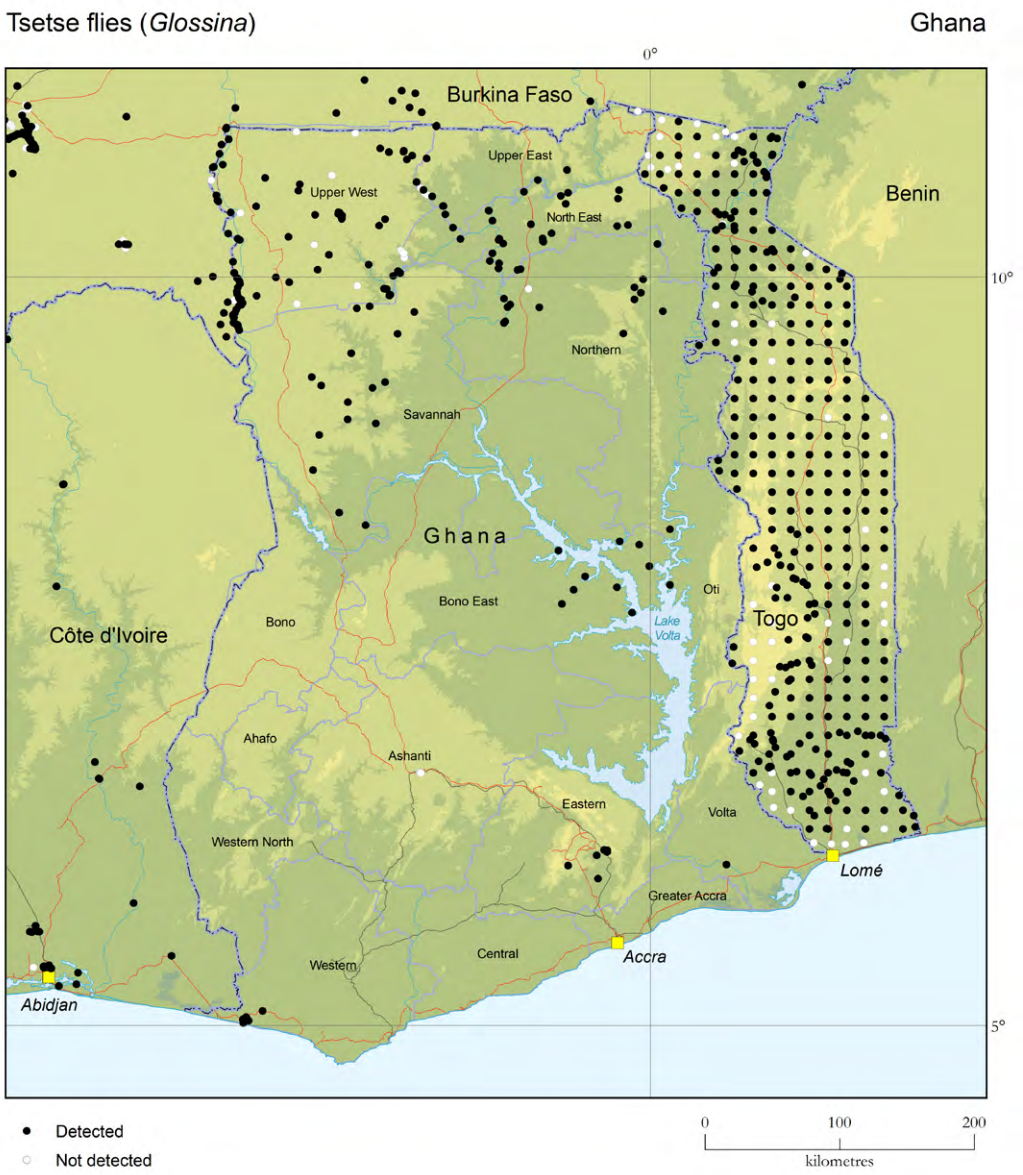
FIGURE A.30
Geographic distribution of the *Glossina* species in the Gambia as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

GHANA

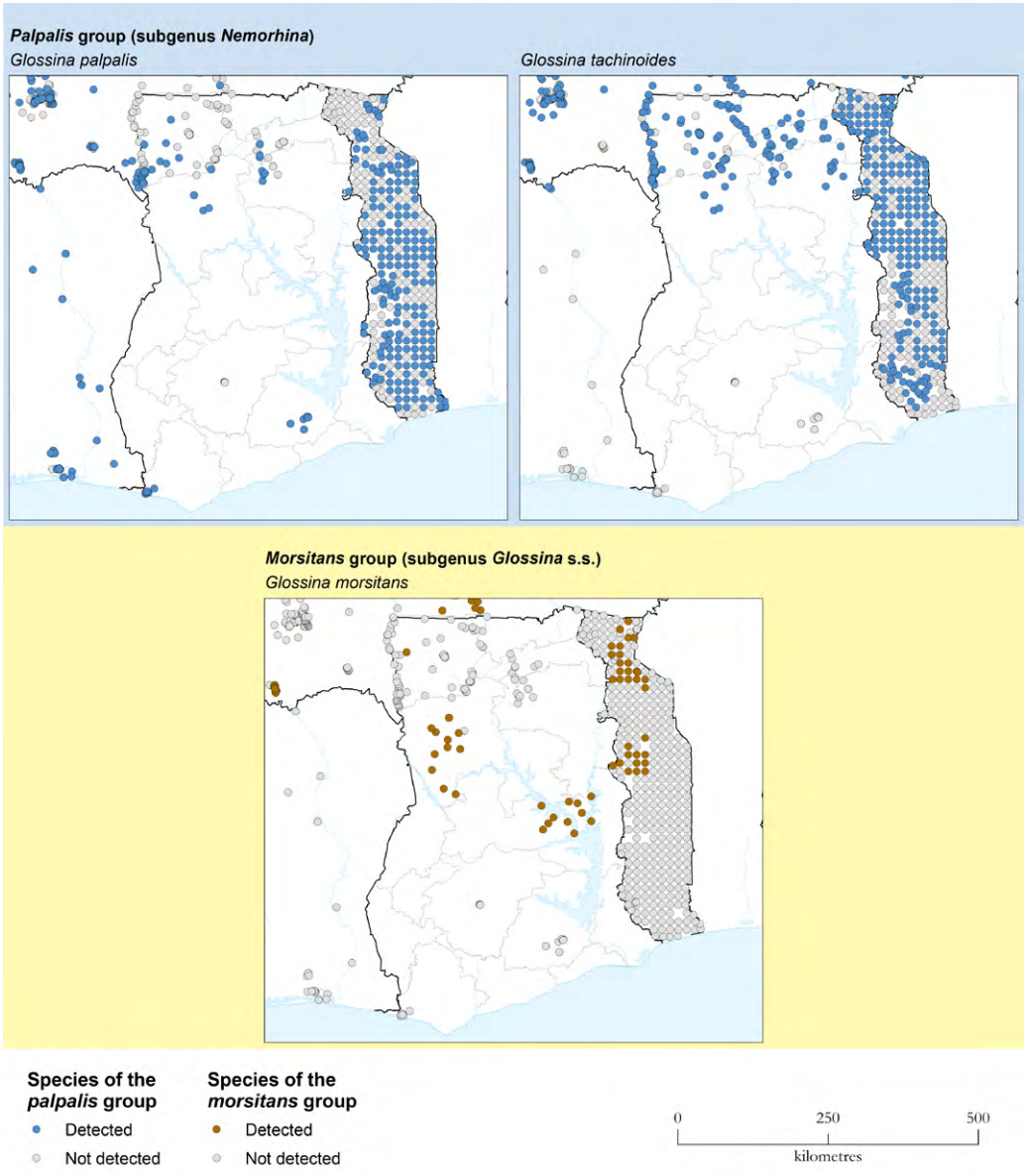
FIGURE A.31
Geographic distribution of tsetse flies (genus *Glossina*) in Ghana as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

GHANA

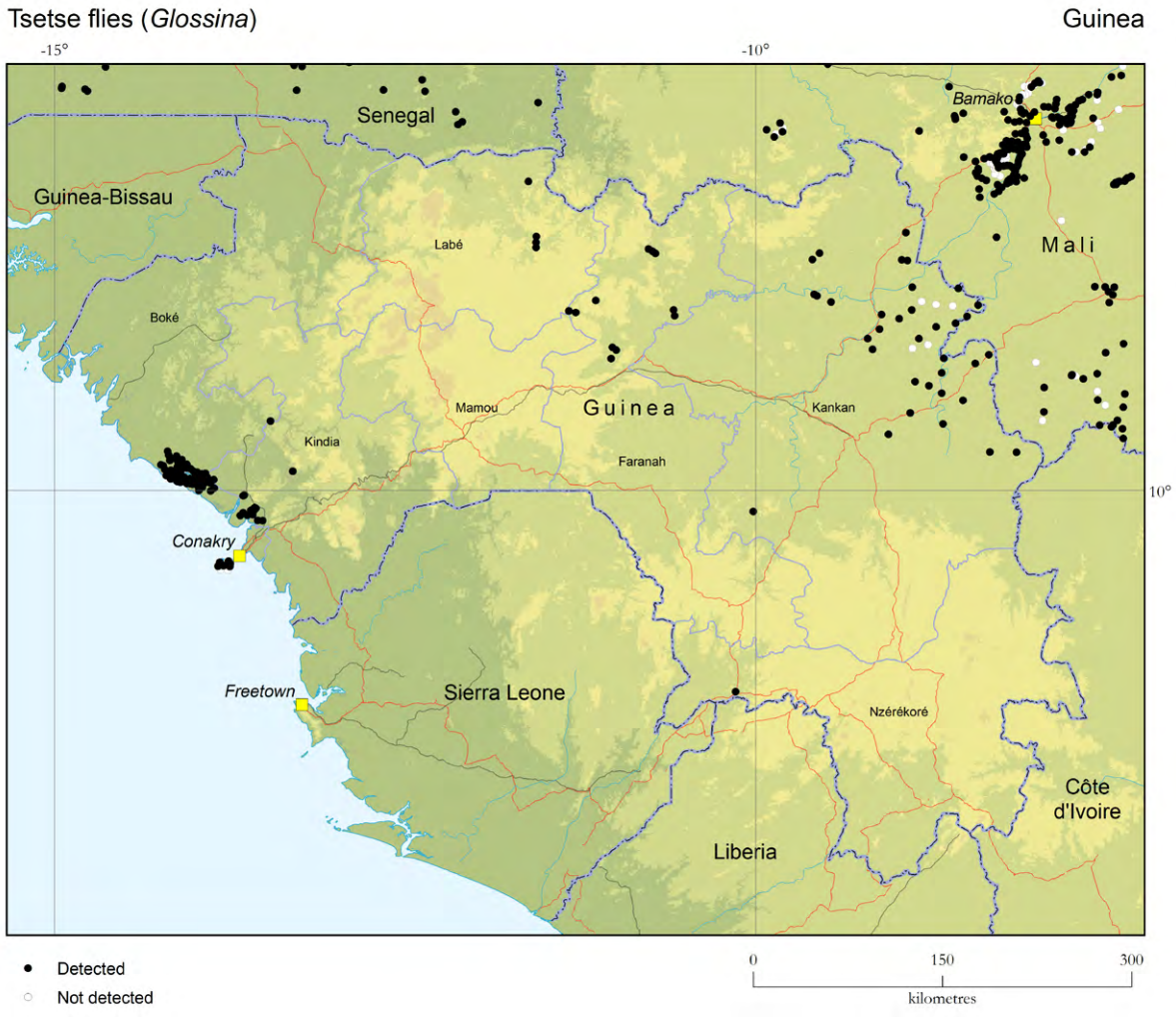
FIGURE A.32
Geographic distribution of the *Glossina* species in Ghana as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

GUINEA

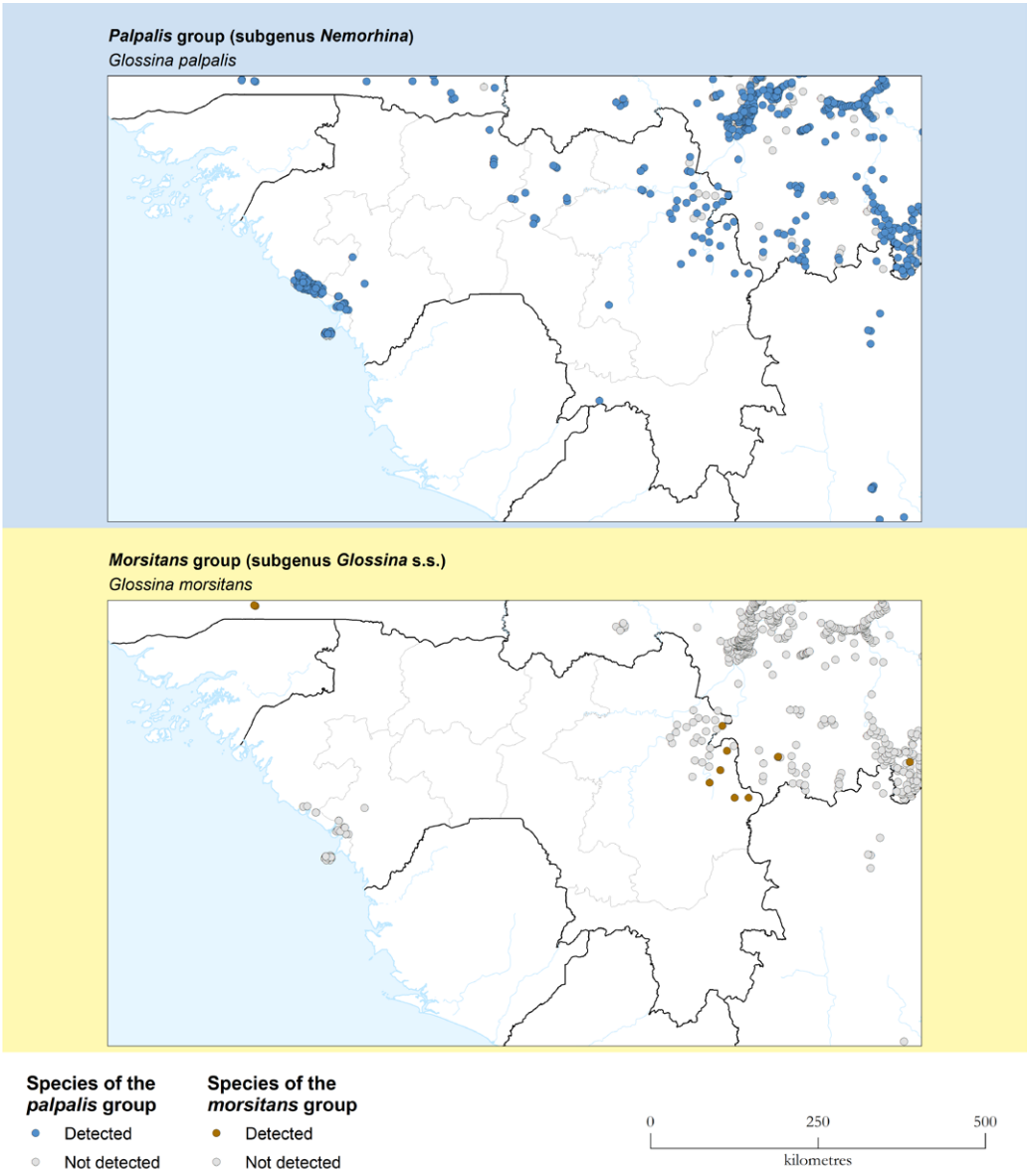
FIGURE A.33
Geographic distribution of tsetse flies (genus *Glossina*) in Guinea as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

GUINEA

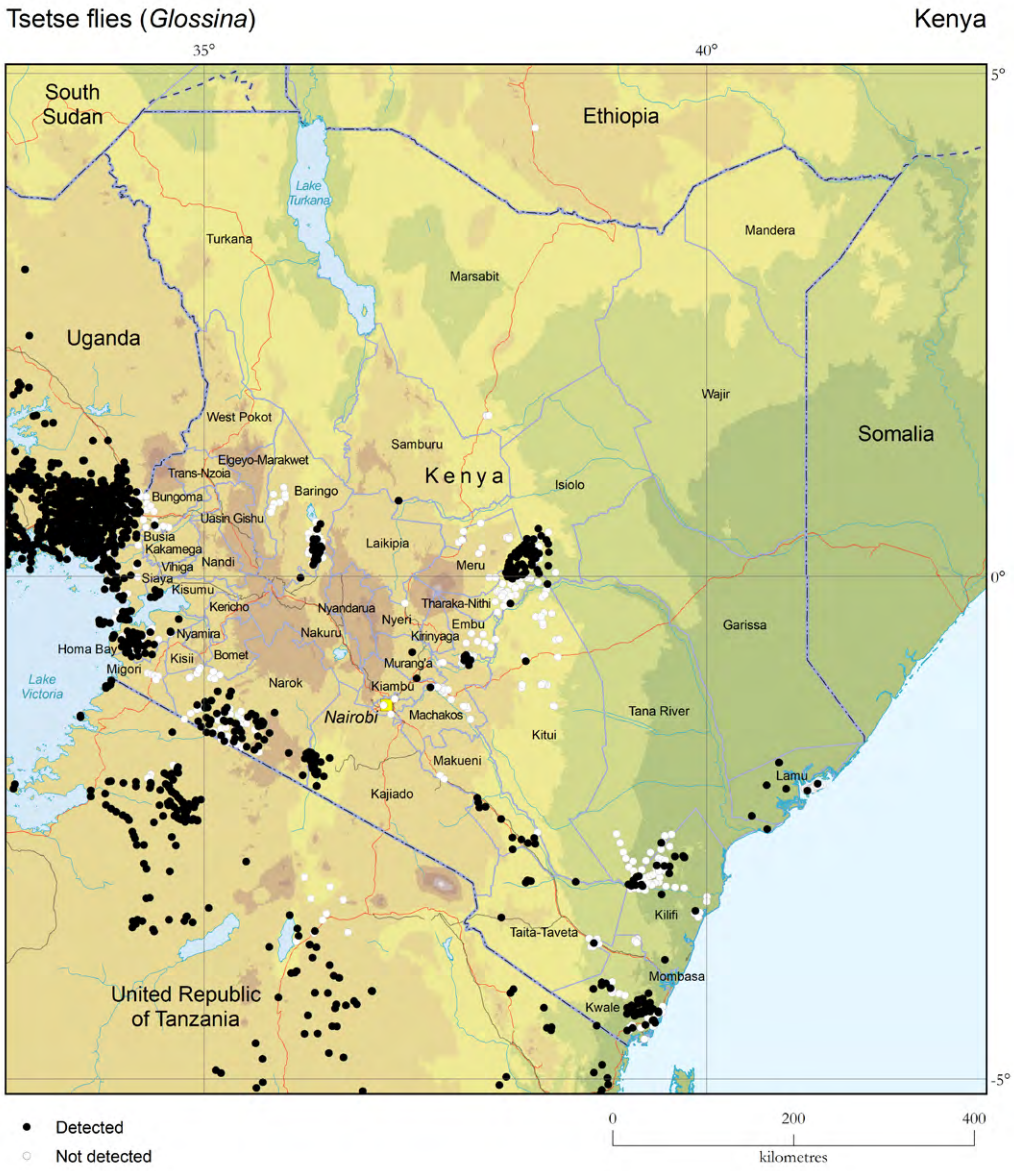
FIGURE A.34
Geographic distribution of the *Glossina* species in Guinea as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

KENYA

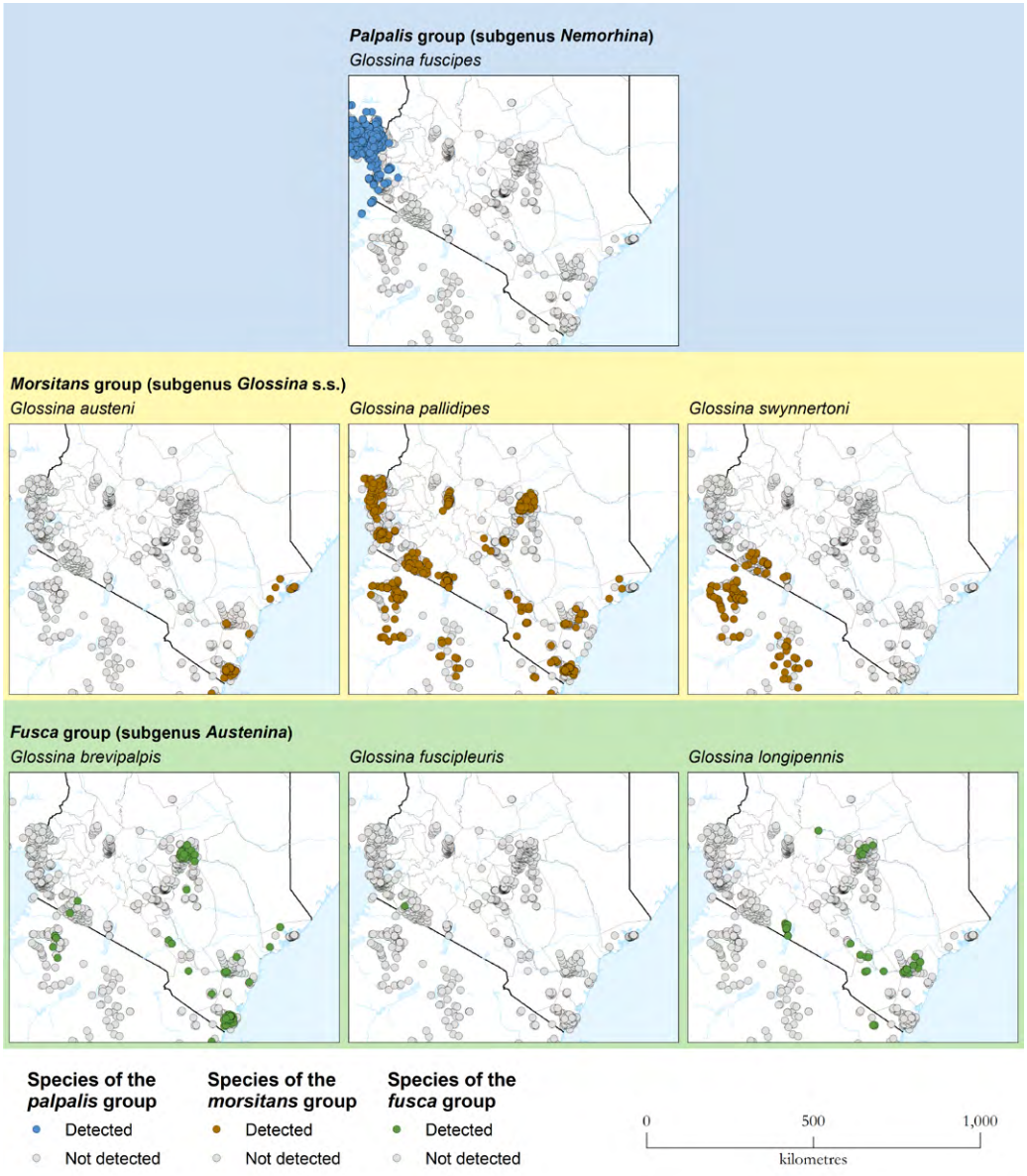
FIGURE A.35
Geographic distribution of tsetse flies (genus *Glossina*) in Kenya as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

KENYA

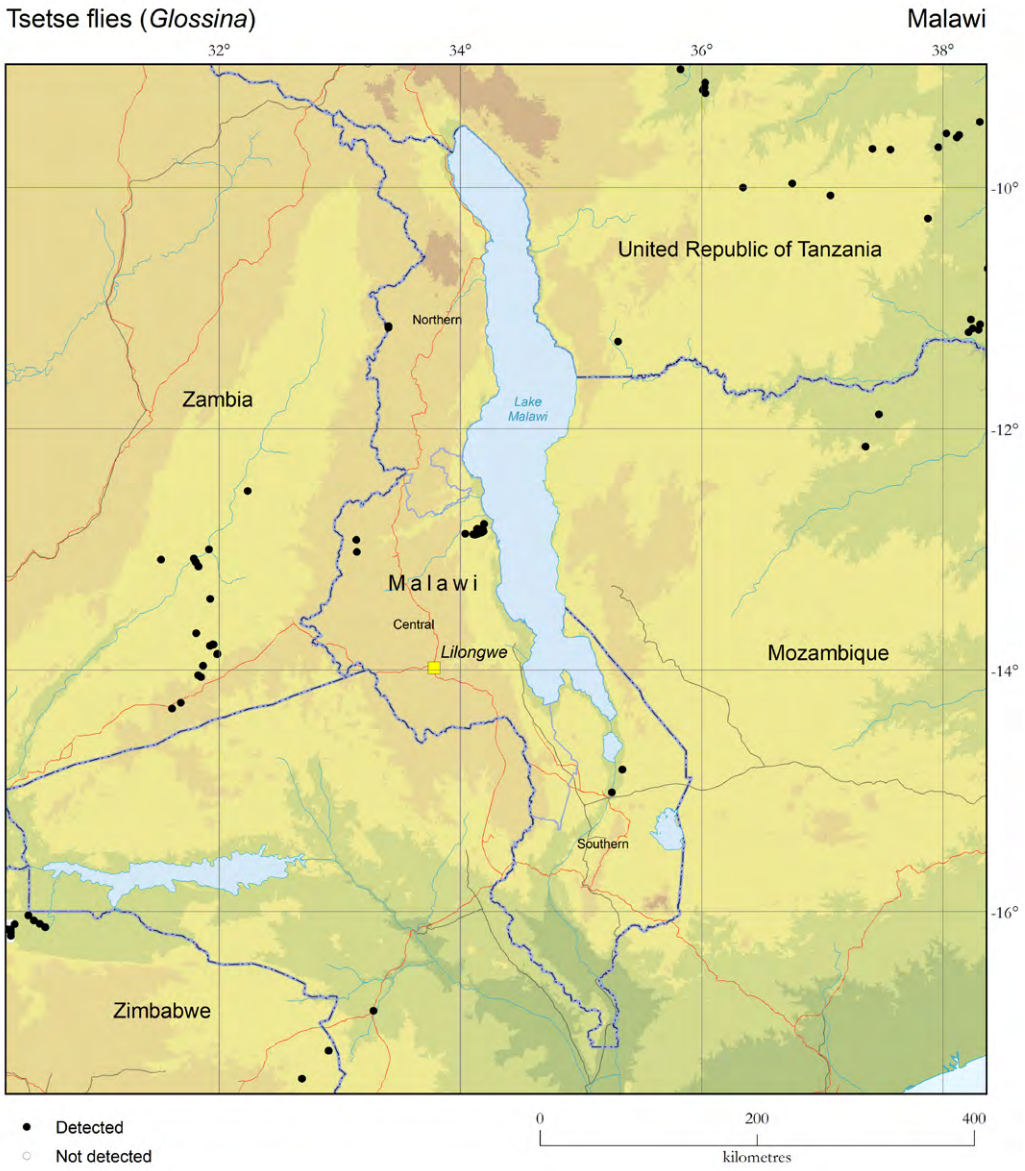
FIGURE A.36
Geographic distribution of the *Glossina* species in Kenya as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

MALAWI

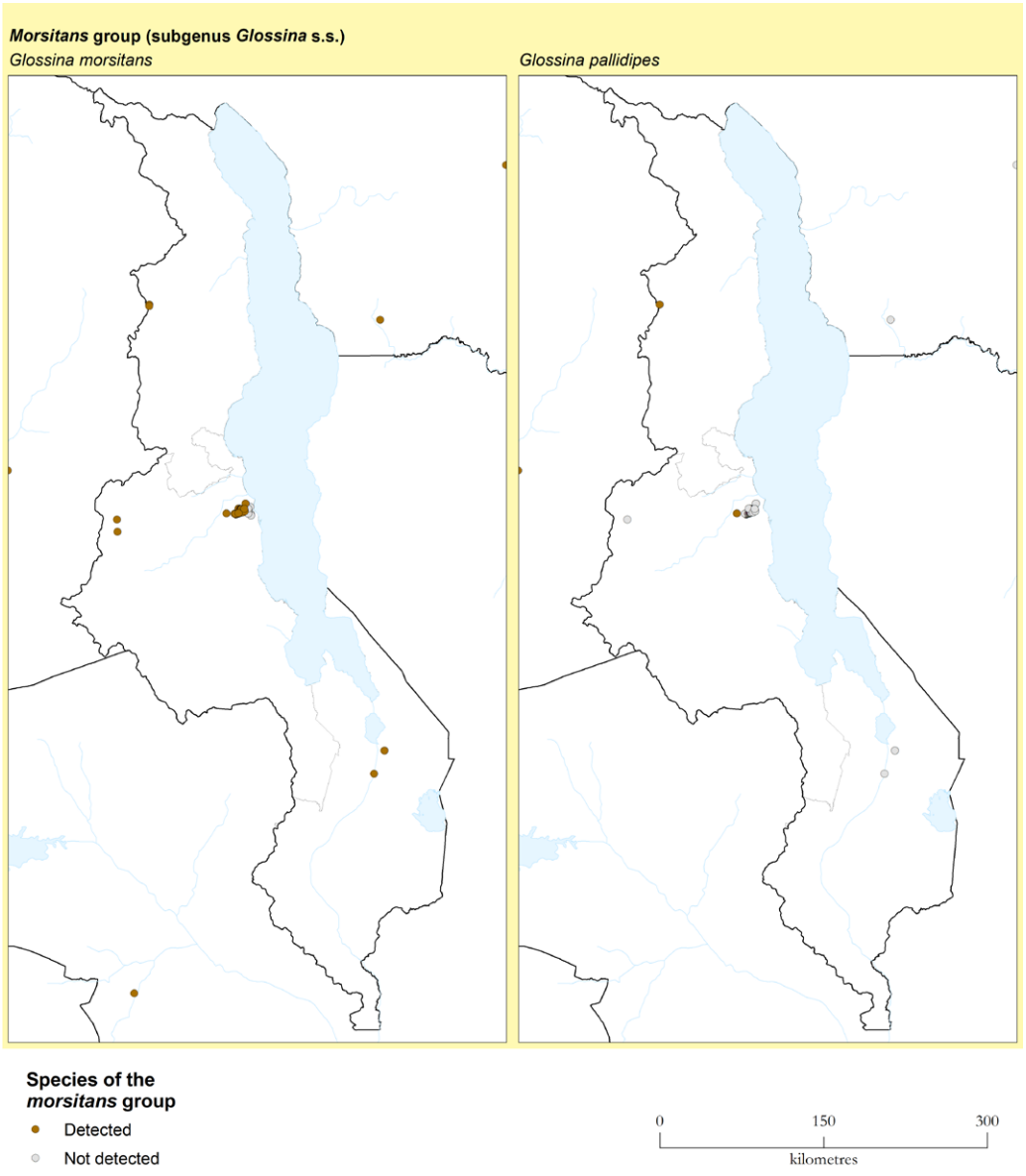
FIGURE A.37
Geographic distribution of tsetse flies (genus *Glossina*) in Malawi as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

MALAWI

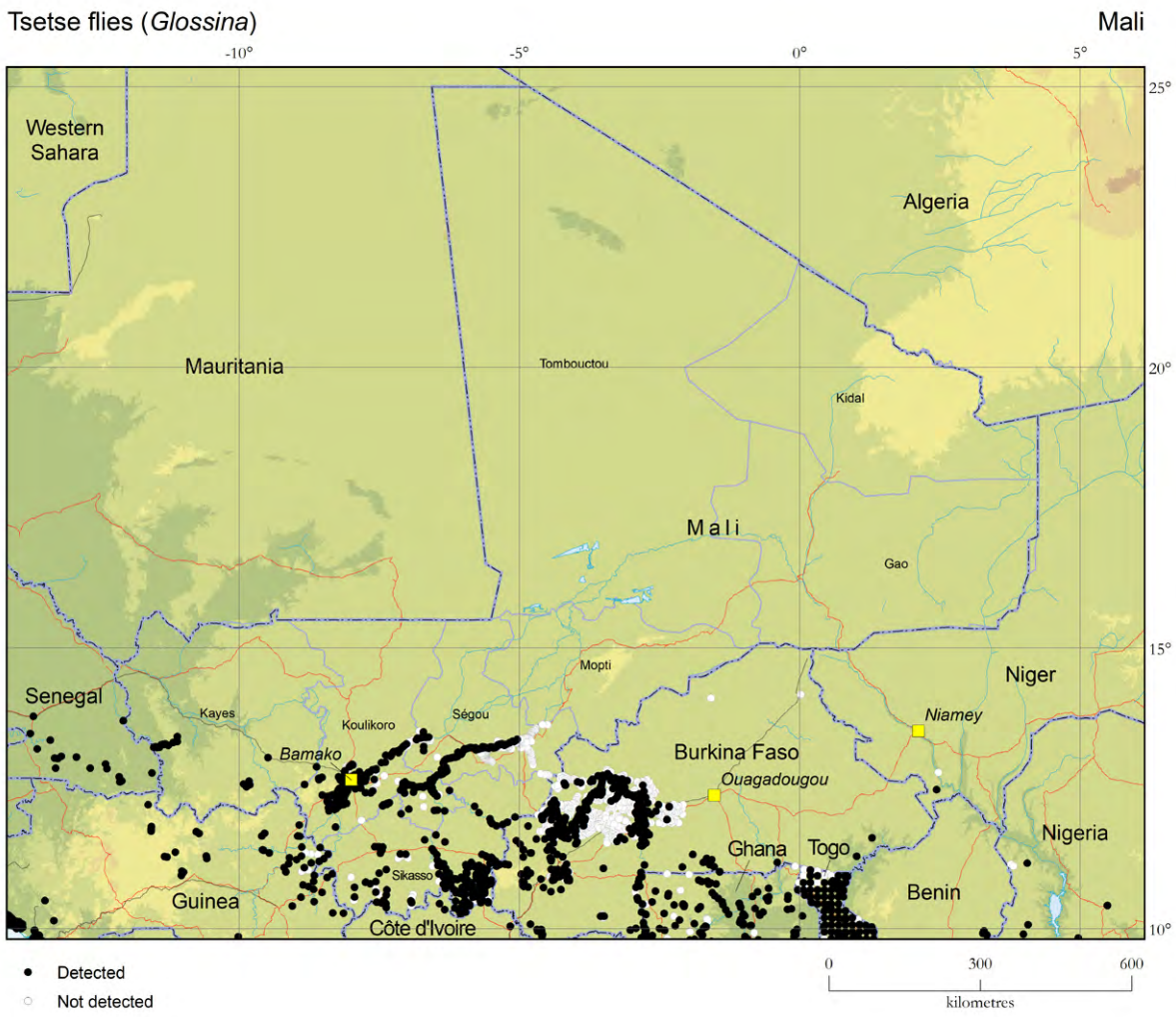
FIGURE A.38
Geographic distribution of the *Glossina* species in Malawi as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

MALI

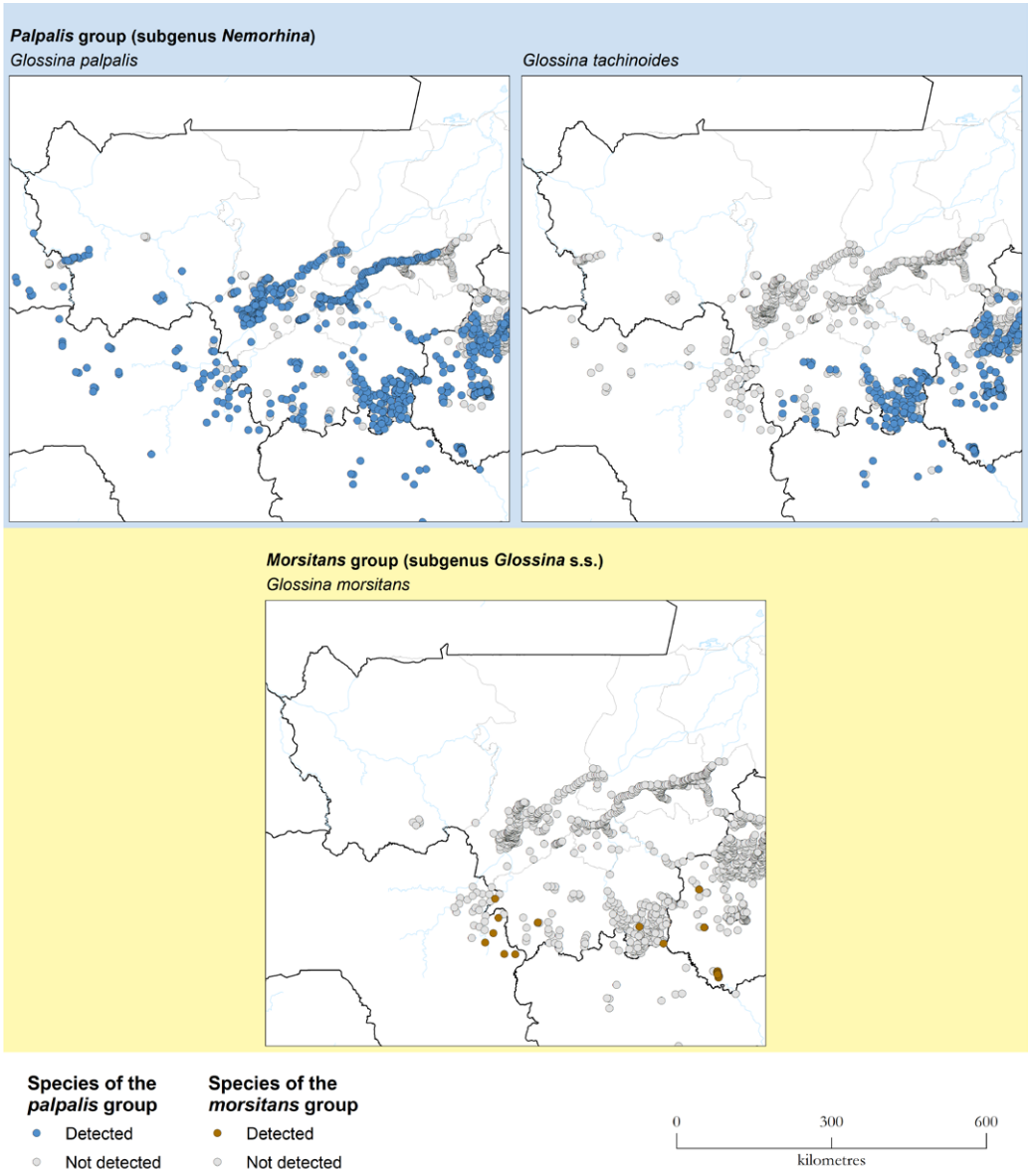
FIGURE A.39
Geographic distribution of tsetse flies (genus *Glossina*) in Mali as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

MALI

FIGURE A.40
Geographic distribution of the *Glossina* species in Mali as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

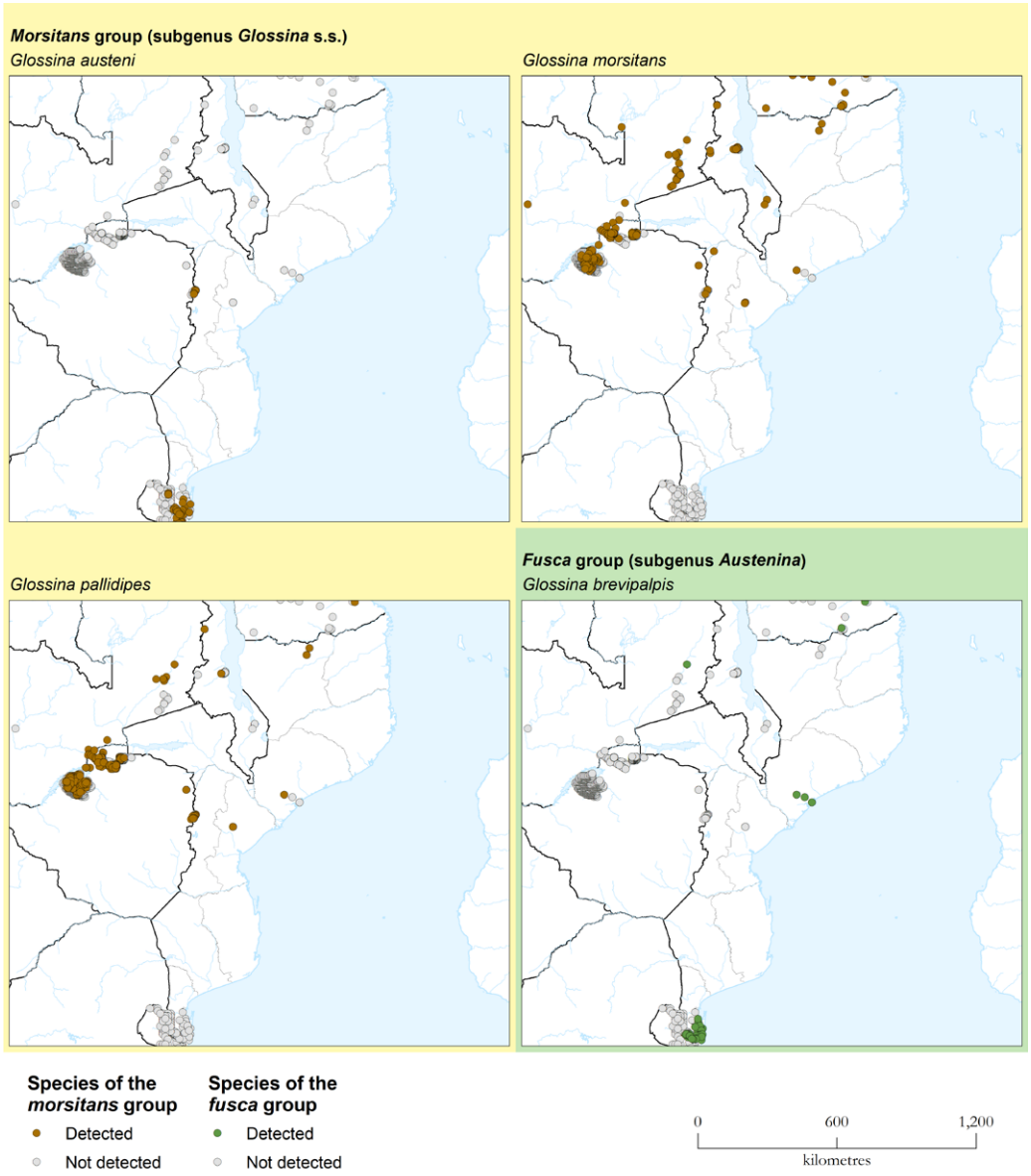
MOZAMBIQUE

FIGURE A.41
Geographic distribution of tsetse flies (genus *Glossina*) in Mozambique as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

MOZAMBIQUE

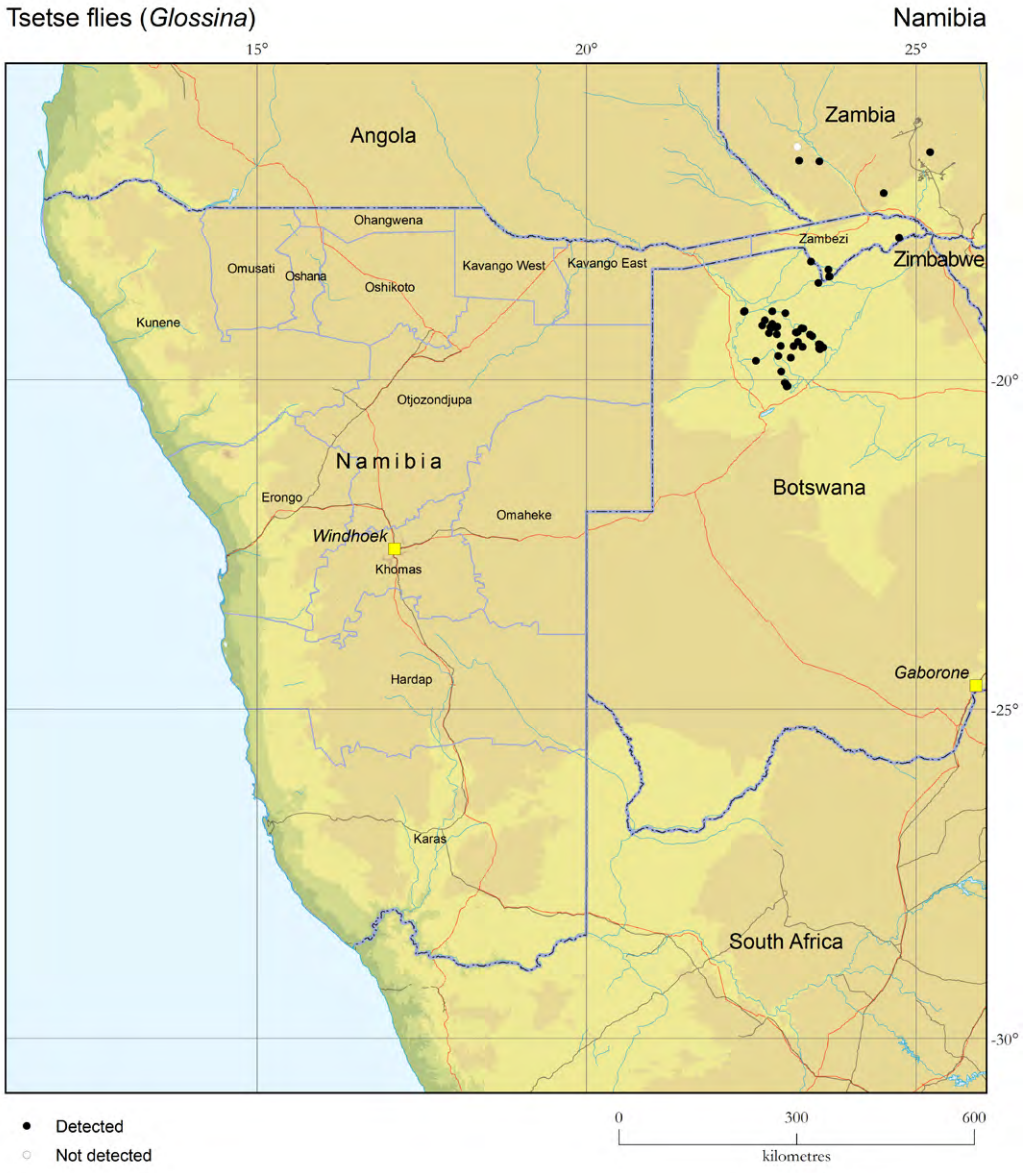
FIGURE A.42
Geographic distribution of the *Glossina* species in Mozambique as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

NAMIBIA

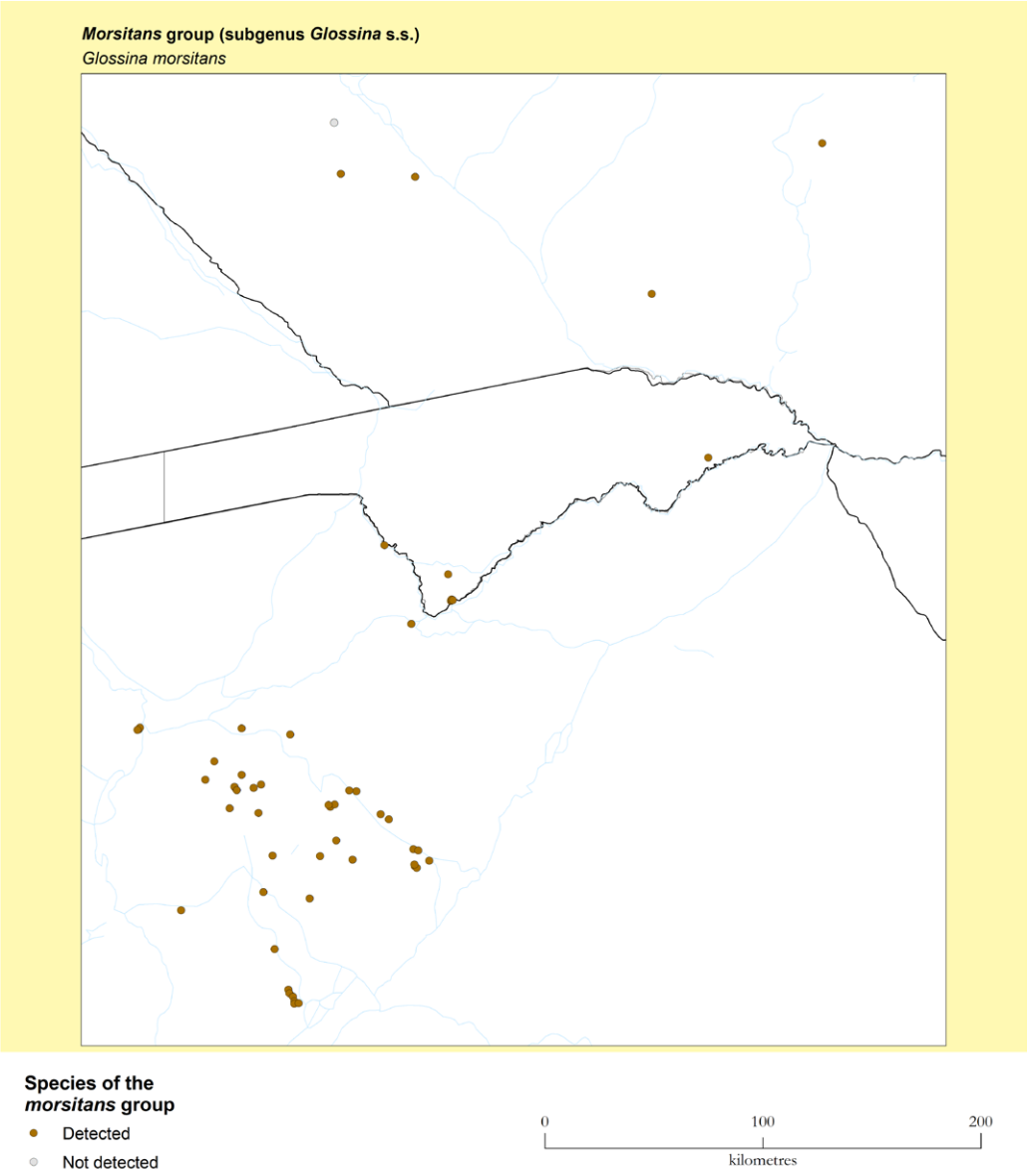
FIGURE A.43
Geographic distribution of tsetse flies (genus *Glossina*) in Namibia as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

NAMIBIA

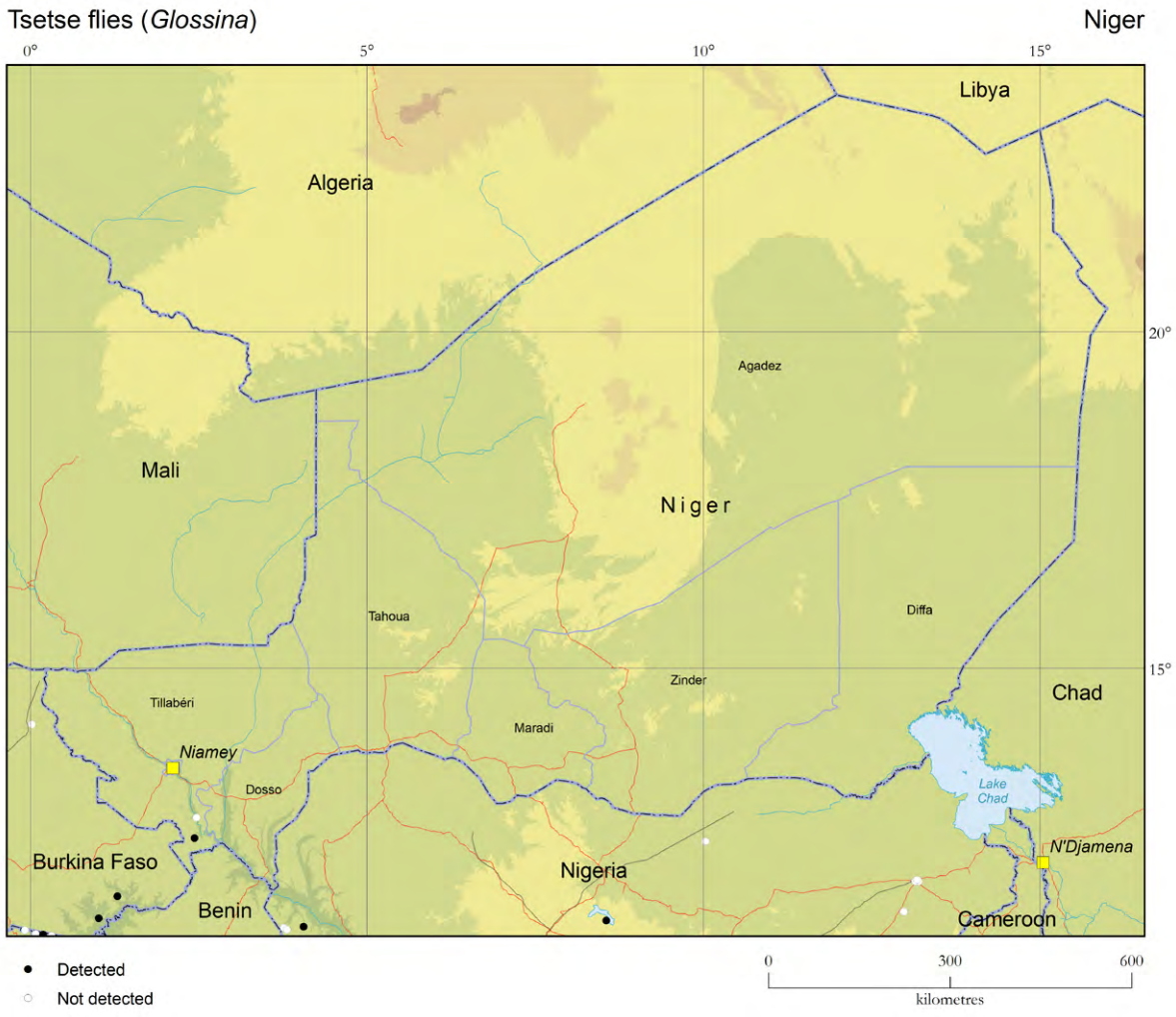
FIGURE A.44
Geographic distribution of *Glossina morsitans* in Namibia as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

NIGER

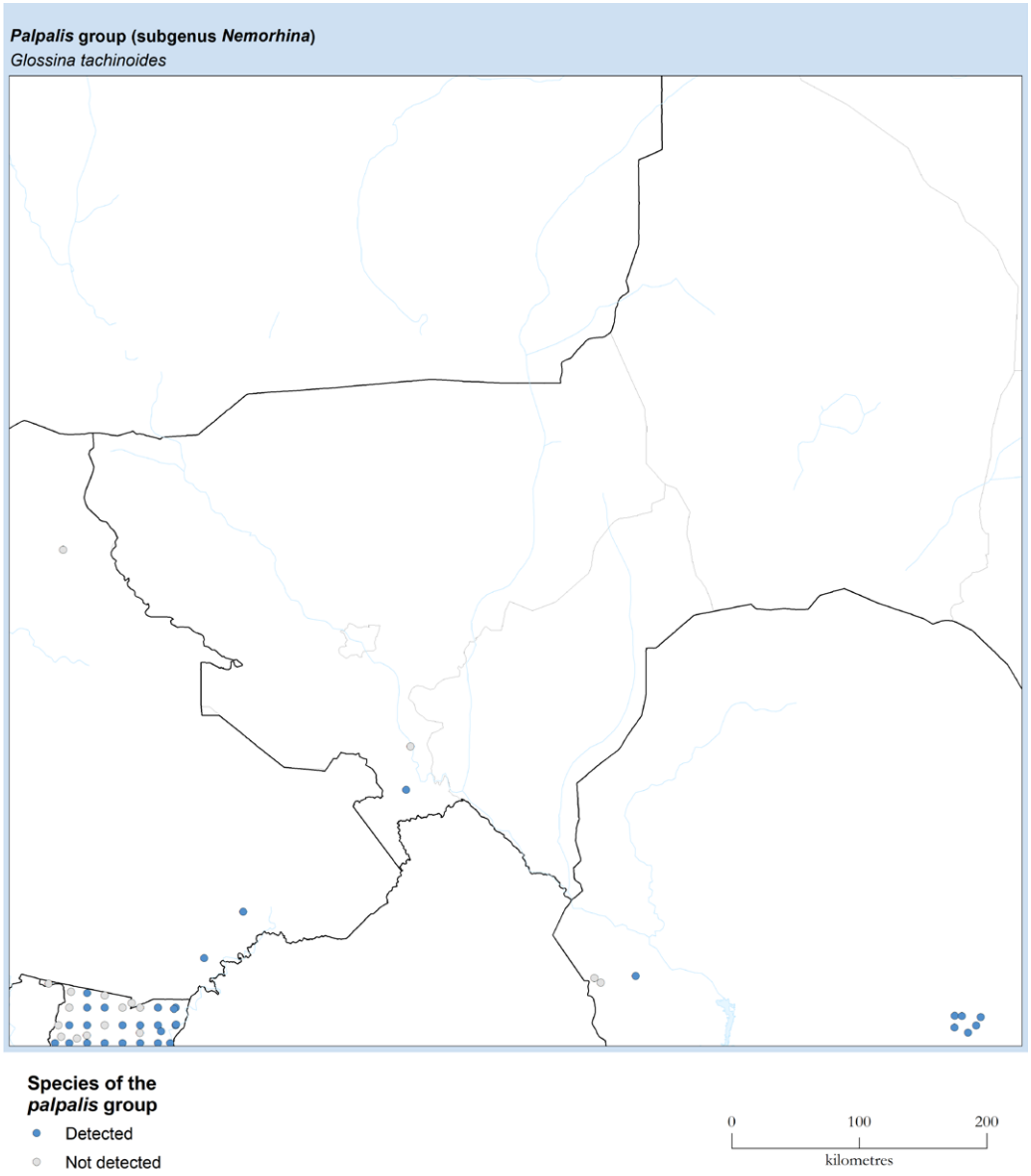
FIGURE A.45
Geographic distribution of tsetse flies (genus *Glossina*) in Niger as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

NIGER

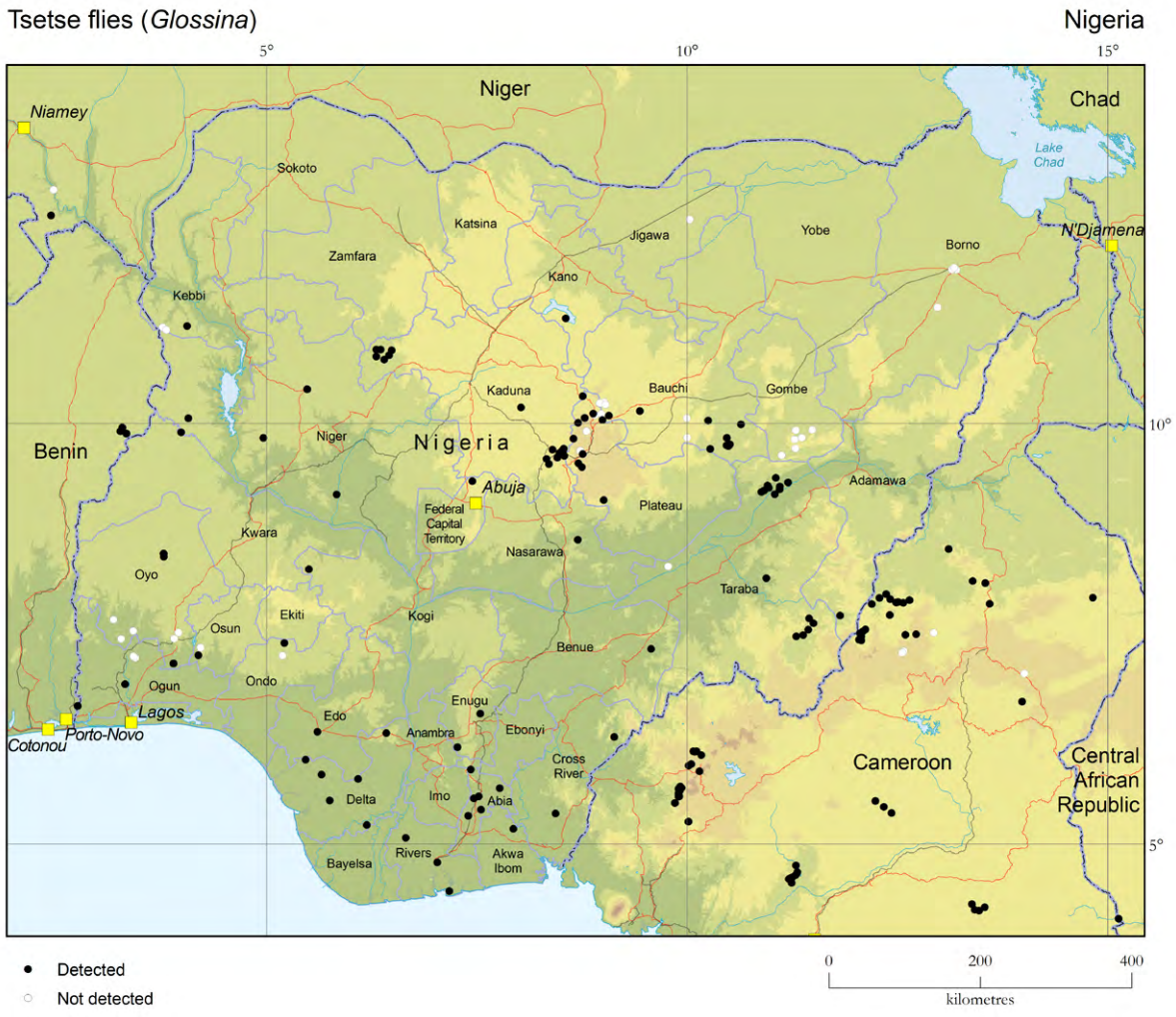
FIGURE A.46
Geographic distribution of *Glossina tachinoides* in Niger as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

NIGERIA

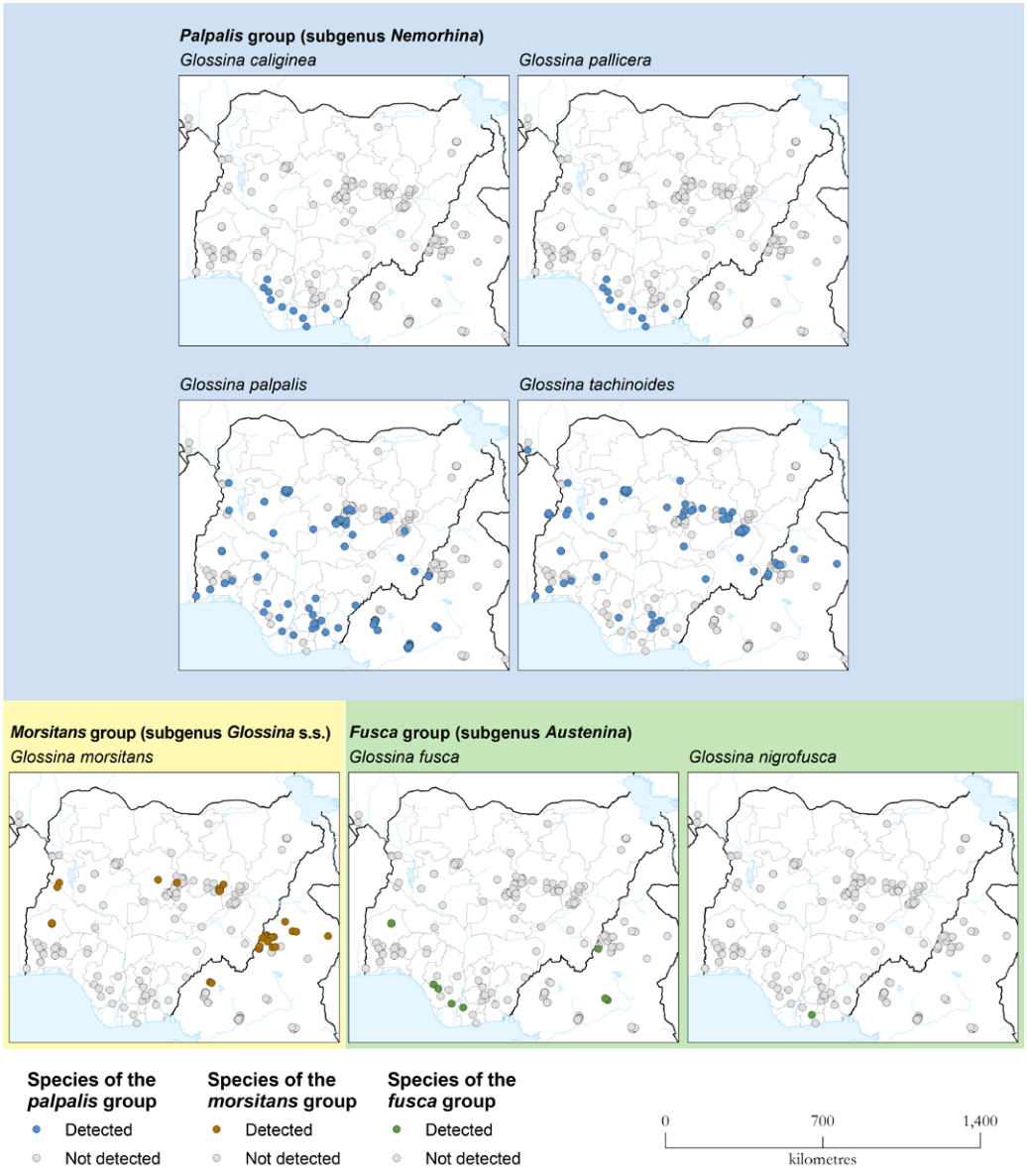
FIGURE A.47
Geographic distribution of tsetse flies (genus *Glossina*) in Nigeria as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

NIGERIA

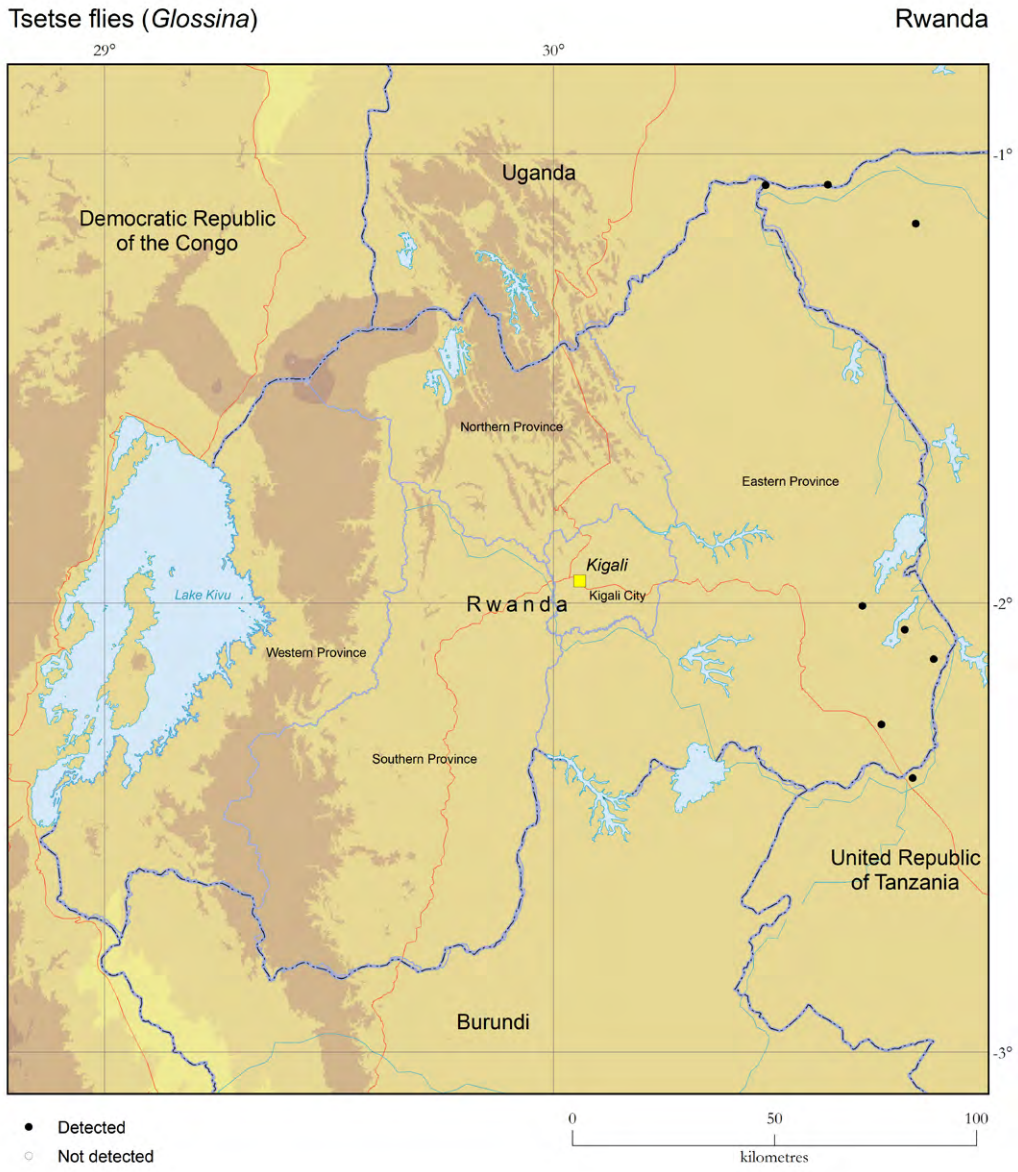
FIGURE A.48
Geographic distribution of the *Glossina* species in Nigeria as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

RWANDA

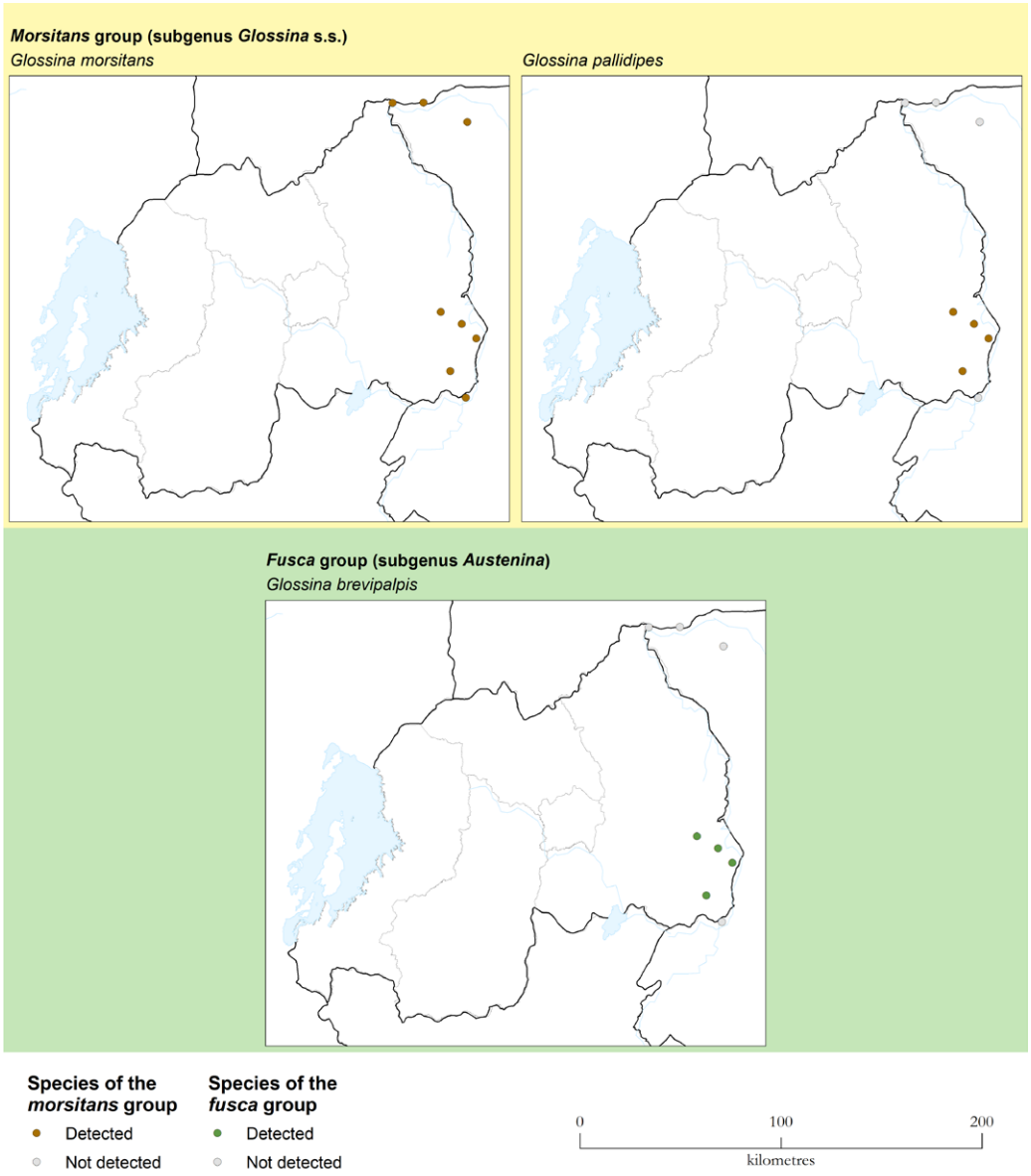
FIGURE A.49
Geographic distribution of tsetse flies (genus *Glossina*) in Rwanda as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

RWANDA

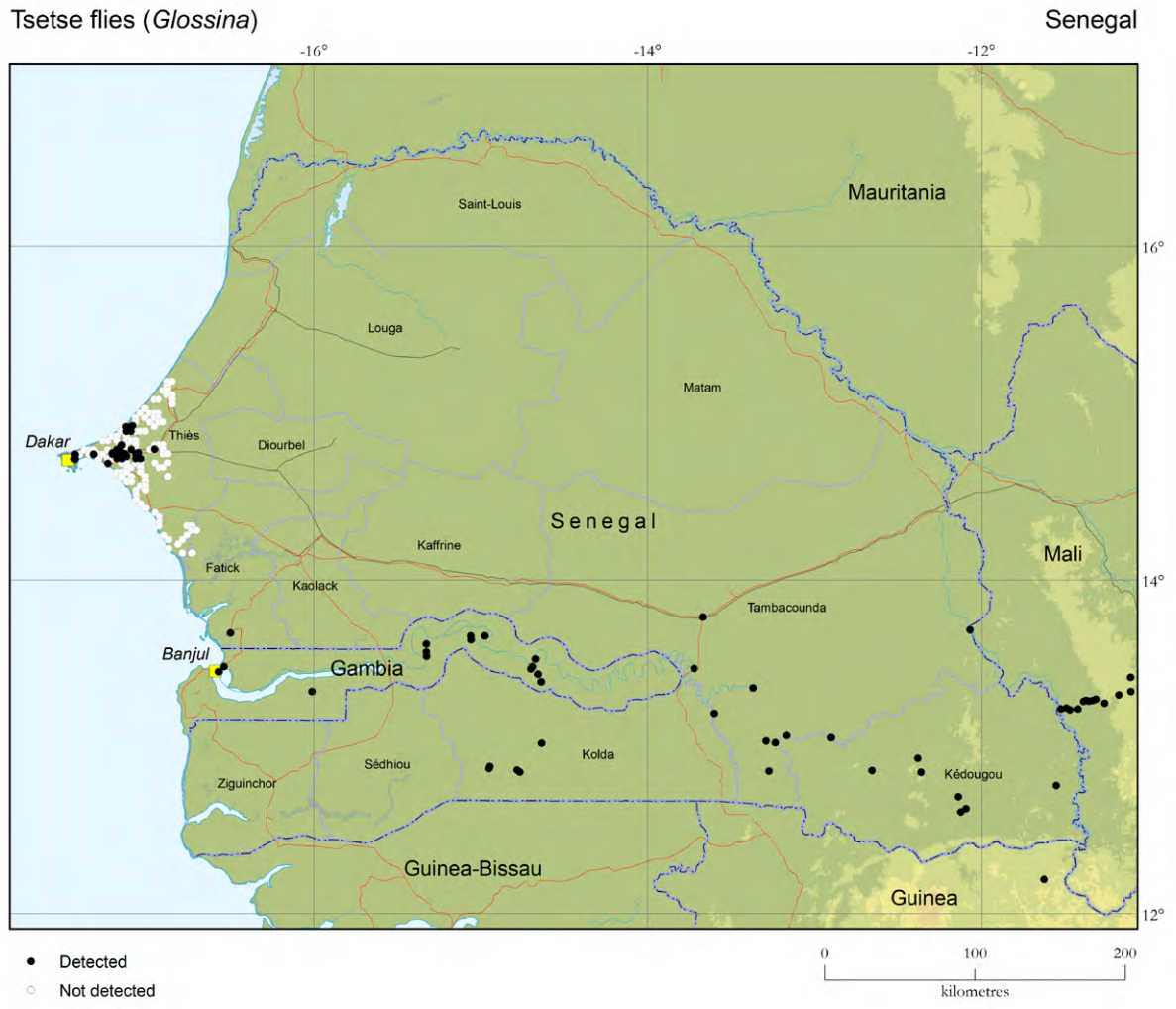
FIGURE A.50
Geographic distribution of the *Glossina* species in Rwanda as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

SENEGAL

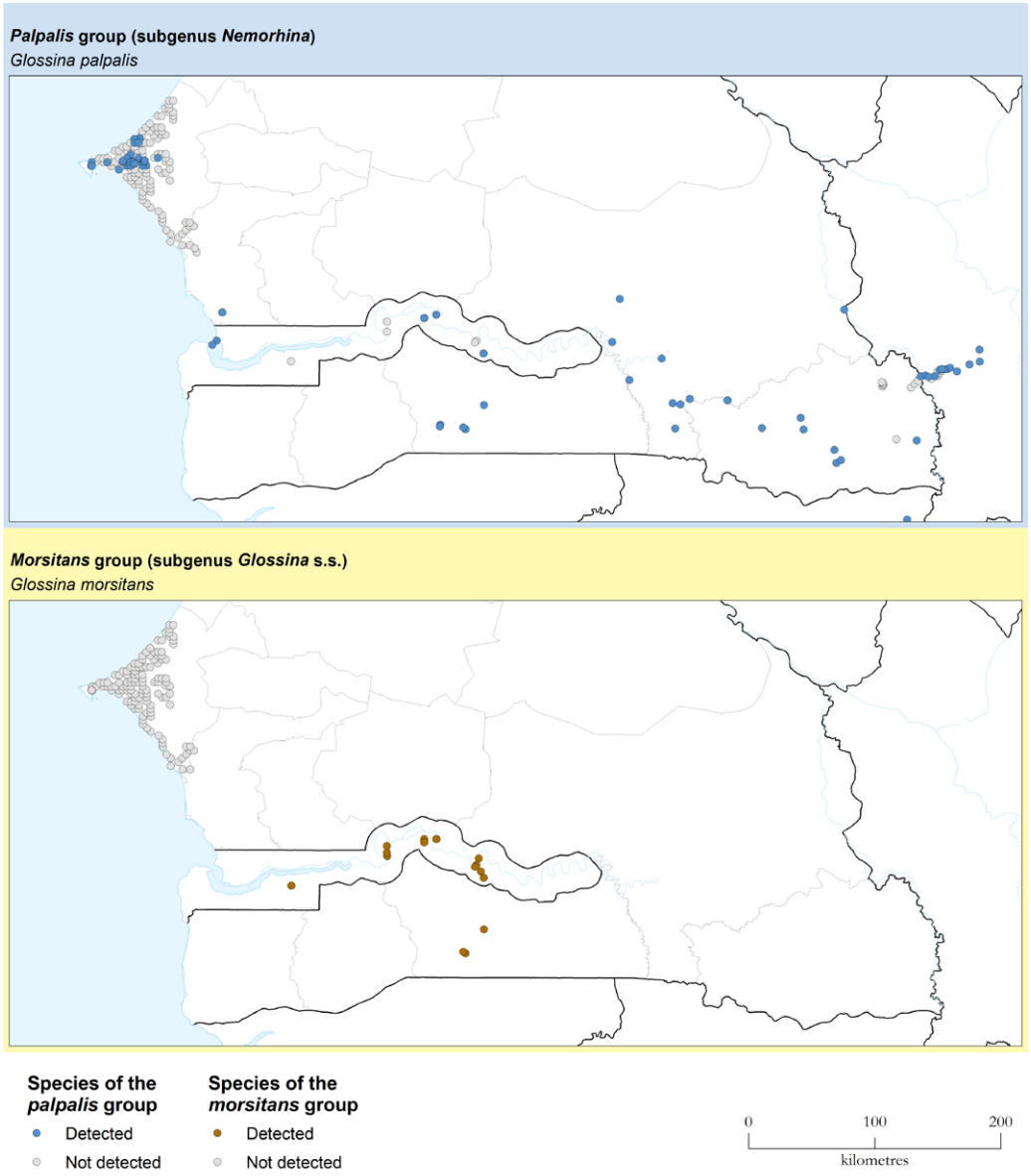
FIGURE A.51
Geographic distribution of tsetse flies (genus *Glossina*) in Senegal as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

SENEGAL

FIGURE A.52
Geographic distribution of the *Glossina* species in Senegal as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

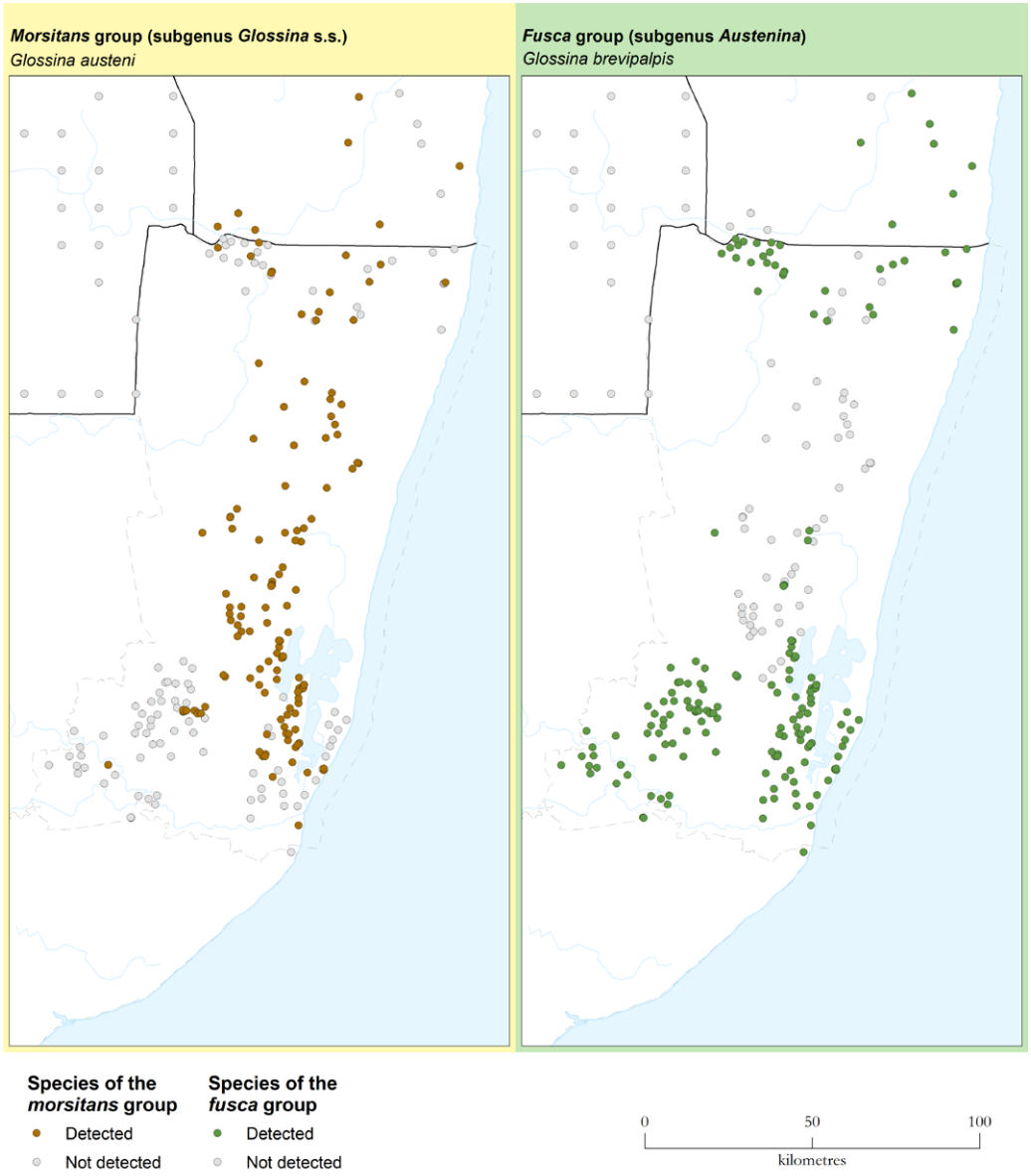
SOUTH AFRICA

FIGURE A.53
Geographic distribution of tsetse flies (genus *Glossina*) in South Africa as reported in scientific papers (publication period: 1990–2020)

Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. New York, USA, UN. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

SOUTH AFRICA

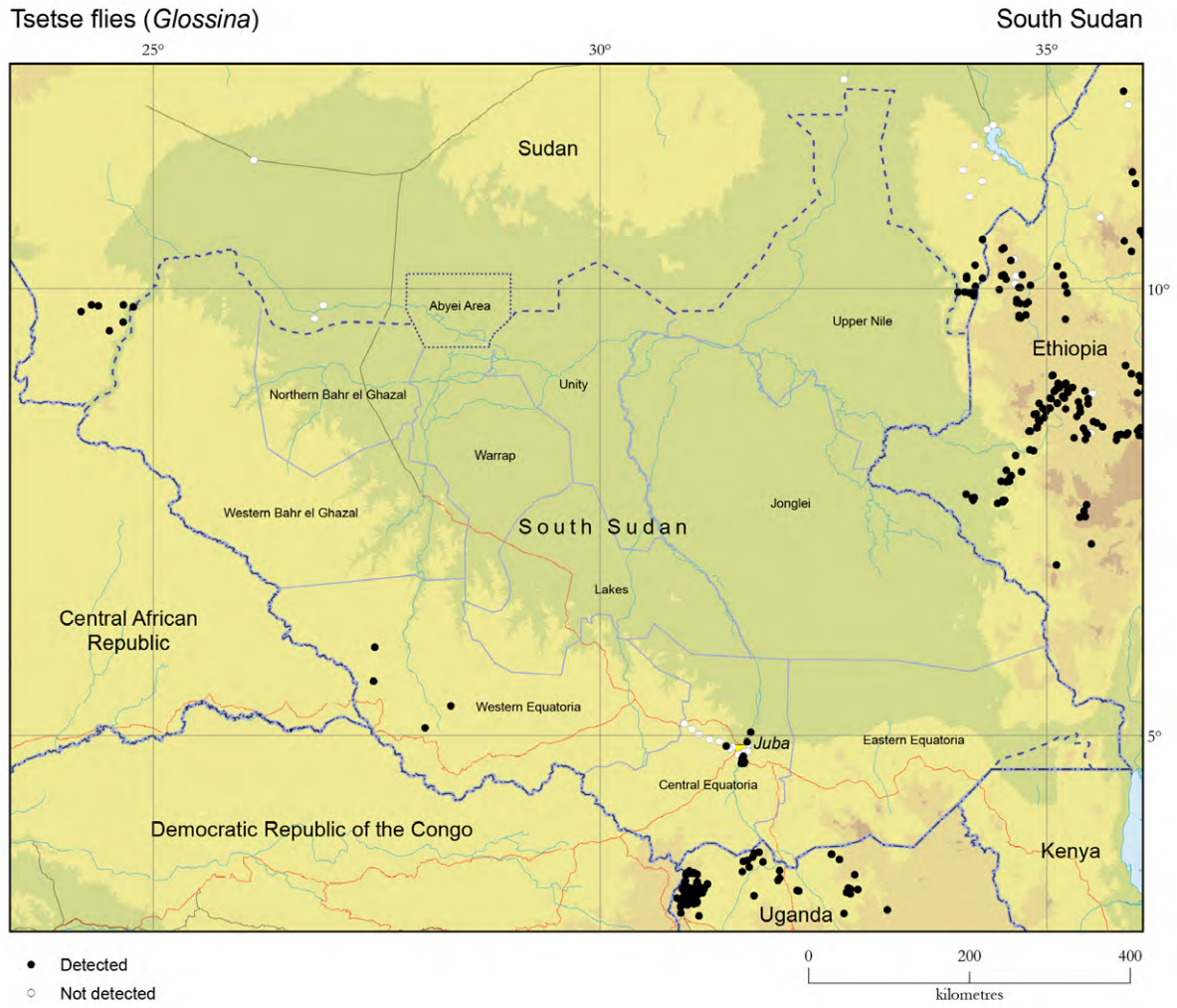
FIGURE A.54
Geographic distribution of the *Glossina* species in South Africa as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

SOUTH SUDAN

FIGURE A.55
Geographic distribution of tsetse flies (genus *Glossina*) in South Sudan as reported in scientific papers (publication period: 1990–2020)

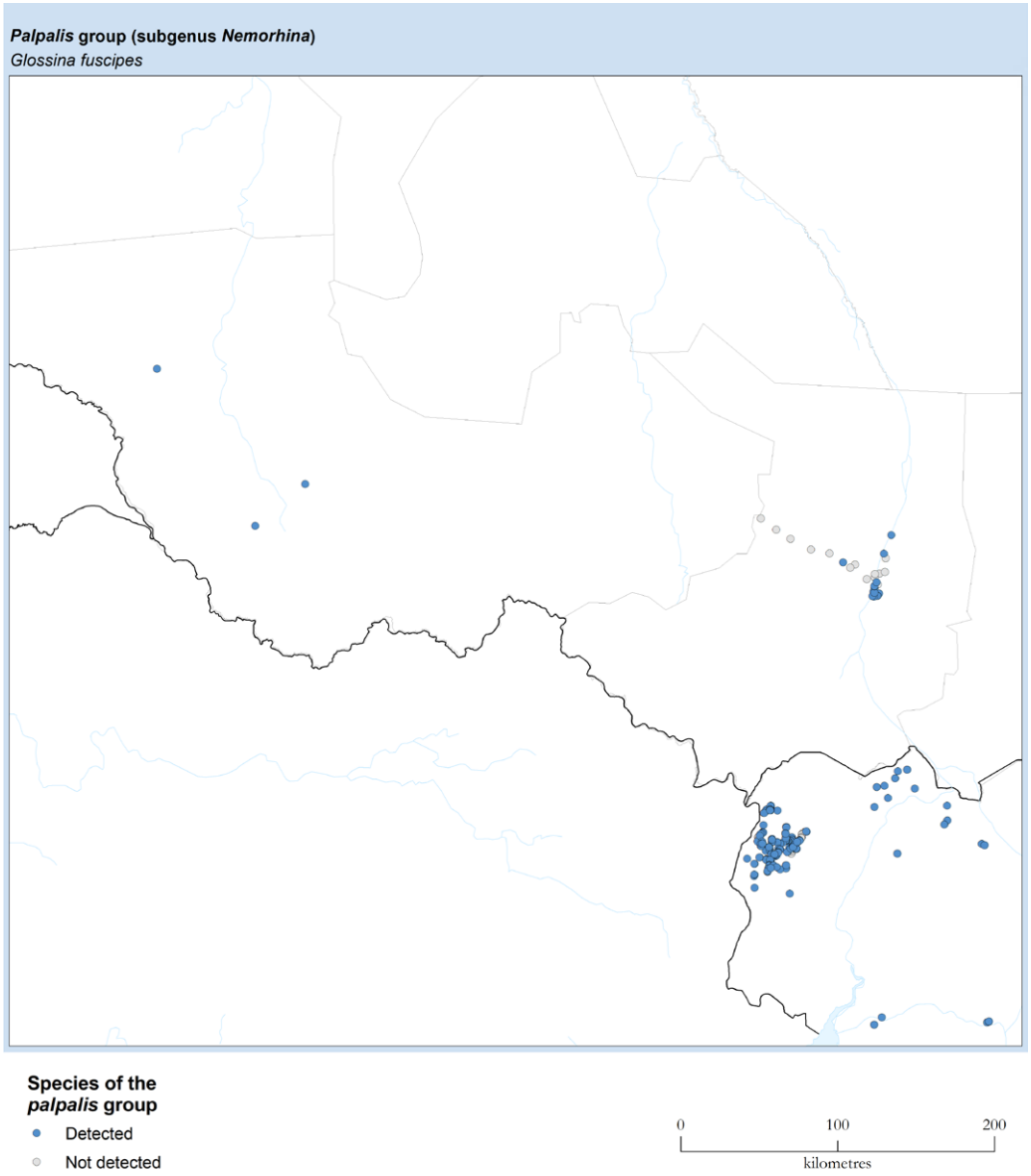


Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined. The final status of the Abyei area is not yet determined.

SOUTH SUDAN

FIGURE A.56
Geographic distribution of *Glossina fuscipes* in South Sudan as reported in scientific papers (publication period: 1990–2020)

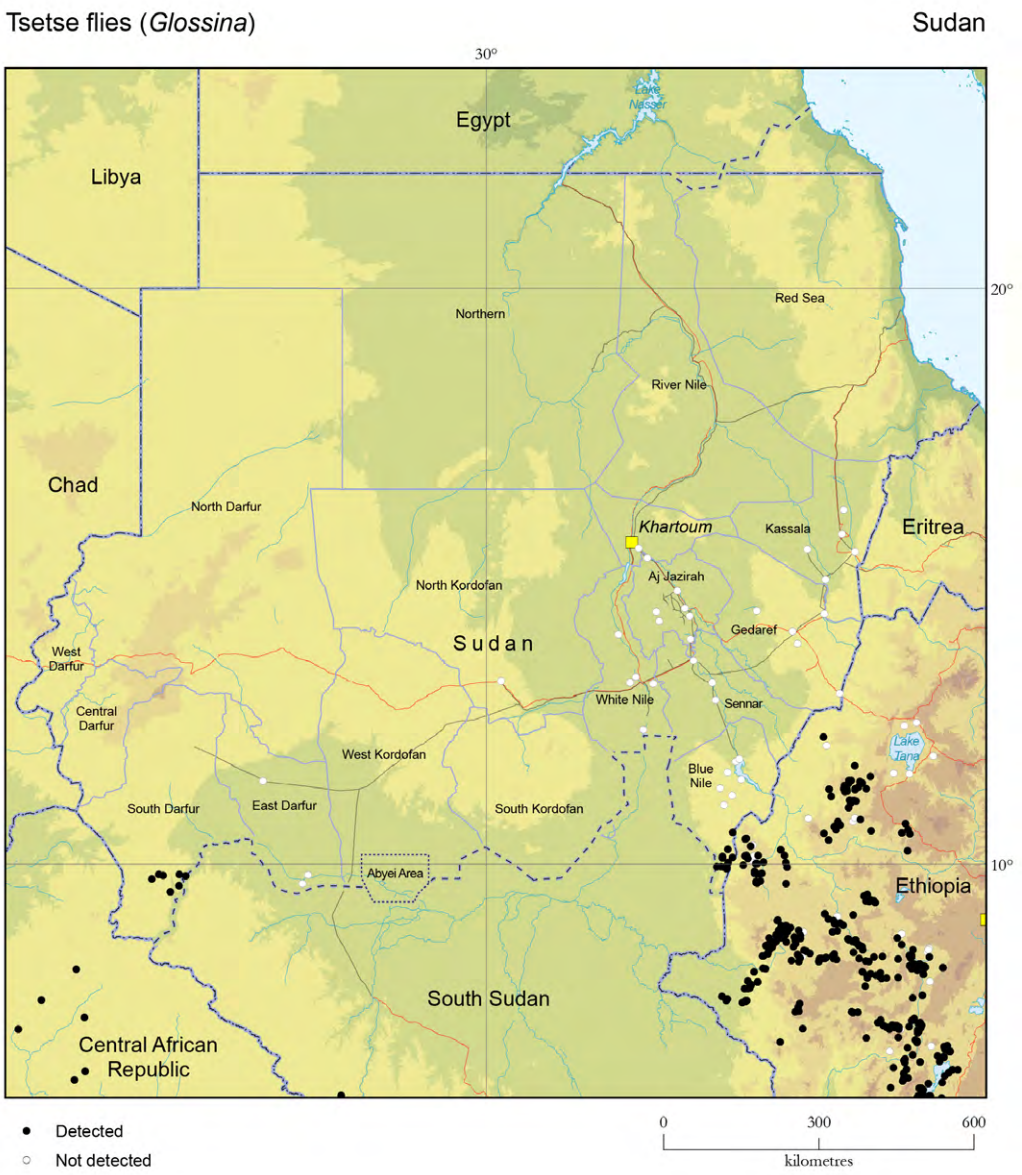


Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined. The final status of the Abyei area is not yet determined.

SUDAN

FIGURE A.57
Geographic distribution of tsetse flies (genus *Glossina*) in Sudan as reported in scientific papers (publication period: 1990–2020)

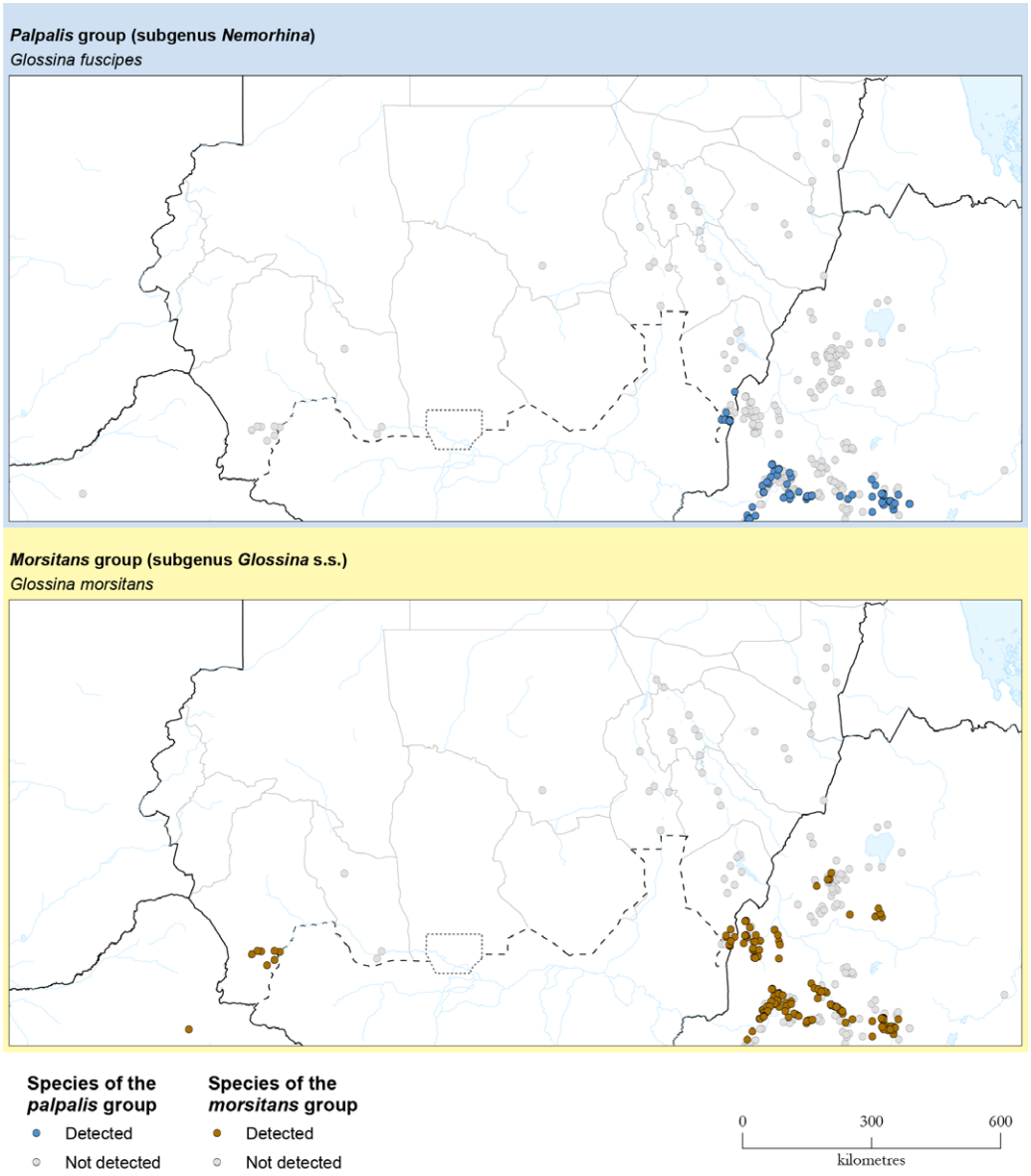


Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined. The final status of the Abyei area is not yet determined.

SUDAN

FIGURE A.58
Geographic distribution of the *Glossina* species in Sudan as reported in scientific papers (publication period: 1990–2020)

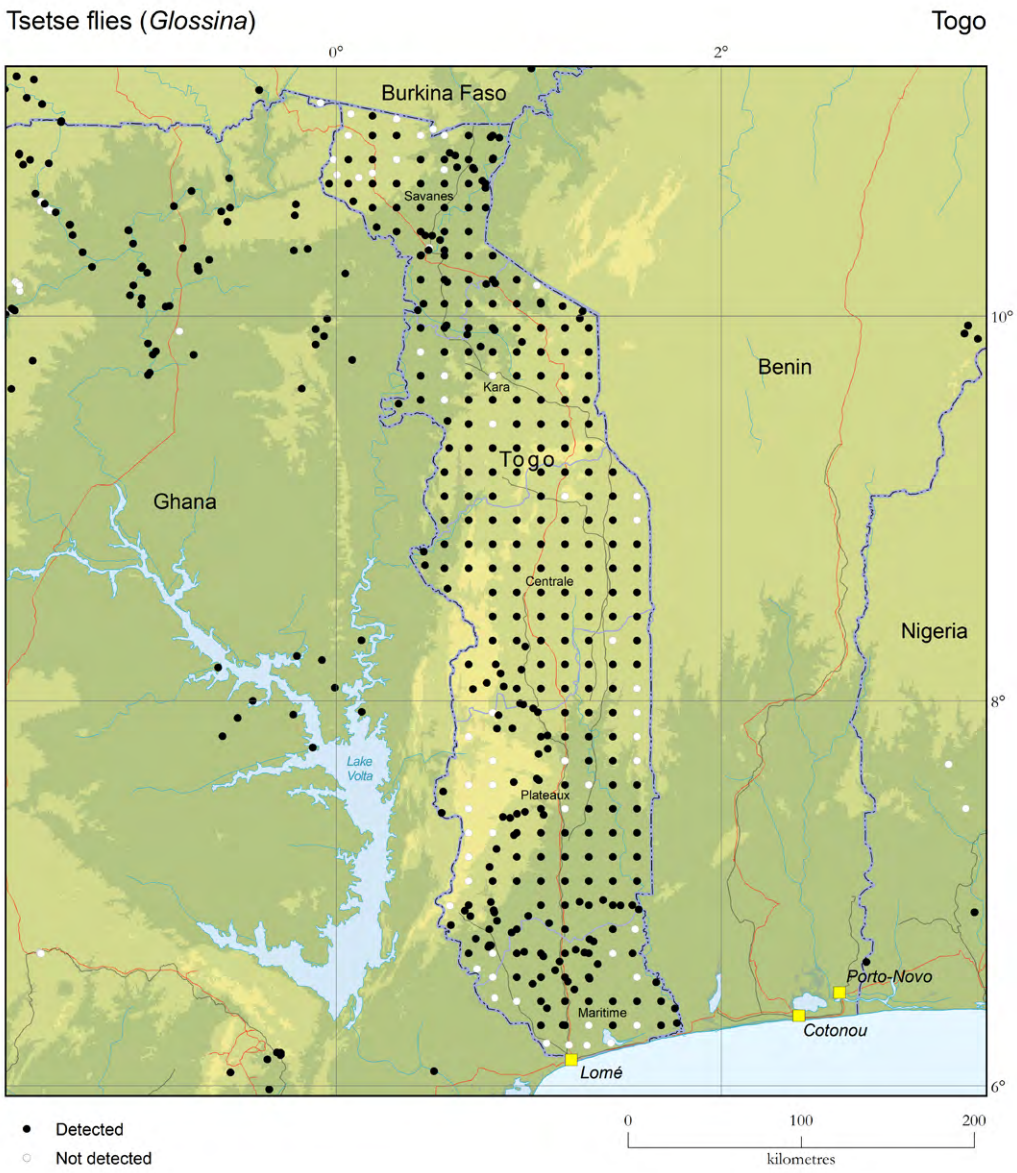


Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Note: The final boundary between the Republic of South Sudan and the Republic of the Sudan has not yet been determined. The final status of the Abyei area is not yet determined.

TOGO

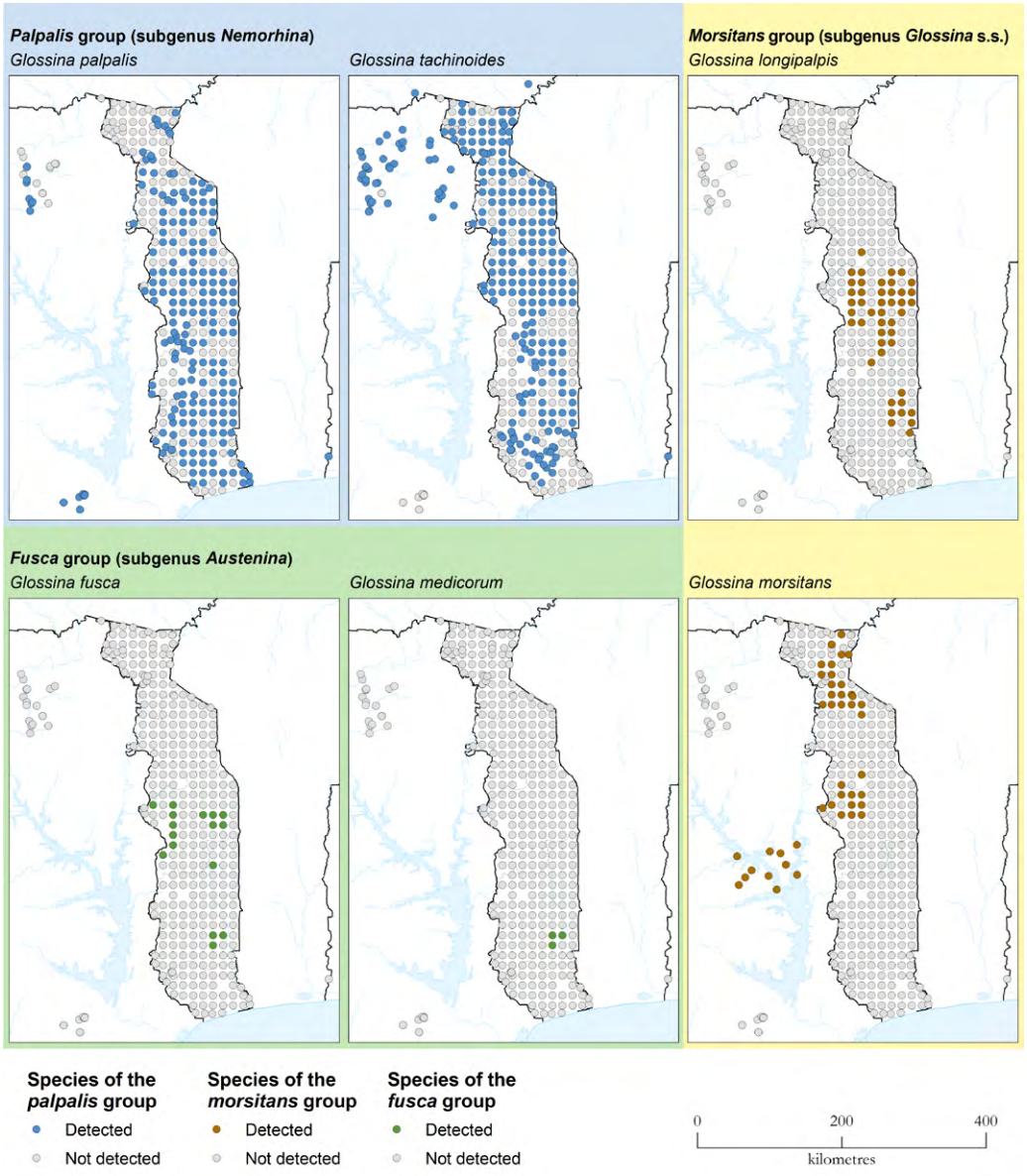
FIGURE A.59
Geographic distribution of tsetse flies (genus *Glossina*) in Togo as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

TOGO

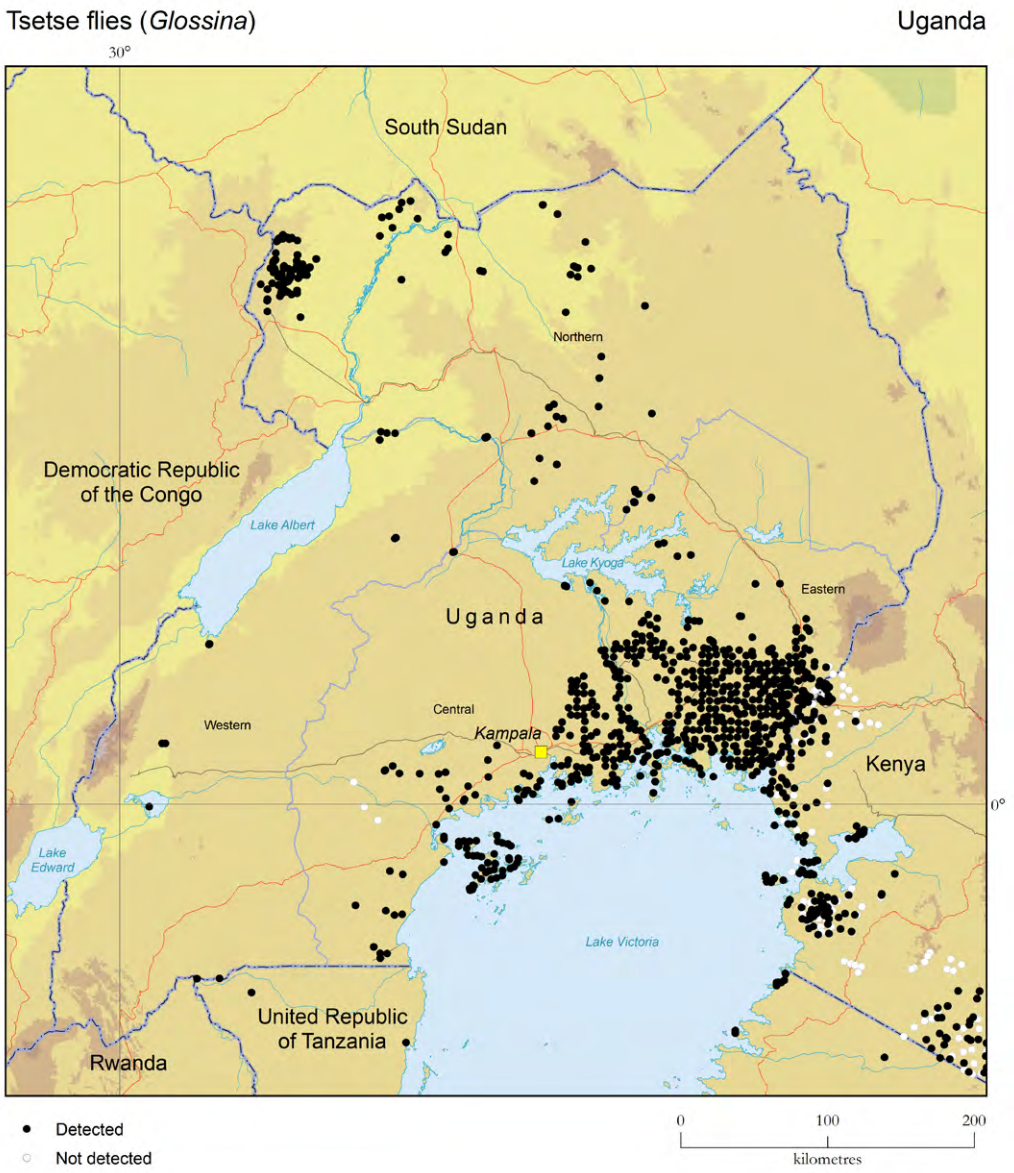
FIGURE A.60
Geographic distribution of the *Glossina* species in Togo as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

UGANDA

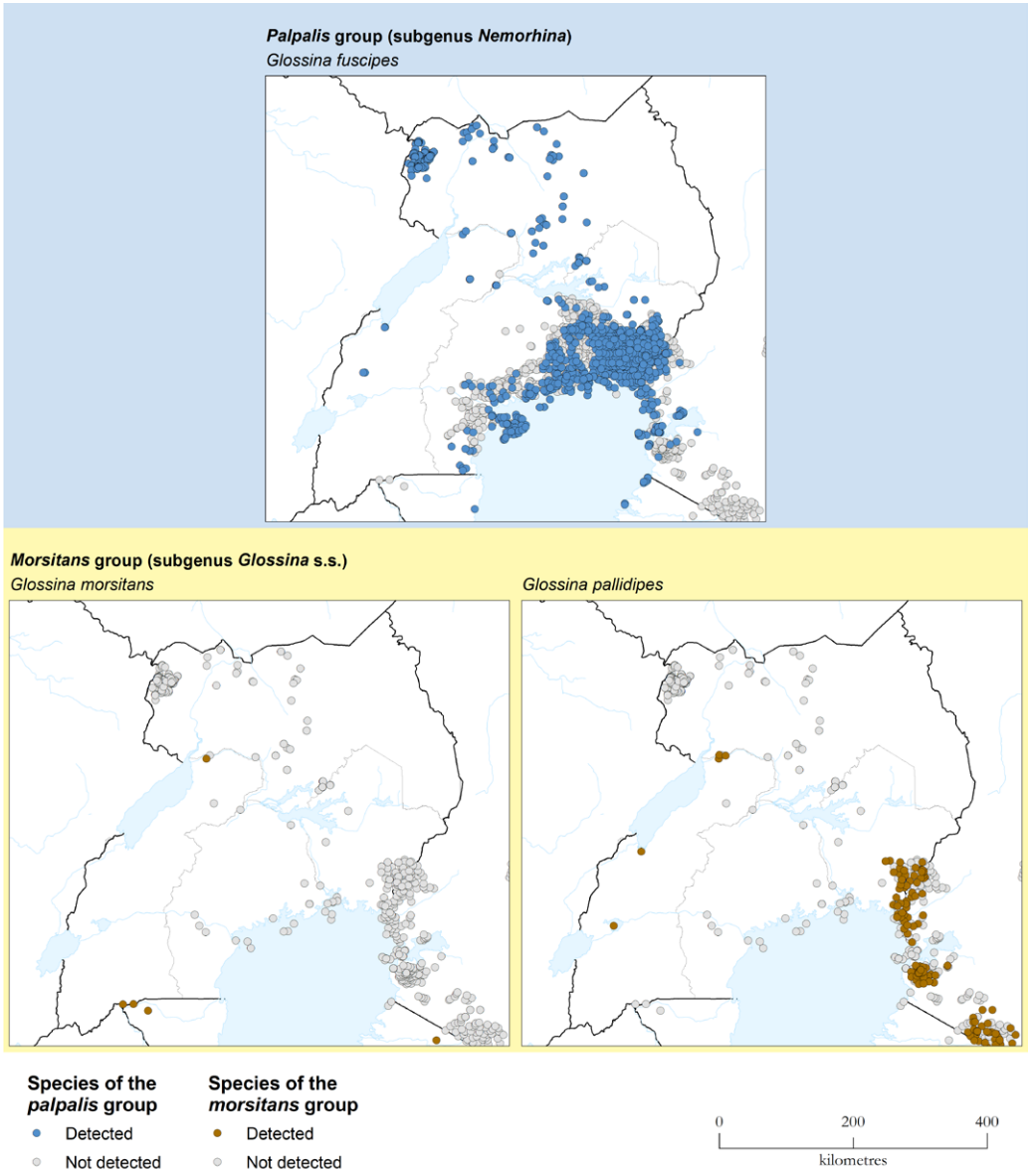
FIGURE A.61
Geographic distribution of tsetse flies (genus *Glossina*) in Uganda as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

UGANDA

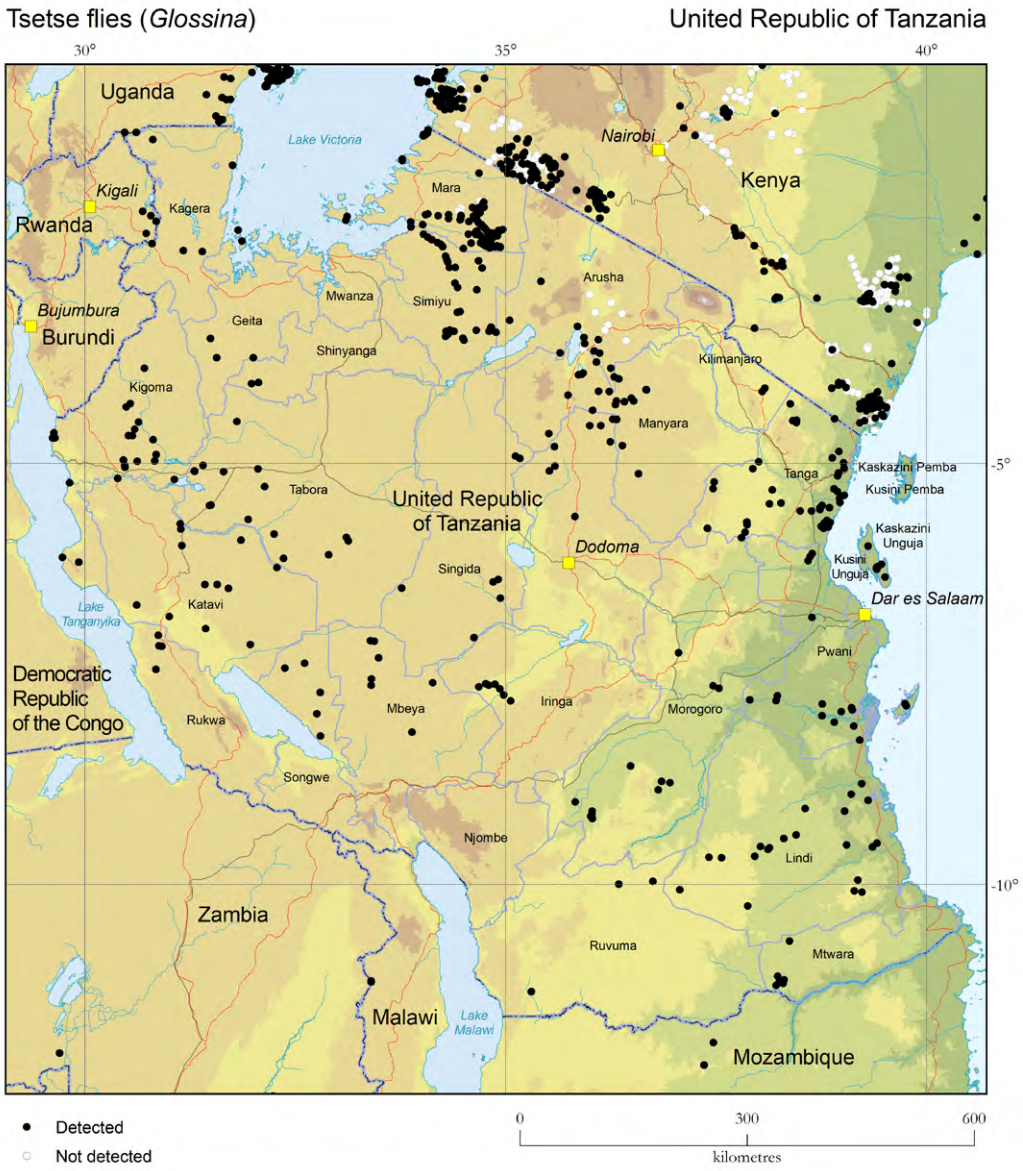
FIGURE A.62
Geographic distribution of the *Glossina* species in Uganda as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

UNITED REPUBLIC OF TANZANIA

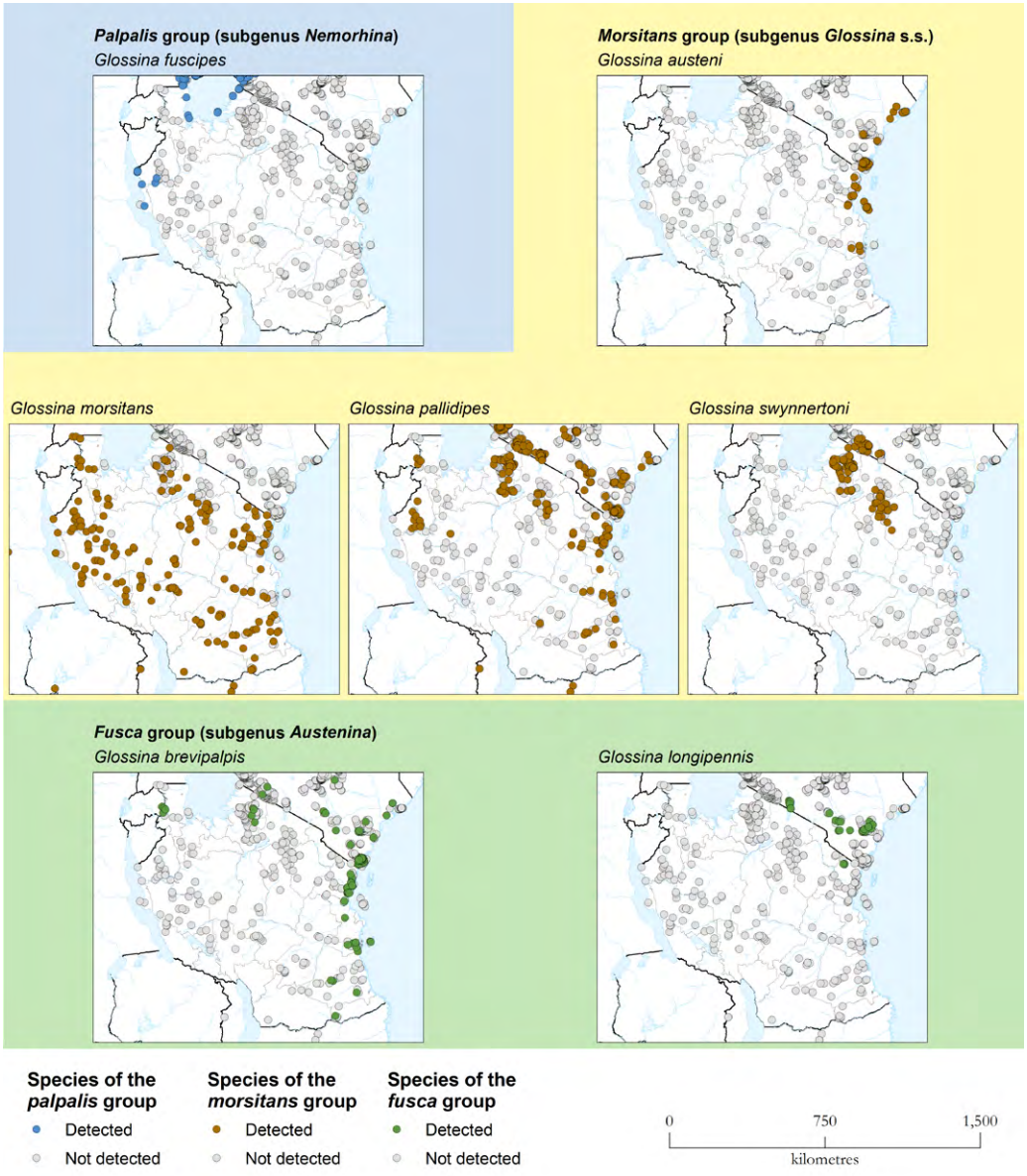
FIGURE A.63
Geographic distribution of tsetse flies (genus *Glossina*) in the United Republic of Tanzania as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

UNITED REPUBLIC OF TANZANIA

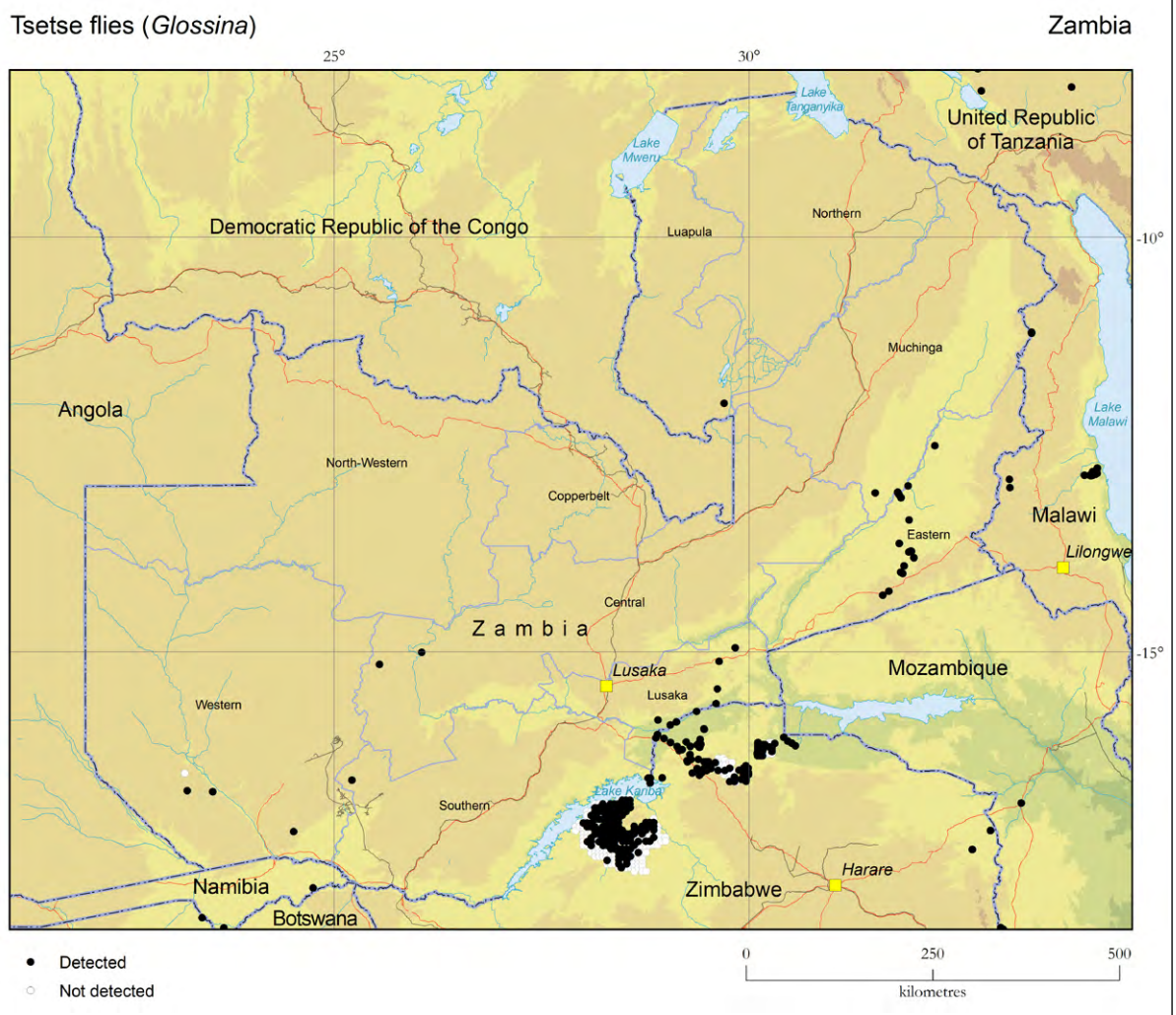
FIGURE A.64
Geographic distribution of the *Glossina* species in the United Republic of Tanzania as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

ZAMBIA

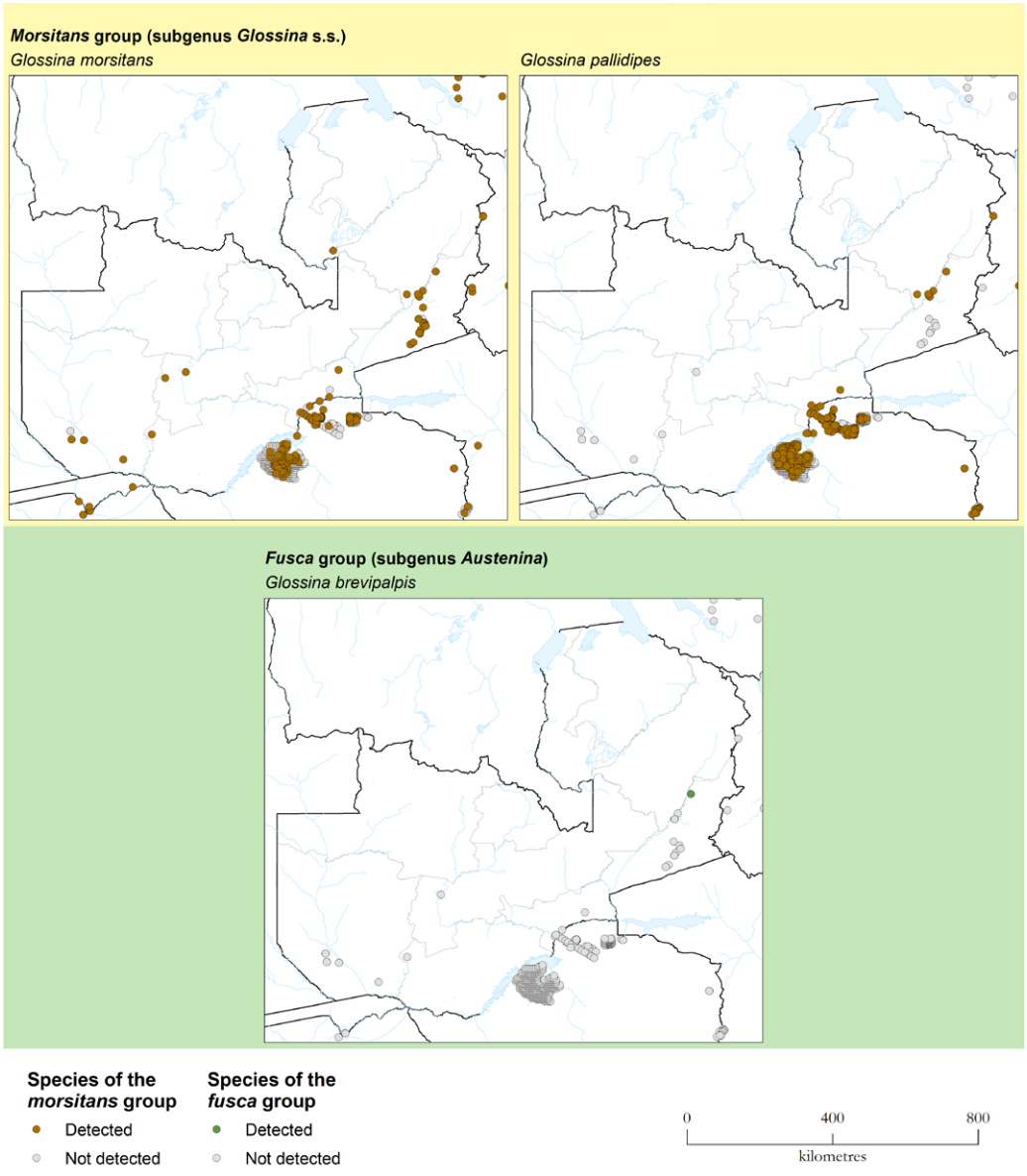
FIGURE A.65
Geographic distribution of tsetse flies (genus *Glossina*) in Zambia as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

ZAMBIA

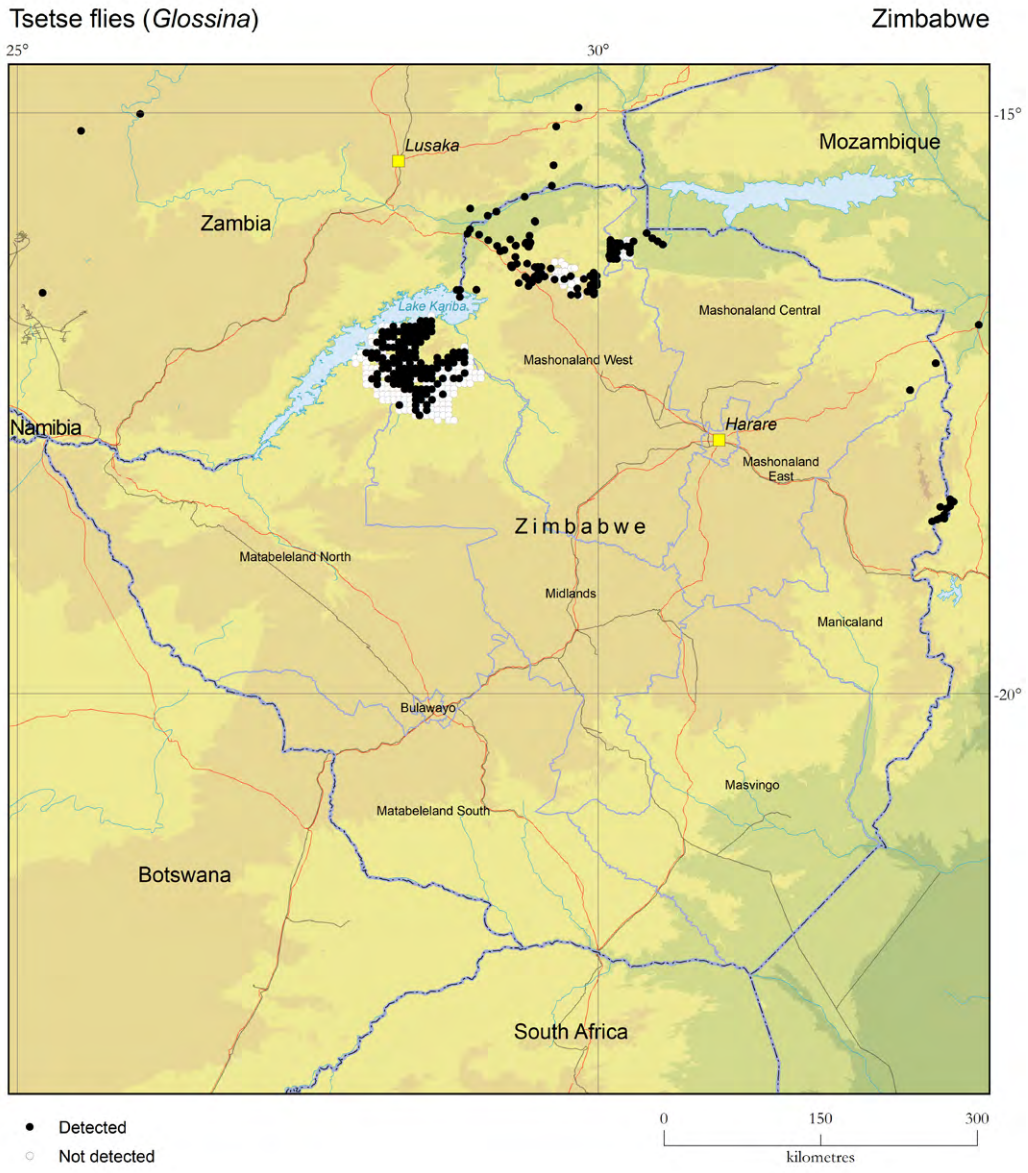
FIGURE A.66
Geographic distribution of the *Glossina* species in Zambia as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

ZIMBABWE

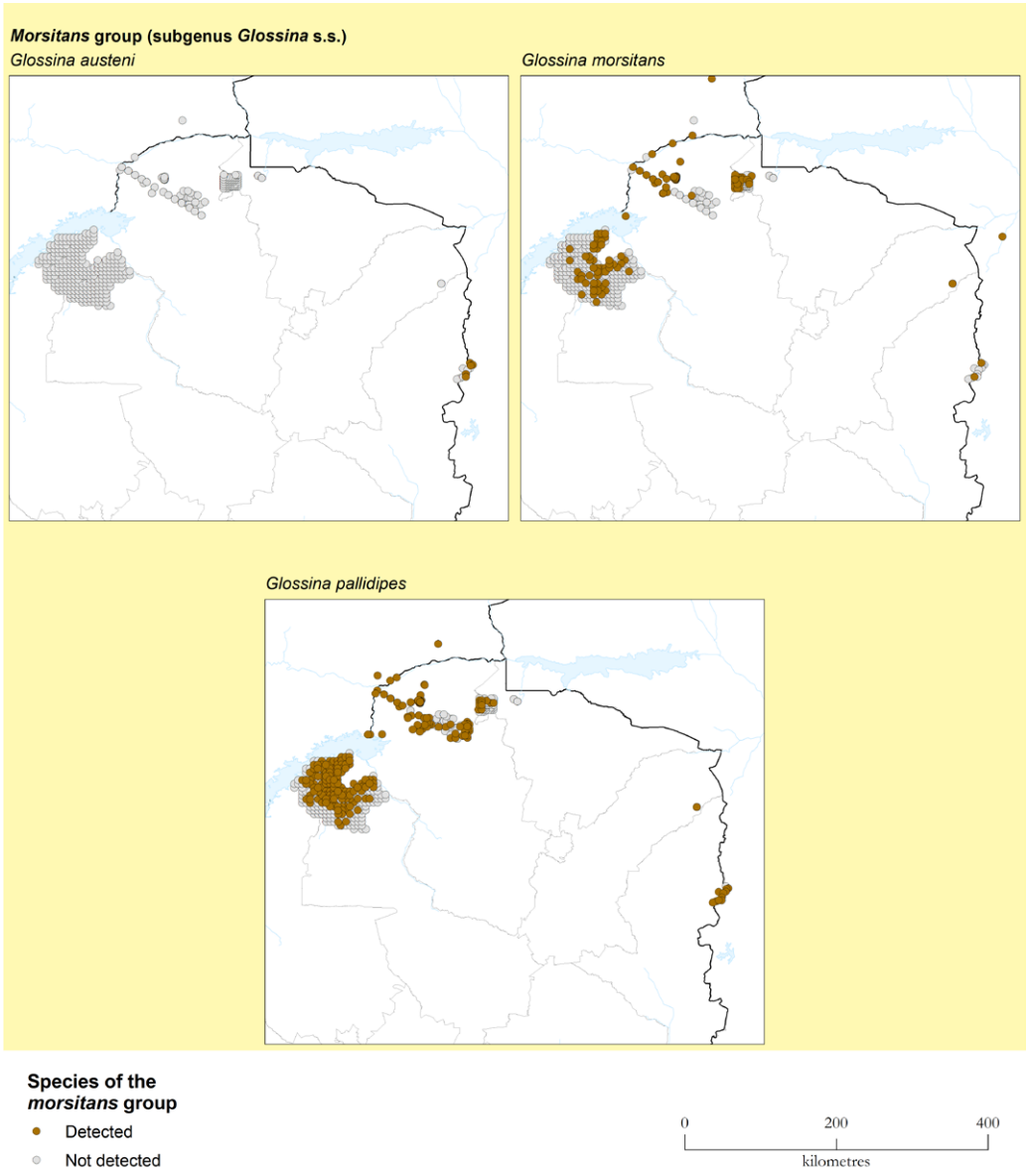
FIGURE A.67
Geographic distribution of tsetse flies (genus *Glossina*) in Zimbabwe as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

ZIMBABWE

FIGURE A.68
Geographic distribution of the *Glossina* species in Zimbabwe as reported in scientific papers (publication period: 1990–2020)



Source: Authors' own elaboration. Country boundaries based on **UN Geospatial**. 2023. Map of the World. In: *United Nations*. [Cited: 4 April 2024]. www.un.org/geospatial/content/map-world-1

Tsetse flies (genus *Glossina*) occur in sub-Saharan Africa, where they transmit trypanosomosis, a group of parasitic diseases that affect both animals and humans. Tsetse and trypanosomosis are a constant drain on the resources of poor African livestock keepers and they also impose a public health burden.

Comprehensive data on the geographic distribution of tsetse flies is crucial to design evidence-based and cost-effective strategies against animal trypanosomoses, and it is also important in eliminating the human form of the disease. Despite this, the latest maps of tsetse distribution in Africa were published several decades ago.

The present publication provides an update on the geographical distribution of tsetse flies in Africa. A total of 669 scientific publications spanning a period of 31 years (1990–2020) provided the input data, and almost 7 400 distinct geographical locations were mapped. Tsetse flies were recorded from a maximum latitude of 15° north in Senegal to a minimum of 28.5° south in South Africa. Data coverage is uneven, and no eligible publication was found for Burundi, Guinea-Bissau, Liberia, Sierra Leone or Somalia. A dearth of information also affects a few other countries, such as Angola, the Congo, the Democratic Republic of the Congo and South Sudan. At the level of tsetse species, relatively abundant data were identified for the species of major veterinary and public health importance, especially of the riverine (*palpalis*) and savannah (*morsitans*) groups. By contrast, limited information is available on many species of the forest (*fusca*) group.

The continental atlas of tsetse flies, in combination with the upcoming component on animal trypanosomosis, can be used by policymakers, practitioners and scientists engaged in the control and elimination of tsetse flies and trypanosomosis in Africa. It also provides a blueprint for national authorities to develop country-level information systems (i.e. "national atlases") to assist planning and monitoring of control activities at the national and local levels.

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