International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 10-12-2025, Accepted: 22-01-2026, Published: 07-02-2026
Volume 11, Issue 1, 2026, Page No. 220-224

Simulid species in Kafolo in the Tchologo region of northern Ivory Coast

Dr. Coulibaly Fatoumata[1], Yapi Grégoire Yapi[2], Dr. Aime Louis Stevens[1], Coulibaly Donisongue[3], Dr. Doannio[3], Julien Marie-Christian[4]

[1] Research Associate, Medical and Veterinary Entomology Center, Affliated to Alassane Ouattara University, Bouaké, Ivory Coast

[2] Research Master, Medical and Veterinary Entomology Center, Affliated to Alassane Ouattara University, Bouaké, Ivory Coast

[3] Entomology Technician, Veteran of Onchocerciasis Control Program (OCP), Bouaké, Ivory Coast

[4] Research Director, Public Heath Specialist**,** Affliated to Péléforo Gon Coulibaly University, Korhogo, Ivory Coast

Abstract

Since the end of the OCP in December 2002, there has been no updated entomological data on the situation of onchocerciasis in Côte d'Ivoire, specifically in Kafolo in the Tchologo region. The objective of this study is to identify the species of black flies present in Kafolo in the Tchologo region of Côte d'Ivoire. Sampling was carried out by prospecting pre-imaginal habitats and capturing adult black flies using human bait from January to December 2019. The sampling frequency was one outing per month. The results of this study showed that the pre-imaginal black fly population consisted mainly of S damnosum sl, while adult black flies were mainly savannah species rather than forest species.

Keywords: Tchologo region, Onchocerciasis, Simulid, Ivory Coast

Introduction

Diptera constitute one of the largest orders of benthic macroinvertebrates. In this study, we focus specifically on the Simuliidae family, which forms a significant component of Diptera and consists of organisms that filter feed in flowing water (Fassel *et al*., 1993) [5]. Black flies from the Simuliidae family are vectors of onchocerciasis. Onchocerciasis, also known as river blindness, is a debilitating cutaneous-dermal filariasis caused by a parasite called Onchocerca volvulus. The main species of black flies that transmit onchocerciasis are Simulium damnosum, Simulium neavei, Simulium albivirgulatum, Simulium ochraceum, Simulium metallicum and Simulium exiguum (Philippon, 1978; Adjami, 2006) [1, 12]. The first three species are vectors of onchocerciasis in Africa (Boussinesq, 1997) [4], while the last three are American vectors (Philippon, 1978; Adjami, 2006) [1, 12]. Simulium damnosum is the sole vector of Onchocerca volvulus in West Africa. Aware of the epidemiological scale and socio-economic repercussions of this disease, the World Health Organisation (WHO) has mobilised human, material, technical and financial resources to combat onchocerciasis (Hougard *et al*., 2002) [7]. Thus, from 1974 to 1990, the WHO implemented a vast programme to combat onchocerciasis called OCP (Onchocerciasis Control Programme), which covered endemic countries in West Africa, including Côte d'Ivoire. Unfortunately, since the end of the OCP in December 2002, there has been no updated entomological data on the situation of onchocerciasis in Kafolo in the Tchologo region of Ivory Coast. This study is being conducted with the aim of updating data to serve as a basis for establishing entomological surveillance of onchocerciasis in this border area. This surveillance also includes knowledge of the species present there. Thus, the objective of this article is to identify the Simulidae species present in Kafolo in the Tchologo region of Ivory Coast.

Methods

Study area

The study area is located in Kafolo. Kafolo is a village on the Ivorian-Burkinabe border in the Tchologo region, in northern Côte d'Ivoire, approximately 65 kilometres north of Kong (Figure 1). The study area is characterised by a transitional tropical climate (Sudanese climate) with two seasons: a dry season from November to March and a rainy season from April to October (Aimé, 2023) [3]. July and September are the rainiest months, with fairly high average monthly rainfall ranging from 145 to 175 mm.

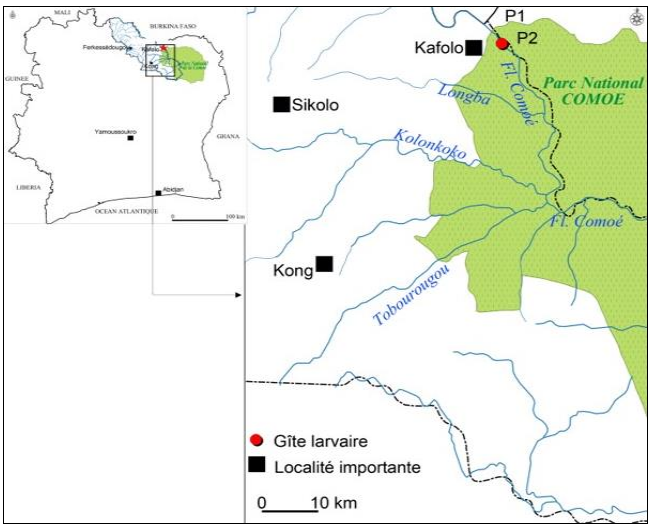

Fig 1: Map of the study area

Data collection

Pre-imaginal stages

The search for pre-imaginal habitats was conducted on land from January to December 2019. The sampling frequency for pre-imaginal stages was one outing at the end of the flood period (January 2019) (Figure 2) and one outing

during the low water period (April 2019) (Figure 3). It consisted of carefully inspecting the plant and/or rock substrates of the lodge located on the Comoé River and collecting samples of the pre-imaginal stages (larvae and pupae) of black flies. In the laboratory, these pre-imaginal stages were sorted using a binocular magnifying glass to separate S damnosum sl species from other black fly species and non-target fauna. The S damnosum sl larvae were preserved in Carnoy's solution for analysis at the WHO/ESPEN Molecular Biology Laboratory in Ouagadougou, with a view to identifying the black fly species. Unfortunately, a break in the cold chain beyond our control damaged the quality of these larvae. As a result, it was not possible to perform cytotaxonomic analysis on them.

Fig 2: Larval breeding site in Kafolo, Côte d'Ivoire during the flood season in 2019

Fig 3: Larval habitat in Kafolo, Ivory Coast, during low water levels in 2019

Imaginative stage

Adult black flies were captured using human bait according to the WHO/OCP capture technique from January to December 2019. Sampling frequency was one outing per month throughout 2019. The black flies captured and kept cool in cotton wool were then identified. To do this, the black flies were first anaesthetised with chloroform, then placed one by one on a slide. The black flies were identified using a binocular magnifying glass. This identification was carried out according to the micro-morphological criteria formerly used by the OCP (Table 1) to distinguish between the different species of the S. damnomum complex. The technique is based on the following criteria: the colour of the antennae; the colour of the first segment of the foreleg or procoxa; the colour of the bristles on the wing tuft and arculus; the colour of the bristles on the scutellum; the colour of the bristles on the ninth abdominal tergite. These criteria have enabled the identification of savannah and forest females.

Table 1: Morphological identification criteria for female S. damnosum sl (WHO/OCP, 2002)[11]

Identification details Savannah group		Forest Group	
	S. damnosum s.s. S. sirbanum	***S. squamosum, S. yahense S. sanctipauli, S. soubrense***	
Procoxa	lighter than the thorax,	as dark as the thorax	
Antenna	Pale	Dark but articles 1 to 9 generally pale	Dark but 1st article Generally pale
Wing tufts	Pales	dark but sometimes pale or mixed (only in S. squamosum),	Gloomy
Arculus	Pale	brown	Gloomy
Scutellum bristles	Pales	Mixed or pale	Dark
Bristles of the 9th abdominal tergite	Pales	Mixed or pale	Dark
OCP code	06	07	08

Results

Relative abundance of black fly larvae in pre-imaginal stages

Forty (40) S damnosum sl larvae were collected from the Kafolo larval habitat or 100 % S damnosum sl in January 2019 (Table 2), with no larvae of other black fly species found. In April 2019, however, with the drying up of the river, 20 larvae of black fly species other than S damnosum sl, or 100 %, were collected (Table 2); no S damnosum sl larvae were collected.

Table 2: Relative abundance of black fly larvae in pre-imaginal stages in 2019

Date Species	*S. damnosum*	*S.* other species
January 2019	100 %	0 %
April 2019	0 %	100 %

Relative abundance of black flies in the imago stage

From January to December 2019, a total of 9,442 blacks flies were collected using the human bait capture method. Of all the black flies captured, 6,539 (69.25%) were Identified. The identification of the 6,539 black flies recorded 6,513 savanna black flies (99.60%) and 26 forest black flies (0.40%) (Figure 4 and Figure 5).

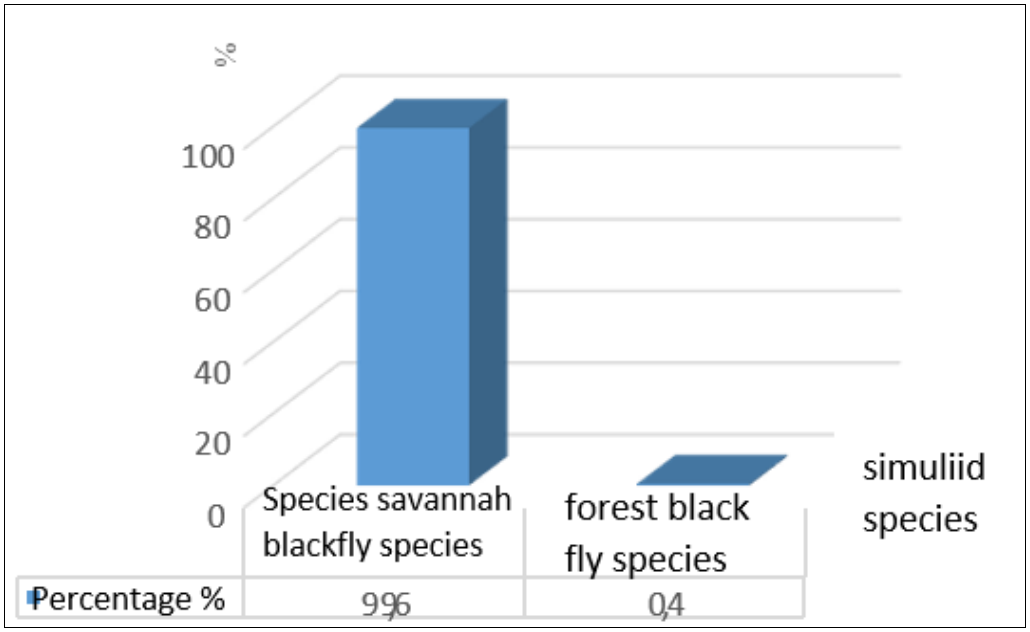

Fig 4: Relative proportions of savannah and forest black flies in Kafolo in 2019

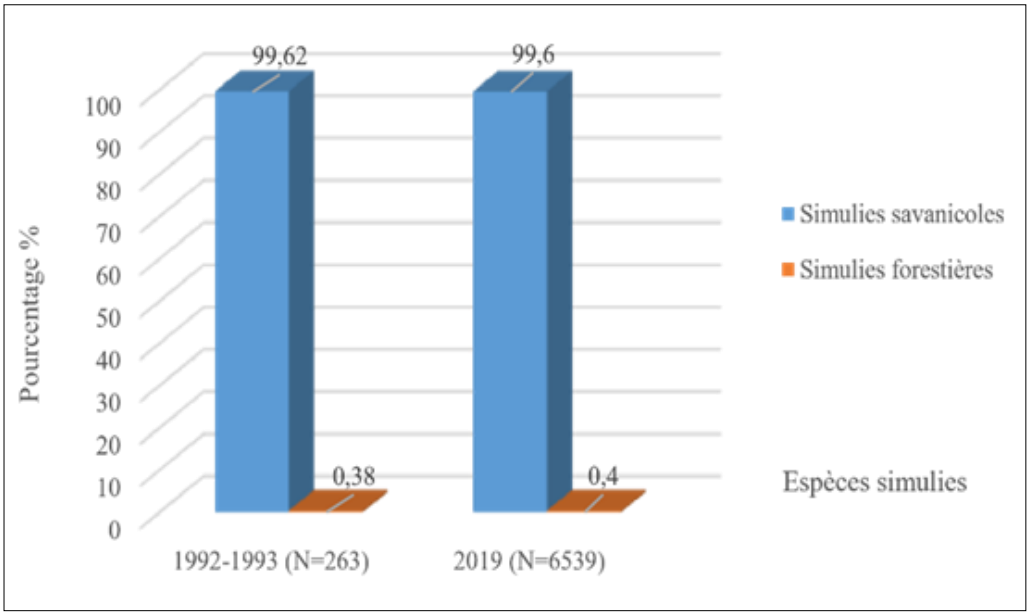

Fig 5: Relative proportions of savannah and forest black flies in Kafolo during vector control (1992-1993) and 26 years later in 2019

Discussion

Larval surveys have enabled the collection of S damnosum sl larvae. The existence of S. damnosum sl, the sole vector of human onchocerciasis in West Africa, indicates the possibility of local transmission of the disease if the pathogen (O volvulus) is present in the area. During the last two months of the dry season, we observed the river drying up in April, with a complete cessation of flow over a very large area of the larval habitat. Only a thin stream of water remained. Surveys carried out found no larvae of S. damnosum sl, but rather those of species other than S damnosum sl. The absence of S damnosum sl during the dry season may be due to climatic conditions that are unfavourable to their development. The adult black flies collected and identified in Kafolo in 2019 belonged mainly (more than 99%) to the savannah group of black flies. Of the 6,539 female black flies identified in total, 6,513 (99.6%) were savannah black flies and 26 (0.4%) were forest species. The large predominance of savannah black flies can be explained by the fact that Kafolo is located in a savannah area. However, the relative proportions of savannah and forest black flies in Kafolo have not varied over time. The same proportions were found during the OCP in 1992-1993. In other areas of Côte d'Ivoire, the predominance of savannah black flies has been reported. This is particularly true in the Middle Bandama basin, where they account for 89% and 94% of black flies captured in the wet and dry seasons, respectively. In the upper Bandama basin, savanna black flies represent 96% and 99% of all black flies captured in the wet and dry seasons, respectively (Adjami *et al*., 2004) [2]. This predominance of savannah black flies was also found in Touba, in the north of the country (Simaro *et al*., 2019) [15] and in Bouaflé, in the centre-west of the country (Yapi *et al*., 2014 and Simaro *et al*., 2019) [15]. As concluded by Adjami *et al*. (2004) [2], we are likely witnessing a phenomenon of 'savannisation' of

onchocerciasis. Indeed, savanna black flies have increased significantly in recent years in each of these regions, unlike forest black flies (Post *et al.*, 2013; Houevoganwa *et al*., 2014) [8, 13]. This phenomenon poses a risk of spreading blind river blindness (Adjami *et al*., 2004) [2]. Furthermore, studies carried out in Tai in south-western Côte d'Ivoire, in a forest area, found a population of forest black flies (S. sanctipauli and S. yahense) (Traoré, 1997) [16]. The forest black flies identified in this study are all black flies of the so/qua group, whose OCP code is 07. This group includes the species S. squamosum, S. sanctipauli and S. soubrense. S. squamosum is widespread in forests, but can also be found in savannahs (WHO, 1994; Yaméogo, 2003) [10, 17]. As Kafolo is located in a savannah area, it is possible to find them there. These forest black flies were all captured during the rainy season from July to November. Indeed, during the rainy season, with the rise in water levels, there is an increase in vegetation. This increase in vegetation, combined with the drop in temperature and rise in humidity that accompanies the rainy season, creates conditions conducive to the survival and development of forest black flies. This explains why forest black flies are only found during the rainy season; the migration of these black flies is therefore linked to rainfall. Rainfall patterns are linked to the movements of the intertropical monsoon front (ITMF), which is the dividing line between the dry, hot air of the harmattan and the humid, relatively cool air of the monsoon (Quillévéré, 1979; Hougard, 1986; Adjami, 2006) [1, 6, 14]. Although the presence of forest species, in this case S. squamosum, has been reported in Burkina Faso (WHO, 1978) [9], studies by Koala (2019) [] have only found savannah species (S. damnosum ss and S. sirbanum). No forest species have been reported.

Conclusion

This study showed that the pre-imaginal black fly population in Kafolo consists mainly of S damnosum sl. However, when weather conditions become harsh, particularly during the peak dry season (March-April), this species becomes very rare and gives way to other black fly species. With regard to the imagoes (adult black flies) collected, there is certainly a large predominance of savannah species, but forest black flies are also present. The latter were all black flies of the species S squamosum, collected only during the rainy season.

Acknowledgements

The authors would like to thank the Centre for Medical and Veterinary Entomology (CEMV) at Alassane OUATTARA University (Bouaké, Côte d'Ivoire) for their contribution to this study.

Credit Contributions

Fatoumata COULIBALY participated in data collection, data analysis and manuscript writing. Grégoire Yapi YAPI and Julien Marie-Christian DOANNIO contributed to the conceptualisation of the study and participated in and supervised the project. Louis Stevens AIME participated in field data collection, analysis and interpretation. Donisongue COULIBALY participated in field data collection and laboratory identification.

References

1. Adjami AAG. Contribution to the entomological and epidemiological surveillance of onchocerciasis in West Africa. Single doctoral thesis, Parasitology, University of Montpellier II, France, 2006, 247.
2. Adjami AAG, Toé L, Bissan Y, Bugri S, Yaméogo L, Koné M, *et al*. Situation actuelle de l'onchocercose dans la zone de transition forêt/savane de Côte d'Ivoire. Parasitology,2004:128(4):407-414.
3. Aimé LS. Assessment of water quality in several dams in northern and central Côte d'Ivoire based on aquatic macroinvertebrates. Single thesis, Hydrobiology, Félix HOUPHOUET-BOIGNY University, Abidjan, Ivory Coast, 2023, 157.
4. Boussinesq M. Human onchocerciasis in Africa. Médical Tropical,1997:57:389-400.
5. Fassel B, Roger MC, Cazin B. Annales de Limnologie,1993:29(3-4):307.
6. Hougard JM. Control of black flies and mosquitoes in West Africa: evaluation of the effectiveness of new larvicides, biological control agents and growth regulator analogues under natural conditions. Doctoral thesis, University of Paris 6, specialising in Medical Entomology, 1986, 259.
7. Hougard JM, Yameogo L, Philippon B. Onchocerciasis in West Africa after 2002: a challenge to be met. Parasite,2002:9:105-111.
8. Houevoganwa MC, Ouinsavi C, Goudegnon E, Gbemavo C, Sokpon N, Akpona S. Spatio-temporal dynamics of vegetation and black flies, vectors of onchocerciasis in Benin. International Journal of Biological and Chemical Sciences,2014:8(4):1669-1683.
9. World Health Organization. Species complexes in Simuliidae. World Health Organization Bulletin,1978:56(2):169-178.
10. World Health Organization. Twenty years of onchocerciasis control in West Africa. Review of the activities of the onchocerciasis control programme in West Africa from 1974 to 1994. WHO/OCP, Geneva, 1994, 178.
11. World Health Organization/Onchocerciasis Control Programme. Training module for national entomologists on the management and supervision of entomological activities for the control of onchocerciasis. Onchocerciasis Control Programme in West Africa (OCP), 2002, 159.
12. Philippon B. Human onchocerciasis in West Africa. Initiation ORSTOM, Paris,1978:38:193.
13. Post RJ, Cheke RA, Boakye DA, Wilson MD, Osei-Atweneboana MY, Tetteh-Kumah A. Stability and change in the distribution of cyto-species of the Simulium damnosum complex (Diptera: Simuliidae) in southern Ghana from 1971 to 2011. Vector Parasites,2013:6:205.
14. Quillévéré D. Contribution to the study of the taxonomic, bioecological and vector characteristics of members of the Simulium damnosum complex present in Côte d'Ivoire. ORSTOM works and documents,1979:09(1):304.
15. Simaro S, Koffi M, Touré M, Yao P, Ahouty B, Tidou AS. Vector capacity and abundance of Simulium damnosum complex populations in three

epidemiological facies in western Côte d'Ivoire. Afrique Sciences,2015:15(2):16-23.
16. Traoré S, Diarrassouba S, Hébrard G, Rivière F. Natural vector capacities of the Simulium damnosum s. l. complex (Diptera: Simuliidae) at the Taï ecological station (Côte d'Ivoire). Bulletin de la société de pathologie exotique,1997:90(3):196-199.
17. Yaméogo L, Lévêque C, Hougard JM. Thirty years of fighting onchocerciasis in West Africa Larvicide treatments and environmental protection. Editors IRD Editions Institut de Recherche pour le Développement Paris, 2003, 267.
18. Yapi YG, Traoré DF, Coulibaly D, Tia E. Study contributing to knowledge of black fly populations in the municipality of Bouaflé, central-western Côte d'Ivoire. International Journal of Biological and Chemical Sciences,2004:8(6):2540-2551.