

Review

Review of the Situation of Human African Trypanosomiasis in the Republic of Congo From the 1950s to 2020

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Abstract

Human African trypanosomiasis (HAT), despite considerable progress in the control, is still occurring in many countries in both west and central African regions. The HAT situation in the Republic of Congo has always been overshadowed by its neighbor the Democratic Republic of Congo where over 60% of all HAT cases occur. In the Republic of Congo, HAT cases have been significantly reduced to about 20 reported cases yearly and the disease is still prevalent in few foci across the country. Although continuous assessment of HAT situation in Congo is been led by the National Control Program for HAT, research on the vector, parasite, and vector control has received little attention. Because there have not been enough reviews summarizing key findings from studies conducted so far, there is still a poor understanding of the global situation of HAT in Congo. In order to achieve sustainable elimination of HAT in Congo a deep appraisal of HAT situation is required. The present study provides a review of studies conducted on HAT in the republic of Congo since the 1950s to date in order to identify gaps in knowledge and help consolidate the gains and progress towards the elimination of sleeping sickness.

Key words: human African trypanosomiasis, tsetse fly, trypanosome, distribution, Congo

Human African trypanosomiasis (HAT), also known as sleeping sickness, is a parasitic disease transmitted by tsetse flies (*Glossina* spp) that has a high lethality unless treated (Büscher et al. 2017). The disease is endemic in sub-Saharan Africa and affects over 65 million people in more than 36 countries particularly those living in rural settings (OMS 2018). Trypanosomiasis due to *Trypanosoma brucei gambiense* is the most widespread and accounts for 98% of reported human cases of sleeping sickness (OMS 2018). At the beginning of the 20th century, HAT cases were highly prevalent and causing high mortality in populations across the continent (Jamot 1933). Control strategies including active detection of cases by mobile teams and treatment of all febrile cases using compounds such as suramin, pentamidine, and the highly toxic organo-arsenical melarsoprol contributed in significantly reducing the burden of the disease such that the

disease was reported residual in most countries after independence in the 1960s (Muraz 1943, Richet 1962). However, in the 1970s, with the stoppage of routine diagnosis and control actions, a resurgence of the disease was observed in historical foci in both west and central Africa. (Saliou and Challier 1976, Duvallet and JF 1979, Lankoande and Ouedele 1982, Solano et al. 2003). Over the last decades the reinforcement of control and surveillance activities across Africa permitted to dramatically reduce its prevalence from 25,841 new cases in 2000 to 2,164 cases in 2016 and 977 cases in 2018 (Franco et al. 2020). In 2009, the number of new cases fell below 10,000 for the first time in 50 years (OMS 2019, Franco et al. 2020). Nevertheless, the disease remains prevalent with a heterogeneous distribution across the continent. Over 60% of HAT cases have been reported in the Democratic Republic of Congo which bears the highest burden

Table 1. Number of cases according to year intervals

Number of cases	Years	References
413	1950–1970	Frézil et al. 1975
2,031	1971–1990	Frézil and Coulm 1977, 1979; Frézil et al. 1975, 1979, 1980, 1981; Gouteux et al. 1987, 1988; Gouteux and Sinda 1990
2,199	2001–to date	Balessegaram et al. 2006, PNLTHA 2015, 2017, 2018, 2019

of the disease (OMS 2019). Whilst in many countries there are now few active foci the potential for outbreaks and disease resurgence is still important due to the circulation of *T. b. gambiense* in both human and animal species (Büscher et al. 2018), movement of populations in and out endemic settings, and the presence of competent Tsetse fly in most epidemiological settings (Solano and Torr 2013).

During the last decades important progress has been achieved in the management of *gambiense* HAT cases with the development of new antibody-based rapid diagnostic tests used for mass and passive screening, the introduction of new and simpler treatments including nifurtimox–eflornithine combination therapy (NECT) and the new oral drug fexinidazole to treat both stages of the disease (Bottieau and Clerinx 2019) (<https://apps.who.int/iris/bitstream/handle/10665/326178/9789241550567-eng.pdf> 2019).

New indicators were also developed to assess the endemic status of countries and to validate HAT elimination as a public health problem at national level (OMS 2019).

As many countries approach the preelimination and elimination phases, thorough understanding of the epidemiological situation of each endemic setting is required in order to avoid resurgence of the disease which could impede progress registered so far. The Republic of Congo is among countries still affected by HAT almost all being *gambiense* HAT cases. In 2001 and 2002, the country reported its most largest number of new cases since the 1980s with 894 and 1005 cases respectively following the socio-political crisis that affected the country (Franco et al. 2018). In Congo, HAT remains endemic in five of the twelve administrative units (Bouenza, Niari, Pool, Plateau, and Cuvette). In 2019, 19 cases were reported after examining a total of 11,308 people (PNLTHA 2019). Although much research has been conducted on HAT in Congo, there are still not enough studies summarizing previous and recent findings to identify gaps in knowledge or to document recent dynamics of vectors or parasites. This information is not only a key for the management of current control programs but also to improve disease surveillance in order to achieve HAT elimination by 2030 as planned by the World Health Organization (OMS 2019). In this regard, the objective of this review is to gather information from previous studies in order to provide a better understanding of the dynamic of HAT situation in the Republic of Congo.

Methods

Selection and Data Collection Process

A systematic search of published literature on human trypanosomiasis in the Republic of Congo was done in both English and French using different accessible online bibliographic database such as PubMed, Google Scholar, IRD (Institut de Recherche pour le Développement) websites with specific/defined keywords such as, ‘Trypanosomiasis and Congo’ or ‘Glossina and Congo’ or ‘Trypanosomiasis and Glossina and Congo’ or ‘maladie du sommeil’

or ‘Trypanosomiasis and Congo’ or ‘Trypanosome and glossine and Congo’. Period of literature search included 1950–2020. The search resulted in the identification of 311 publications of which 264 were excluded because of unavailable or nonreporting data on HAT in the Republic of Congo. A Microsoft Excel spreadsheet was used to register information extracted from each selected published study for easy access and data analysis. Information registered included authors names, the year of the study, type of study, and topic covered (main findings). Annual reports from the national sleeping sickness control program of the Republic of Congo were also consulted (Fig. 1). Three researchers were involved in the selection process of papers and they worked independently.

Eligibility criteria: Studies included were studies conducted on HAT conducted between 1950 and 2020; were not considered studies on animal trypanosomiasis and experimental studies.

Results

Epidemiology of HAT in Congo

In the 1960s, six main hotspots or active transmission foci of HAT were reported in Congo (Maillot 1962). These include the Congo Atlantic foci extending from Loango in the coast to the south of Brazzaville; the corridor foci extending from the north of Brazzaville to the south of Mpouya; the Nkényi foci covering the district of Gamboma, the Alima foci including the Districts of Mairou, Fort-Rousset currently called Owando, Ewo, and the north-western of Djambala; the Likouala foci covering the Likouala-Mossaka valley, and the Likouala grassland foci covering the districts of Mossaka-North, Epena, Impfondo, and Dongou. Following active detection and treatment of HAT, the number of cases drastically reduced across the country (Frézil et al. 1975). However studies conducted between 1975 and 1977 reported frequent cases of HAT in three distinct hotspots which were later grouped into three foci with well-defined phytogeographical facies (Frézil et al. 1977) (Table 1):

- The savannah hotspot (located between the Kouilou and Pool division)
- The forest hotspot (including the Mbomo ‘Cuvette Congolaise’ and Mayombe forests)
- The Congo River hotspot (comprising two active areas the corridor hotspot situated in the southern part of river Congo and the hotspot of Cuvette situated in the northern part of river Congo).

In the Republic of Congo according to the latest report of the National Program for the Control of human African trypanosomiasis only the foci of savannah and of corridor (Congo river) are still active with regular transmission of HAT; with the localities of Loudima, Ngabe, and Mpouya being at the forefront of the transmission (PNLTHA 2019). In the past, the country recorded fairly high prevalence ranging from 5.5 to 10% (Lancien et al. 1981, Noireau et al. 1991) and most recently, this prevalence has fallen to 0.1% (PNLTHA 2019). It has also been shown that a decrease in the tsetse fly population could lead to a decrease in the prevalence of animal trypanosomiasis (Lancien et al. 1981). Although a significant decrease of HAT transmission has been reported across the country, it is not clear whether these changes are only the results of improved case detection and management and vector control activities conducted so far. Reduced transmission has also been associated to the fragmentation of tsetse fly habitats following extension of human settlements or activities such as agricultural practices, road, or dams constructions which have been significantly expanded during the last decade (Maillot 1952, Taufflieb 1965, Frézil et al. 1972, PNLTHA 2019). The cause

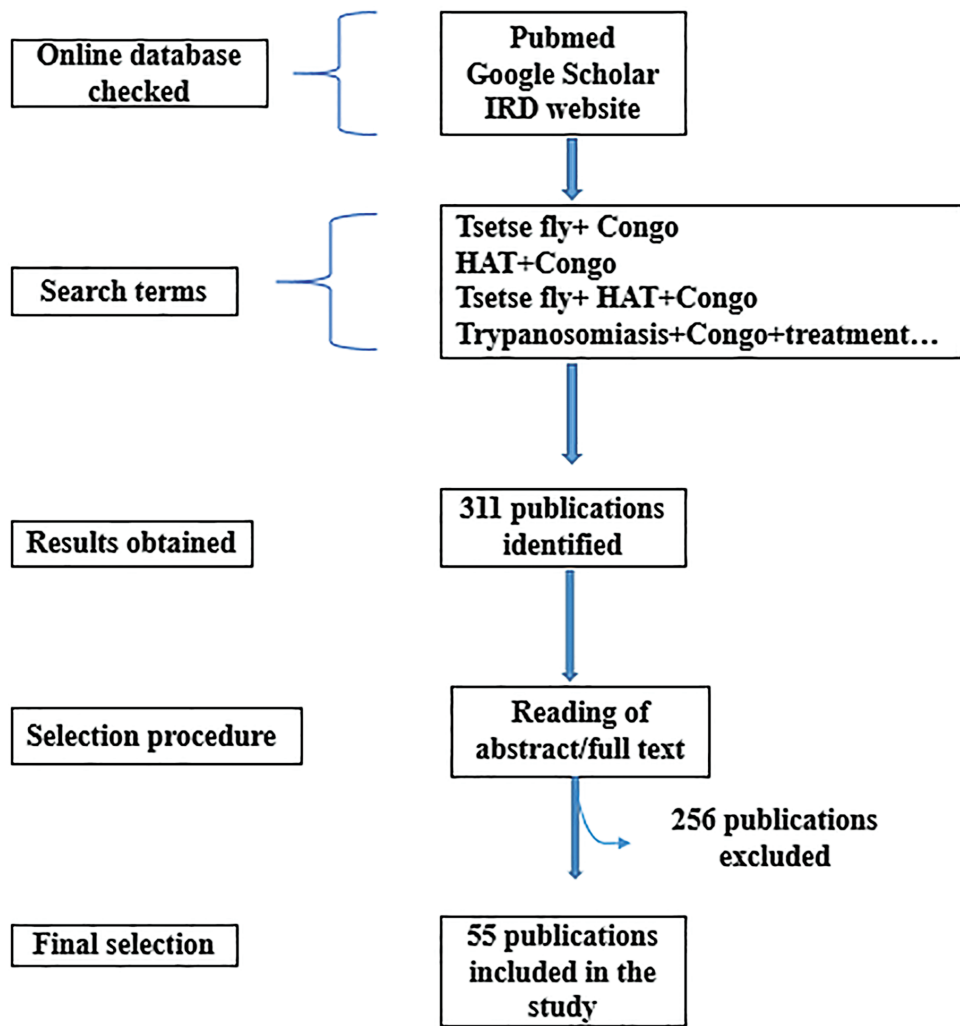


Fig. 1. Diagram showing the protocol for selection of scientific papers.

of the decrease still warrants further investigation may be clearer (Wamwiri and Changasi 2016). The rapid demographic growth of the population is extending human settlements and pushing more people into tsetse-fly infected zones. In addition the practice of intensive agriculture with the use of large quantities of pesticides could have also considerably affected tsetse flies habitat and leading to an apparent elimination of the disease (Mwanakasale and Songolo 2011). Yet this has not been investigated in Congo and deserves further attention. In eastern and southern Africa, simulation analysis suggested that population growth and land use cause a decline of savannah and forest tsetse fly populations. In these parts of the continent, tsetse fly populations have been confined in discrete habitats around wildlife conservation parks and reserves (Reid et al. 2000, Wamwiri and Changasi 2016).

- HAT situation in the cities of Brazzaville and Pointe Noire

Before and during the colonial period, parasitological positive patients were immediately referred to the reference unit in Brazzaville for treatment and, because of poor health infrastructure in the hinterland, most of the patients diagnosed with HAT nowadays, still travel to Brazzaville for treatment (Frézil and Coulm 1977, PNLTHA 2017). This situation favored the transmission of HAT in Brazzaville due to the presence of local tsetse fly populations in the city. The city of Brazzaville is at the southern limit of the

distribution area of *Glossina fuscipes quanzensis*, one of the main vectors of HAT in Congo. Many tsetse flies habitats were described in the ravines and main rivers of the M'foa, Tsiema, Makélékélé, Mfilou, and Djoué districts of Brazzaville (Taufflieb 1965). The city of Brazzaville has been a high hotspot of HAT in Congo until the 1970s (Frézil and Coulm 1977). In 1989 nineteen HAT cases were passively detected in Brazzaville (Jannin et al. 1990). It was not clear whether these were indigenous or imported cases. The practice of brushing and clearing of low vegetation up to 2 m and extension of the city limits (Gouteux et al. 1986b), permitted to reduce the disease burden. Although no tsetse fly has been reported in Brazzaville since the 1990s few HAT cases are regularly reported through passive detection in Brazzaville. In 2015 the national control program for sleeping sickness reported eight cases through passive detection (PNLTHA 2015). Brazzaville is also vulnerable due to its close proximity (less than 3 km) with the city of Kinshasa where urban cases of HAT are regularly reported (Ebeja et al. 2003, Sumbu et al. 2009).

In the city of Pointe Noire there have been so far not many investigations conducted in the area and just few cases have been reported from the city (Maillet 1962). The city is situated close to Cabinda Angola which still has active HAT foci. With the increase of commercial exchanges with the Cabinda region there could be a possible corridor for HAT transmission. In this regard, there is a need

to maintain surveillance of the area through active detection of HAT cases to avoid any resurgence of the disease from this area (Fig. 2).

Vectors (Tsetse Flies)

Of the 33 tsetse fly species described in the Glossinidae family, 11 have been reported in Congo. Species reported so far, belong to the genus *Glossina* and *Nemorhina* and include *Glossina frezili*, *Glossina fuscipes quanzensis* Pires, 1948. *Glossina fuscipes fuscipes* Newst., 1910, *Glossina palpalis palpalis* Rob. Desv., 1830, *Glossina (Nemorhina) caligenea*, *G. tabaniformis*, *G. fusca congolensis*, *G. nashi*, *G. schwetzi*; *G. palicera newsteadi*, *G. hamingtoni* (Maillot and Ceccaldi 1956, Gouteux et al. 1986b, Gouteux 1987, Gouteux et al. 1987, Brunhes et al. 1994) <http://www.fao.org/3/p5178f/P5178F06.htm>; (Duteurtre and Gouteux 1986). These species have been reported in various sites across the country (Maillot 1952, Taufflieb 1965, Frézil et al. 1972).

Glossina (N.) caligenea and *G. frezili*, are found in the costal rainforest of Pointe noire (Gouteux and Noireau 1986, Gouteux 1987). Four species including *G. f. quanzensis*, *G. f. fuscipes*, *G. p. palpalis*, *G. p. newsteadi*, are widely distributed across the country (Maillot 1953, 1960; Maillot 1961). These species are also present in neighboring countries such as Cameroon, Central Africa Republic, Gabon, and DR Congo (Brunhes et al. 1994). Only a single study reported infection of tsetse flies in Congo by *T. b. gambiense* these flies were of the species *G. p. palpalis*, *G. f. fuscipes*, and *G. f. quanzensis* (Maillot 1956). These species are

opportunistic, feed on both human and animal and always display a low infectivity (Frézil et al. 1972). Studies conducted so far indicated the absence of tsetse flies in the city of Brazzaville (Tongue et al. 2009). It is rather possible that tsetse flies distribution may have reduced during the last decades following increase deforestation taking place in most parts of the country.

Significant changes have been recorded in the composition of the *Glossina* fauna in Congo with many species which have become scarce or have totally disappeared with increasing deforestation and transformation of their natural habitat. *G. tabaniformis* which was frequent in collections conducted between 1947 and 1953 in Brazzaville (Maillot 1948) is no more present in Brazzaville (Tongue et al. 2009). It is possible that the transformation of its habitats following rapid urbanization of the city of Brazzaville deeply affected its bionomic. This species was also reported from the Plateau Bateke (Lefni foci) (Gouteux 1991).

Glossina schwetzi is a species reported for the first time in the country in 1947 (Taufflieb 1964). This species was also found in collections done in 1961 (Maillot 1961). It was mainly distributed in forest gallery and savannah of the Bouenza. Since 1964 this species has no more been reported (Taufflieb 1964).

Glossina nashi is a species reported in Mayombe and neighboring villages (Maillot 1963, Eouzan 1982). However, it seems like the species is no more present in Congo since repeated samplings conducted in its type locality did not yielded any sample (Bourzat and Gouteux 1990, Gouteux 1991).

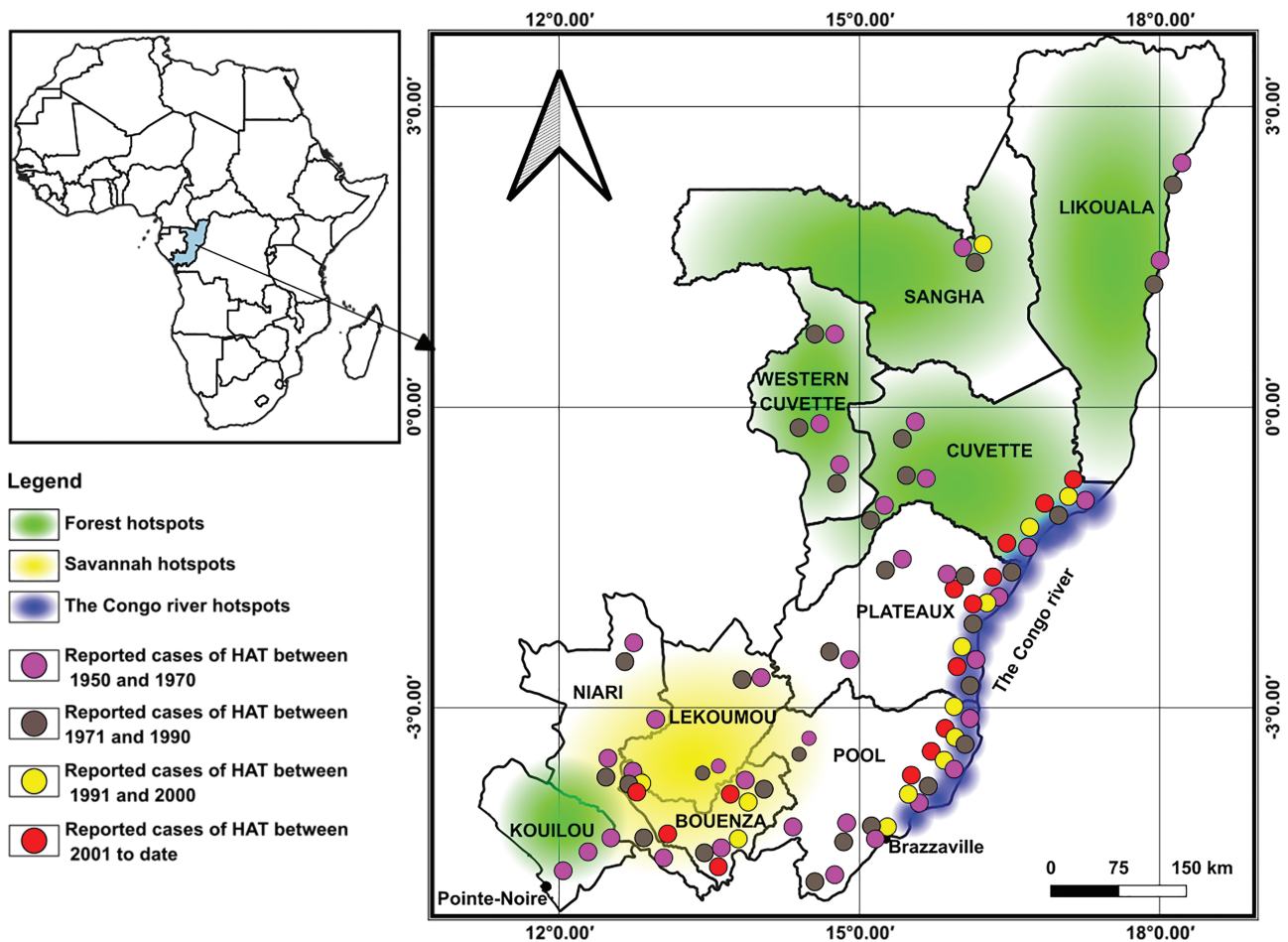


Fig. 2. Graphical representation of reported HAT cases.

Parasites Species

Trypanosoma brucei gambiense, the only pathogen of human sleeping sickness in Congo, was recorded in both human and glossina and was frequent in most sites. Four other *Trypanosoma* species have been reported in Congo. These include *T. congolense*, *T. vivax*, *T. simiae*, and *T. grayi*, however they do not cause disease in humans, rather animal African trypanosomiasis (Frézil et al. 1972, Scott et al. 1983, Noireau et al. 1991) (Table 2).

Disease Diagnostics

Active screening of the population is recommended by WHO for the control of HAT (WHO Expert Committee on the Control 1998). Several screening techniques are used for trypanosomes detection in different biological fluids (e.g., blood, cerebrospinal fluid, saliva). In past campaigns diagnosis of trypanosomiasis relied on the examination of lymph node or blood (fresh and/or stained) using a microscope. From the 1970s ‘the search for immunoglobulin M (IgM)’ was added to the diagnostic of HAT in the Republic of Congo (Mattern et al. 1961). This technique was tested in 1972 in Loudima, Mpouya, Kinzaba, and Kimongo localities, but showed margin error of at least 10% and was rapidly abandoned in favor of indirect immunofluorescence (IFI) (Frézil 1983). IFI was used for several years for HAT detection (Frézil and Coulm 1977, Gouteux et al. 1988). Despite the fact that it has a high sensitivity, it was found difficult to apply on the field for mass screening because it required qualified personnel (Frézil 1983). Following the development of the CATT (Card Agglutination Test for Trypanosomiasis) by Magnus et al. (Magnus et al. 1978) this tool became the main diagnostic tool used for mass screening of HAT across Africa. The Republic of Congo adopted this technique in the 1980s and it is still used to date in active screening campaigns (Noireau et al. 1991b, PNLTHA 2019). Combination of IFI-CATT was also tested on the field and gave good results. During the last decades several novel and improved techniques were developed for active detection of HAT cases this includes techniques such as light emitting diode fluorescence microscopy (Njiru et al. 2008). The Loop Mediated Isothermal Amplification (LAMP) technique and individual rapid diagnostic tests (RDTs) (Njiru et al. 2008, Büscher et al. 2013, Mitashi et al. 2015). The national sleeping sickness program of Congo started using Rapid Diagnostic Test (HAT sero-K-set test) for the diagnosis of HAT in 2015 (PNLTHA 2015). Yet this tool has not replaced CATT but both are used on the field because of their high sensitivity and specificity (Boelaert et al. 2018). RDT tests particularly HAT sero-K-set test were found to present a sensitivity of 98.5% and a specificity of 98.6% for *T. b. gambiense* antibody detection (Büscher et al. 2014). The use of RDT is also limited by frequent power supply shortages in most rural settings affecting the conservation of RDT. Although CATT could display a sensitivity of up to 98% for the detection of primary infection cases, it is not reliable to monitor treatment outcome (Lejon et al. 2010). The LAMP (loop mediated isothermal amplification) technique has also been tested in some field sites (PNLTHA 2017).

Management of HAT Cases

Over years, the treatment of sleeping sickness has evolved considerably. Up to the 2000s, patients with sleeping sickness were treated with pentamidine (for stage I patients) and melarsoprol (for stage II patients). Unfortunately, melarsoprol was highly toxic, causing several deaths (Ginoux et al. 1984). In 2000 Congo adopted the use of eflornithine a new compound, more effective and less toxic to replace melarsoprol, (Eozenou et al. 1989, Balasegaram et al. 2006, Balasegaram et al. 2009). Eflornithine was used for stage I and II

patients but the nonrespect of treatment protocol by medical personnel particularly for both old and new cases led to an increase in relapse and adverse events (Pépin et al. 2000, Priotto et al. 2007, Priotto et al. 2009, Jansson-Löfmark et al. 2015). The recent introduction of NECT (Nifurtimox–eflornithine combination therapy) in 2007 significantly improved sleeping sickness treatment in Congo. NECT was found to be more efficient for the treatment of patients with stage II trypanosomiasis and was found to limit the emergence of resistant strains (Priotto et al. 2007, Priotto et al. 2009, PNLTHA 2015, 2017).

Vector Control

Vector control is considered as a key component of sleeping sickness control. In several epidemiological foci across Africa it was proven that the implementation of vector control measures alongside medical interventions (diagnostic and treatment) contributed significantly to the reduction of the incidence of HAT cases (Solano and Torr 2013, Courtin et al. 2015, Tirados et al. 2015, Mahamat et al. 2017). Due to the fact that tsetse females produce a limited number of progeny, targets of tsetse flies have been practiced in most epidemiological foci to reduce population densities (Solano and Torr 2013). In Congo, the spraying of sites with 5% DDT was tried in Loudima between 1969 and 1971, unfortunately it was a failure due to the rapid recolonisation of the sites (Adam and Challier 1969, Adam et al. 1969, Adam and Le Pont 1971). Yet with the development of traps there were several trials conducted in some endemic gHAT foci to target and control Tsetse flies. First attempts started with the biconical trap impregnated with insecticide (DDT) (Challier et al. 1977), used during the seventies and eighties to control tsetse flies (Lancien et al. 1981, Gouteux and Noireau 1986). However, these traps were found less efficient for targeting tsetse flies and were replaced (Gouteux et al. 1986a). From 1986 the pyramidal trap was introduced and was found to be more effective in targeting tsetse flies compare to biconical trap (Gouteux et al. 1986b). Although there have been considerable advances with the development of new cost-effective tool such as the tiny target which is more effective in the control of riverine tsetse flies particularly *G. fuscipes* and *G. palpalis* species (Esterhuizen et al. 2011, Rayaisse et al. 2011), there have been so far no assessment of its suitability for controlling tsetse flies in Congo. In addition to the fact that the traps are very small easily transportable on the field they also cost much less. The adoption of these traps by the national sleeping sickness program of Congo might improve disease control in hotspot areas as it was the case in other epidemiological setting with HAT burden (Shaw et al. 2015, Tirados et al. 2015, Lehane et al. 2016, Mahamat et al. 2017).

Conclusion

The study provided an overview of studies conducted so far in the Republic of Congo on vector and trypanosome species distribution, case management, disease prevalence, and control measures. Although surveillance activities conducted by the national sleeping sickness programme suggested significant reduction of HAT cases in Congo, much still need to be done to achieve the elimination of HAT as a public health problem (Tirados 2015, #171). There have been since the 2000 not many research and surveillance activities on the vectors and trypanosomes as a result, it is not clear whether there are additional active foci inland contributing to HAT transmission and requiring further attention. Surveillance activities conducted by the national sleeping sickness programme are conducted once yearly and in a limited number of villages (PNLTHA 2019, #64). All these could limit the accuracy of findings resulting from these surveillance activities.

Table 2. Summary of studies reporting the presence of *Glossina* species and *Trypanosoma* species in Congo since the 1950s

Foci	Sites	Vector species	Year	Species of trypanosoma	Hosts ^a	References
Corridor hotspot	Brazzaville	<i>G. fuscipes quanzensis</i>	1953	<i>T. gambiense</i>	Tsetse flies	(Maillot 1953)
	Brazzaville	<i>G. fuscipes quanzensis</i>	1956	<i>T. brucei gambiense</i>	Tsetse flies	(Maillot and Ceccaldi 1956)
	Brazzaville and surroundings	<i>G. fuscipes quanzensis</i>	1972	<i>T. brucei gambiense</i> , <i>T. grayi</i> , <i>T. simiaie</i>	Tsetse flies, pig	(Frézil et al. 1972)
Savannah hotspot	Kaba Ngomba, Kounzoulou Lipilli and Edouani	<i>G. fuscipes quanzensis</i>	1981	<i>T. congolense</i> , <i>T. brucei</i>	Domestic animals, human	(Lancien et al. 1981)
	corridor	—	1983	<i>T. brucei gambiense</i>	Sheep	(Scott et al. 1983)
	Corridor and Pool	<i>G. fuscipes quanzensis</i>	1989	<i>T. brucei gambiense</i>	Sheep, pig	(Noireau et al. 1989)
	Brazzaville and Kounzoulou	—	1991	<i>T. brucei gambiense</i>	Pig	(Truc et al. 1991)
	Loudima	<i>G. palpalis palpalis</i>	1969	<i>T. brucei gambiense</i> , <i>T. congolense</i>	Tsetse flies, human	(Adam and Challier 1969)
	Loudima	<i>G. palpalis palpalis</i>	1971	<i>T. brucei gambiense</i> , <i>T. vivax</i> , <i>T. grayi</i>	Tsetse flies	(Adam and Le Pont 1971)
	Kingouala-Nsouadi, Kinzaba and Makondo Mabengue	<i>G. palpalis palpalis</i>	1981	<i>T. congolense</i> , <i>T. brucei</i> , <i>T. brucei gambiense</i>	Domestic animals, human	(Lancien et al. 1981)
	Niari	—	1983	<i>T. brucei gambiense</i>	Sheep	(Scott et al. 1983)
	Bouenza	<i>G. palpalis palpalis</i>	1989	<i>T. brucei gambiense</i>	Sheep, pig	(Noireau et al. 1989)
	Kimbedi, Kitoundou	<i>G. palpalis palpalis</i>	1990	<i>T. congolense</i>	Tsetse flies, sheep, pig, goat	(Noireau et al. 1990)
Savannah hotspot	Kimbedi	—	1991	<i>T. congolense</i>	Domestic animals	(Noireau et al. 1991)
	Kinzaba, Comba and Mbinda	—	1991	<i>T. brucei gambiense</i>	Pig	(Truc et al. 1991)
Forest hotspot	Mbomo	<i>G. tabaniformis</i> , <i>G. fuscipes fuscipes</i>	1981	<i>T. congolense</i> , <i>T. brucei</i> , <i>T. vivax</i> , <i>T. grayi</i>	Tsetse flies	(Frézil et al. 1981)
	Makoua	—	1983	<i>T. brucei gambiense</i>	Sheep	(Scott et al. 1983)
	Mandigo-Kayes	<i>G. caliginea</i>	1986	—	—	(Gouteux et al. 1987)
	Mandigo-Kayes	<i>G. tabaniformis</i> , <i>G. fusca congolensis</i> , <i>G. frezili</i>	1987	—	—	(Gouteux 1987)
	Sangha	<i>G. fuscipes fuscipes</i>	1989	<i>T. brucei gambiense</i>	Sheep, pig	(Noireau et al. 1989)
Mayombe	Mayombe	<i>G. palpalis palpalis</i>	1990	<i>T. congolense</i> (forest), <i>T. grayi</i> , <i>T. vivax</i> and indeterminate species	Tsetse flies	(Bourzat and Gouteux 1990)
	Makoua	—	1991	<i>T. brucei gambiense</i>	Pig	(Truc et al. 1991)

^aRefer to the host on which the Trypanosoma was isolated.

The limited number of research work conducted by Congolese teams on HAT point the need for strengthening capacities of human resources involved in the fight against HAT in Congo. The fact that Congo is situated close to the Democratic Republic of Congo and the Central Africa Republic where HAT is still highly prevalent (Büscher 2017, #26) could increase the importation of new cases from these affected areas. The following highlights the need for strict surveillance activities along the borders and also in inland settings (Bottieu 2019, #35).

Furthermore, due to the political instability in the central Africa sub-region which is always exposed to civil wars or political or social crises (Franco et al. 2018), it is possible that massive population migration resulting from these crises could influence the dynamic of HAT in Congo and in the subregion as it was the case, in 2015, for the Nola foci in the Central African Republic and a deep attention need to be put on these risk factors which could hinder elimination efforts in Congo and the subregion (Büscher 2017, #26). HAT is a neglected tropical disease which now attracts less funding it is important in this regards that more advocacy and communication be undertaken to have an active participation of all stakeholders and also that the available resources are well managed for improved surveillance of the disease (Büscher 2017, #26).

Several challenges affecting both the treatment, diagnosis, operational implementation, and vector control interventions have also been highlighted in the review and deserve further attention in the context of HAT elimination in Congo and Africa (Bottieu 2019, #35). For instance HAT treatment are not readily available in rural health care centres and patient need to travel to main regional health facilities to receive treatments. New compounds such as fexinidazole still await approval for their use in the country (Organization 2019). Although different diagnostic tools such as LAMP, RDT, and CATT are now available for HAT detection and have improved the diagnosis and treatment of the disease in Congo there are not readily available in all rural health care centre. As the number of cases is reducing it will be important in the course of elimination, to also use sensitive techniques such as molecular technique (PCR) to confirm total clearance of parasites in patients under treatment. The supply chain also proved not to be robust and needs to be reinforced. Regular screening of the population living close to endemic foci need also to be considered (Bottieu 2019, #35).

As Congo now approach elimination targets it is becoming urgent that new strategies including active detection, monitoring, reporting, and vector control intervention be implemented to achieve HAT elimination. Particular emphasis has to be put in reducing tsetse flies densities as these flies could infect on wild animals and transmit pathogens to the population (Simo et al. 2015, #172, Bottieu 2019, #35). Surveillance of the animal reservoir and land use changes which could affect tsetse flies distribution and transmission pattern also need careful consideration to ensure sustainable elimination of HAT in Congo (Bottieu 2019, #35).

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Data Availability

The datasets supporting the findings of this paper are included in this paper.

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