



Dynamics of the main necrophagous Diptera populations of forensic interest, in the Guinean zone of Côte d'Ivoire

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Abstract

Recent studies in the Guinean zone of Côte d'Ivoire, by Koffi *et al.* (2017a), showed that a pig corpse exposed to the open air, was rapidly colonized by necrophagous insects. These authors observed that the very first insects to arrive on the corpse were Diptera belonging to the families Calliphoridae, Sarcophagidae and Muscidae. So they are the ones, experts in forensic entomology, can use to establish a short or minimum post mortem interval (PMImin). But so far, no research work has demonstrated, the ability of these necrophagous Diptera of medicolegal interest, to colonize an exposed corpse, whatever the time of year. This is the reason why the objective of this research work was to study the population dynamics of the main necrophagous Diptera of forensic interest, listed in the southern forest zone of Côte d'Ivoire (Koffi *et al.*, 2018). To do this, a trapping device, inspired by that of Upton (1991), and using as bait, a portion of 500 g of pig's liver or viscera, was installed on the experimental site of the National Center of Agronomic Research (CNRA / Adiopodoumé, Km 17), located west of the city of Abidjan. The weekly catches that were carried out from August 26, 2015 to August 23, 2016, allowed harvesting, after 52 weeks, a total of 207275 individuals, divided into 11 taxa grouped into three families, namely, those of Calliphoridae, Sarcophagidae and Muscidae. Individuals (150,845) of the family Calliphoridae (8 taxa), accounted for 72.78% of the total numbers of necrophagous Diptera harvested, with an abundance of *Chrysomya albiceps* (48.55% of Calliphoridae). The Muscidae family (48,628 individuals) came in second position with 23.46% of the total numbers, with *Musca domestica* as the main representative. In Sarcophagidae, the most abundant species harvested was *Sarcophaga carnaria* (3.77% of the total numbers). The study of the sex ratio of the different species, showed a higher proportion of females, oscillating between 59.56 and 74.14%. Although the weekly numbers of the species caught varied strongly throughout the year, no correlation was observed between these variations in population levels and recorded climatic parameters, temperature, rainfall and humidity relative and insolation. However, we can note that these species were present throughout the year, in our different catches. This means that, at any time of the year, a corpse exposed in the open air, in the Guinean zone of Côte d'Ivoire, is likely to be colonized by these necrophagous Diptera of medicolegal interest.

Keywords: population dynamics, necrophagous diptera, *Chrysomya albiceps*, *Musca domestica*, *Sarcophaga carnaria*, Guinean zone of Côte d'Ivoire

1. Introduction

In the context of an entomological expertise to estimate a short post mortem delay, the most commonly used insects belong mainly to the Order of the Diptera. Koffi *et al.* (2017a) ^[1] have shown that, in the southern forest zone of Côte d'Ivoire, the first insects that arrive to colonize a pig corpse exposed to the open air, are necrophagous Diptera belonging to families Calliphoridae, Sarcophagidae and Muscidae. The delay between death and the arrival of these first necrophagous insects, depends mainly on the immediate environment of the body (accessibility) and the climatic conditions (temperature, relative humidity, rainfall, insolation, etc.) that may influence the presence and activity of these latter. A rural study of rat cadavers has demonstrated seasonal variations in fly populations (Tomberlin *et al.*, 1998) ^[2]. Thus, the ability of Diptera populations to colonize an exposed

cadaver in the wild can vary with the seasons (Charabidze *et al.*, 2012) ^[3]. To these seasonal variations, can be superimposed short-term variations, mainly related to climate and nycthemeral rhythm.

In Côte d'Ivoire, the rare work done to date, on necrophagous insects, especially those of Adou (2014) ^[4], Dao *et al.* (2017) ^[5], Yapo *et al.* (2017) ^[6] and Koffi *et al.* (2017a, 2017b, 2018) ^[1, 7, 8], could not bring out the ability of necrophagous Diptera to colonize a corpse at any time of the year.

The purpose of this work, therefore, is to study the influence of the climatic parameters of the Guinean zone of Côte d'Ivoire, on the variations of population levels, of the main necrophagous Diptera of forensic interest. In other words, is it possible for a corpse exposed in the open air in the southern forest zone of Côte d'Ivoire, to be colonized by necrophagous Diptera, whatever the time of year?

2. Material and methods

2.1 Study site

The work carried out as part of this study was carried out in the Guinean zone of Côte d'Ivoire, specifically in the city of Abidjan ($5^{\circ} 20'11''N - 4^{\circ} 1'36''W$). The experimental site

chosen for our experiments was that of the National Center of Agronomic Research (CNRA, Adiopodoumé Km 17 / $5^{\circ} 19'40.13''N - 4^{\circ} 07'54.80''W$ - Altitude 17m). This site presents the characteristics of a subequatorial climate, hot and humid (Fig. 1).

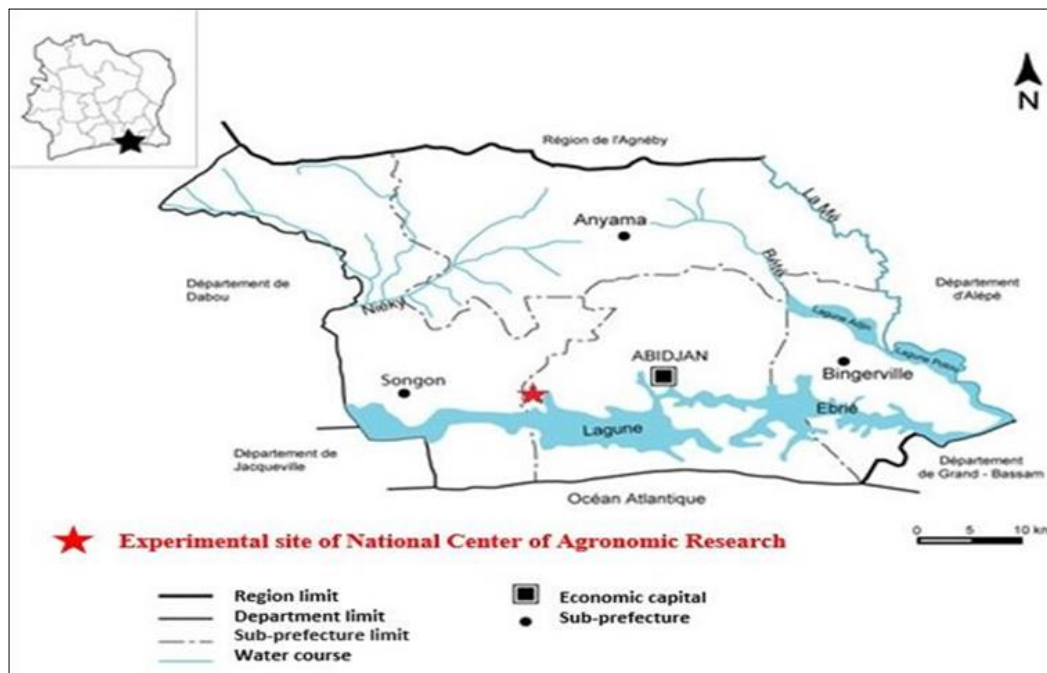


Fig 1 : Location of the experimental site of the National Center of Agronomic Research (CNRA)

2.2 Experimental Device

The experimental device was made up of an attractive trap inspired by that of Upton (1991) [9]. It consisted of two compartments mounted on a wooden support, about 1.20 m high and fixed in the ground. The first compartment was trapezoidal and had on each of the 4 sides, a fine stainless wire mesh (mesh = 1 mm²) and a cone (base = 15 cm, top = 1.5 cm) allowing the entry of Diptera and preventing their exit. This first compartment was surmounted by a second consisting of a reservoir bucket that can trap trapped Diptera. The first and second compartments communicate with each

other thanks to a cone allowing access to the Diptera and preventing their exit. This attractive device used as bait, a portion of pig liver of about 500 g, placed in a plastic tray covered with a mosquito net. The bait was placed inside the first compartment (Fig. 2). In order to maximize the trapping, the entire device had 3 attractive traps distant from each other of about 100 m. On the experimental site, a thermo hygrometer recorder type "IHM - 0172SI", was installed to record daily atmospheric temperatures and relative humidity. Rainfall and insolation data were provided by the Meteorology Department of SODEXAM – Abidjan.

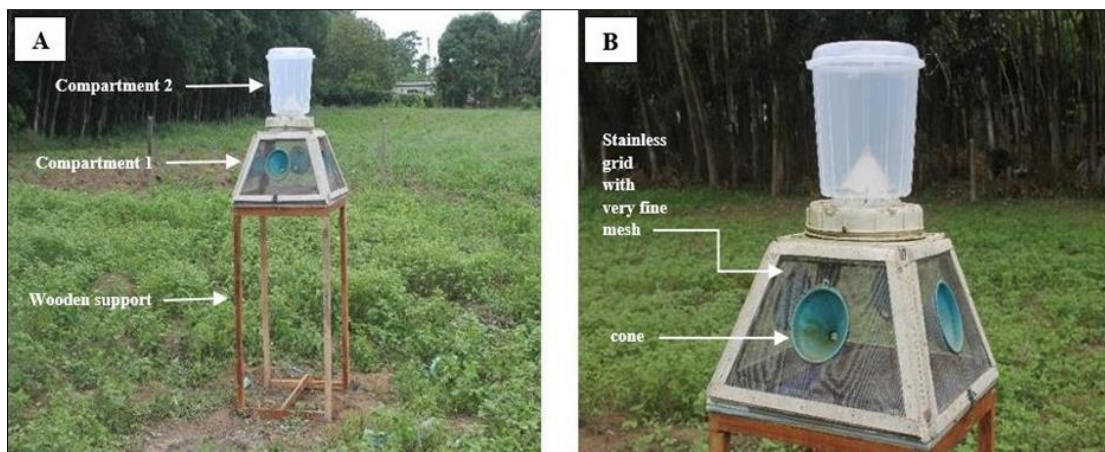


Fig 2: Device for trapping the necrophagous Diptera, inspired by that of Upton (1991). A - Overview. B - Detailed view of compartments 1 and 2.

2.3 Methods

A fresh portion of approximately 500 g of porcine liver or viscera was placed in a plastic box covered with mosquito net tulle to prevent the trapped Diptera from gaining access to the bait. The plastic box containing the bait was then placed inside the compartment 1. A few minutes after the setting of the bait, many flies were attracted and trapped in the compartment 1 and then in the 2, thanks to cones whose apex is about 1.5 cm of diameter. Seven days later, the bait was removed and replaced. The trapped insects still alive at the moment the trap was raised were killed by CO₂ gas asphyxiation and then sent to the laboratory. Trap recovery and bait replacement took place weekly starting September 02, 2015.

The identification of the necrophagous insects harvested was made using a binocular loupe of the "Optika LAB20" type and

various identification keys (Prins 1982, Smith 1986, Delvare and Alberlenc 1989, Regina 2002, Wyss and Chérix 2006, Couri 2007, Claudio and Cátia 2008, Szpila 2009, Whitworth 2010, Irish 2014, Rochefort *et al.* 2015, <https://quelestcetanimal-lagalerie.com/coleopteres/>)^[10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21]. Most of the insects harvested have been identified up to the taxonomic level of order, family, genus and species. This identification work concerned only the Diptera species (Fig. 3).

For the quantification of necrophagous species, adults harvested using the attractive traps were sorted and grouped by genus and species for count. The trapping period was extended over a full 52-week year from August 26, 2015 to August 23, 2016.



Fig 3: C - Portion of 500 g of pig liver placed in a plastic box covered with a mosquito net. D - Bait placed inside the compartment 1. E - Diptera attracted, trapped and killed, to be collected for transport to the laboratory. F - Binocular loupe with accessory to Micro-Camera for identification of Diptera.

2.4 Data Processing

The trapping carried out over a whole year, i.e. over 52 weeks, made it possible to catch among other species, those of the Diptera belonging to the families Calliphoridae, Sarcophagidae and Muscidae. These have been identified and then grouped together to obtain sufficient numbers of taxa for data processing and analysis. A sex sorting at the level of each species was done to establish the sex ratio. The daily data of temperature, rainfall, relative humidity and insolation, allowed to calculate the monthly and weekly averages of these. A

correlation test between the evolution of the weekly numbers of the captured species and the recorded climatic parameters was carried out using the Statistica version 7.1 software.

3. Results and Discussion

3.1 General experimental climatic conditions

Monthly averages of temperature, rainfall, relative humidity and insolation were calculated from daily data recorded from August 26, 2015 to August 23, 2016 (Fig. 4, 5 and 6).

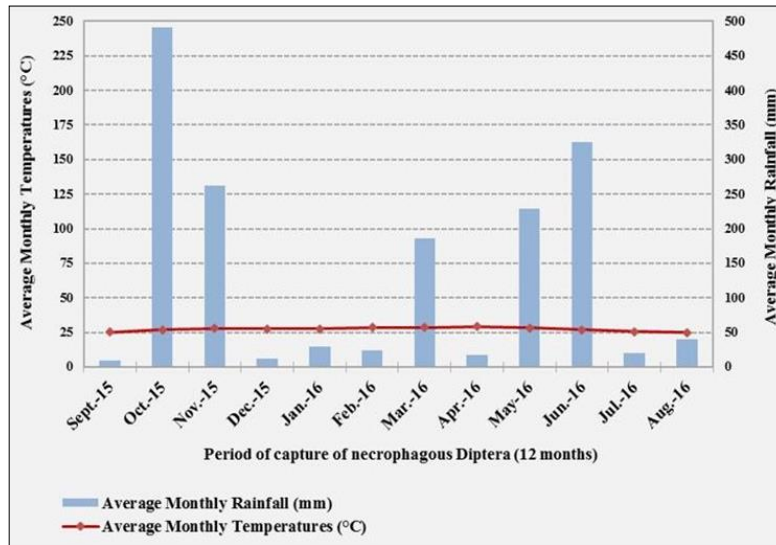


Fig 4 : Ombro thermal diagram of climatic conditions recorded during trapping experiments from August 26, 2015 to August 23, 2016.

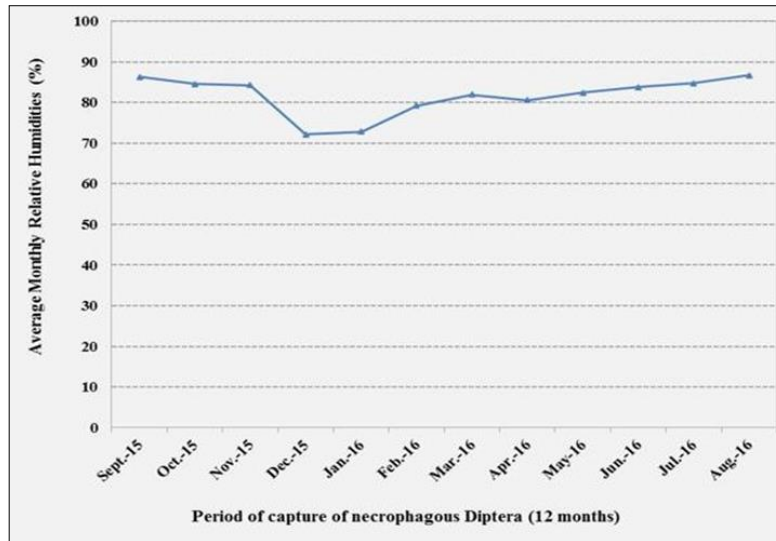


Fig 5 : Average monthly relative humidity recorded during trapping experiments from August 26, 2015 to August 23, 2016.

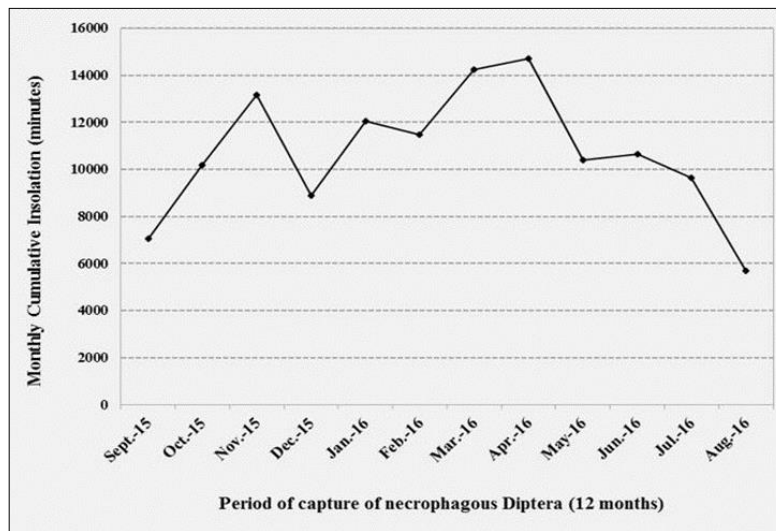


Fig 6: Cumulative monthly insolation recorded during trapping experiments from August 26, 2015 to August 23, 2016.

3.2 Relative Abundance and Sex Ratio of captured Diptera species

The main necrophagous Diptera of forensic interest, which were the subject of this study, were those most commonly used in the estimation of a short post mortem interval (PMI_{min}). These are the species belonging to the families Calliphoridae, Sarcophagidae and Muscidae. They are the first ones to colonize a pig corpse exposed to the open air in the Guinean zone of Côte d'Ivoire (Koffi *et al.*, 2017a) [1]. In total, over a full year, 207275 individuals were captured. They were divided into 11 taxa grouped into 3 families, namely, those of Calliphoridae, Sarcophagidae and Muscidae. Calliphoridae accounted for 72.77% of the total numbers of

captured individuals. Muscidae and Sarcophagidae, respectively, accounted for 23.46 and 3.77% of the total numbers of individuals captured. Calliphoridae counted 8 taxa grouped into 3 subfamilies, namely, Chrysomyinae, Lucilinae and Calliphorinae. The most abundant species of Calliphoridae caught was *Chrysomya albiceps* with a proportion of 48.55%. The Muscidae family was represented by only one captured species, *Musca domestica* (100%). In Sarcophagidae, *Sarcophaga carnaria* was the most abundant species with 75.59% of the individuals captured (Table 1). The proportion of females within the species ranged from 59.56 to 75.21% (Fig. 7).

Table 1: Total numbers and relative abundance of species / taxa caught for 52 weeks (or a whole year) from August 26, 2015 to August 23, 2016.

Families	Species	Numbers	Relative Abundance / Total Numbers Families (%)	Relative Abundance / Total Numbers Diptera (%)
Calliphoridae	<i>Chrysomya albiceps</i>	73227	48.55	35.33
	<i>Chrysomya marginalis</i>	16657	11.04	8.04
	<i>Chrysomya megacephala</i>	7968	5.28	3.84
	<i>Chrysomya putoria</i>	4846	3.21	2.34
	<i>Lucilia sericata</i>	25799	17.10	12.45
	<i>Lucilia caesar</i>	8382	5.56	4.04
	<i>Calliphora vomitoria</i>	10615	7.04	5.12
	<i>Calliphora vicina</i>	3341	2.22	1.61
Muscidae	<i>Musca domestica</i>	48628	100.00	23.46
Sarcophagidae	<i>Sarcophaga carnaria</i>	5905	75.59	2.85
	<i>Sarcophaga africa</i>	1907	24.41	0.92
Total		207275		

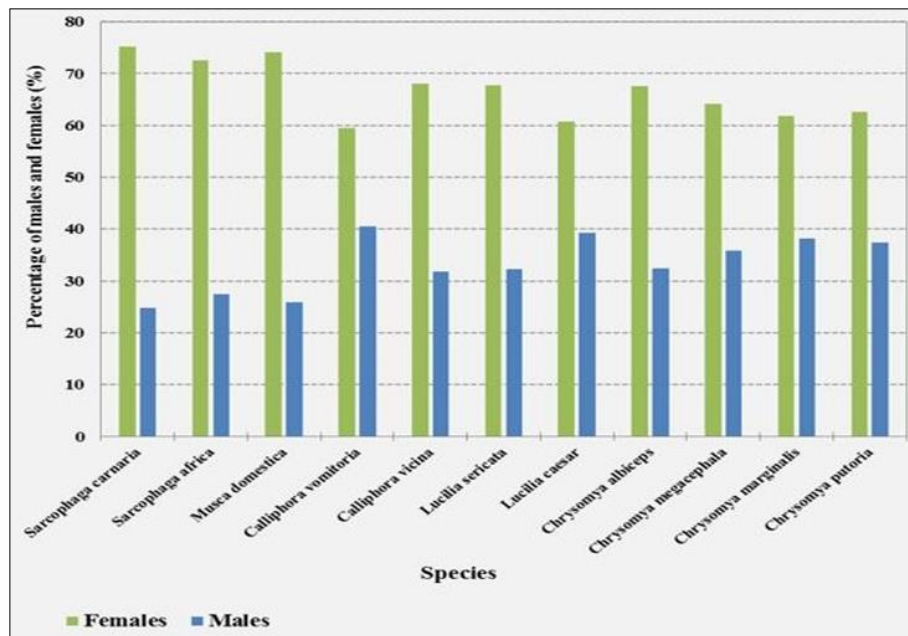


Fig 7: Sex ratio (percentage of total numbers) calculated on the basis of total individuals captured from August 26, 2015 to August 23, 2016.

3.3 Annual and weekly evolution of the population levels of the main necrophagous Diptera of forensic interest

The first week of catches extended from August 26 to

September 1, 2015. The last week, meanwhile, extended from August 17 to September 23, 2016 (Table 2).

Table 2: Weekly periods of capture of the necrophagous Diptera of forensic interest.

26.08 - 01.09.15	w1	30.12.15 - 05.01.16	w19	04.05 - 10.05.16	w37
02.09 - 08.09.15	w2	06.01 - 12.01.16	w20	11.05 - 17.05.16	w38
09.09 - 15.09.15	w3	13.01 - 19.01.16	w21	18.05 - 24.05.16	w39
16.09 - 22.09.15	w4	20.01 - 26.01.16	w22	25.05 - 31.05.16	w40
23.09 - 29.09.15	w5	27.01 - 02.02.16	w23	01.06 - 07.06.16	w41
30.09 - 06.10.15	w6	03.02 - 09.02.16	w24	08.06 - 14.06.16	w42
07.10 - 13.10.15	w7	10.02 - 16.02.16	w25	15.06 - 21.06.16	w43
14.10 - 20.10.15	w8	17.02 - 23.02.16	w26	22.06 - 28.06.16	w44
21.10 - 27.10.15	w9	24.02 - 01.03.16	w27	29.06 - 05.07.16	w45
28.10 - 03.11.15	w10	02.03 - 08.03.16	w28	06.07 - 12.07.16	w46
04.11 - 10.11.15	w11	09.03 - 15.03.16	w29	13.07 - 19.07.16	w47
11.11 - 17.11.15	w12	16.03 - 22.03.16	w30	20.07 - 26.07.16	w48
18.11 - 24.11.15	w13	23.03 - 29.03.16	w31	27.07 - 02.08.16	w49
25.11 - 01.12.15	w14	30.03 - 05.04.16	w32	03.08 - 09.08.16	w50
02.12 - 08.12.15	w15	06.04 - 12.04.16	w33	10.08 - 16.08.16	w51
09.12 - 15.12.15	w16	13.04 - 19.04.16	w34	17.08 - 23.08.16	w52
16.12 - 22.12.15	w17	20.04 - 26.04.16	w35		
23.12 - 29.12.15	w18	27.04 - 03.05.16	w36		

Note : w1 = week1 (one),...w52 = week52 (Fifty-two).

From August 26, 2015 to August 23, 2016, weekly average atmospheric temperatures ranged from 25.3 (w51) to 29.9 ° C (w32-35-36), while those from rainfall, relative humidity and cumulative weekly insolation, respectively varied between 0 (w1-6, w16 to w21, w23-24-26-45-47) and 35.2mm (w42), 64.7 (w18) and 87.8% (w52), and 276 (w8) and 4086 minutes (w35).

3.3.1 Family of calliphoridae

The family of Calliphoridae is the one that provided the

largest number of species caught. Eight taxa were identified and the species that was most abundant during the entire catch was *Chrysomya albiceps* (48.55%). The weekly numbers of this species have evolved from 63 (w23) to 5493 (w46) (Fig. 8). The least abundant species was *Calliphora vicina* (2.22%), whose weekly numbers evolved during the year between 0 (w5) and 368 trapped individuals (w27). The correlation tests that were made, showed that there was no correlation between the weekly numbers of the eight Calliphoridae species, and the weekly averages of temperature, rainfall, relative humidity and insolation. (Fig 9 and Table 3).

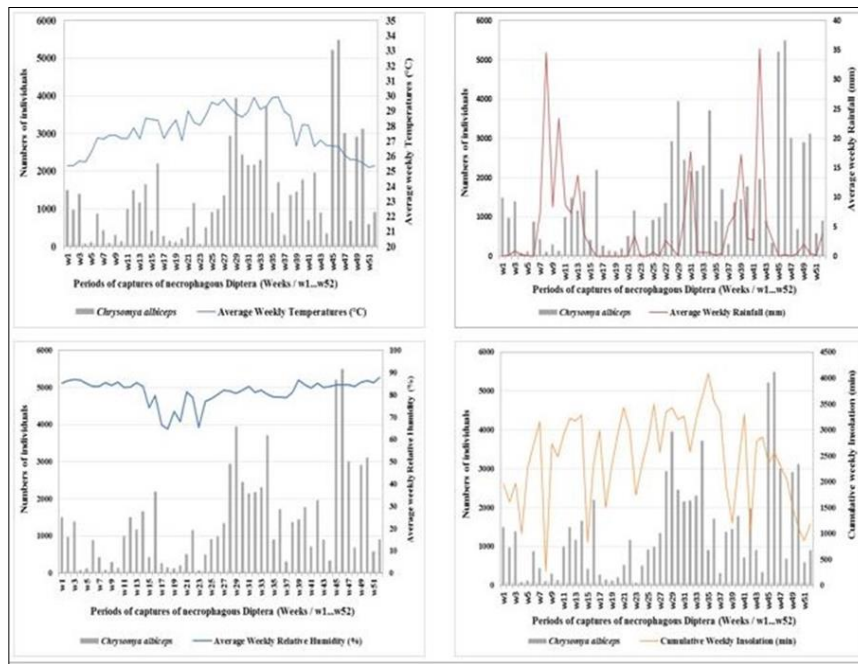


Fig 8: Weekly evolution of population levels of *Chrysomya albiceps* under conditions of temperature, rainfall, relative humidity and insolation, recorded from August 26, 2015 to August 23, 2016.

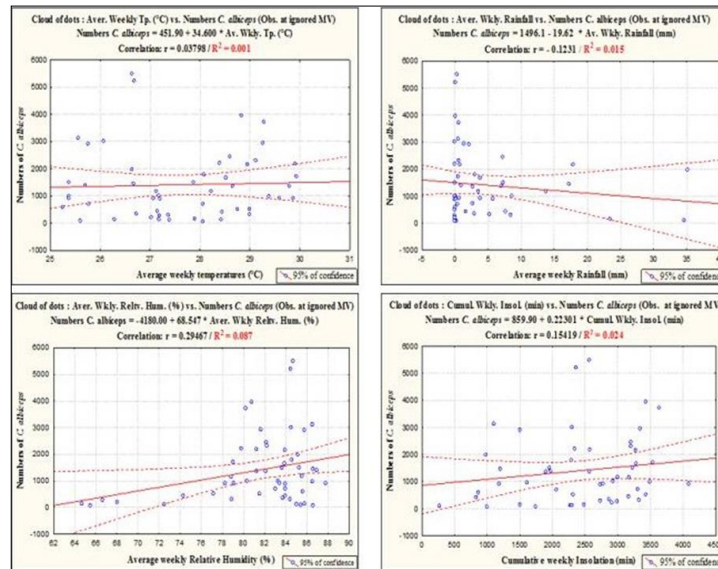


Fig 9: Absence of correlation between the weekly evolution of *Chrysomya albiceps* numbers and the climatic parameters of temperature, rainfall, relative humidity and insolation.

Table 3: R² values of the Correlation tests between the evolution of the weekly numbers of the different species of Calliphoridae caught and the different climatic parameters recorded from August 26, 2015 to August 23, 2016.

	Correlation Tests – Value of R ²							
	<i>C. vomitoria</i>	<i>C. vicina</i>	<i>L. sericata</i>	<i>L. Caesar</i>	<i>C. albiceps</i>	<i>C. megacephala</i>	<i>C. marginalis</i>	<i>C. putoria</i>
Av. wkly. Temp.	0.060	0.132	0.072	0.084	0.001	0.001	0.0002	0.002
Av. wkly. Rainfall	0.001	0.015	0.029	0.020	0.015	0.022	0.024	0.024
Av. wkly. Reltv. Hum.	0.001	0.0001	0.0001	0.0003	0.087	0.079	0.068	0.101
Cumul. Wkly. Insol.	0.049	0.071	0.070	0.095	0.024	0.016	0.007	0.019

Note : Temp. = Temperature, Reltv. Hum. = Relative Humidity, Cumul. Insol. = Cumulative Insolation, Av. = Average, wkly. = weekly.

3.3.2 Family of Muscidae

The family of Muscidae was mostly represented by the species *Musca domestica*. The weekly numbers of this species have evolved between 21 (w5) and 7486 (w30) captured individuals

(w46) (Fig. 10). Statistical analyzes showed that there was no correlation between weekly numbers of this species of Muscidae and weekly averages of temperature, rainfall, relative humidity and insolation (Figure 11).

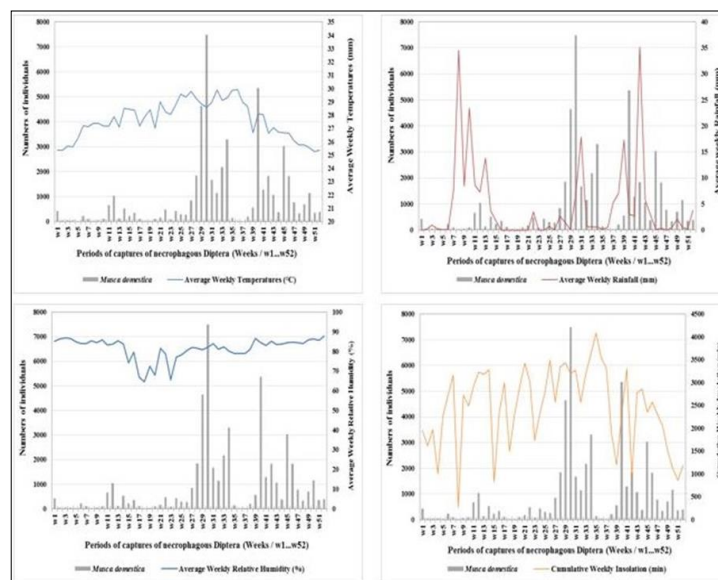


Fig 10: Weekly evolution of population levels of *Musca domestica* under conditions of temperature, rainfall, relative humidity and insolation, recorded from August 26, 2015 to August 23, 2016.

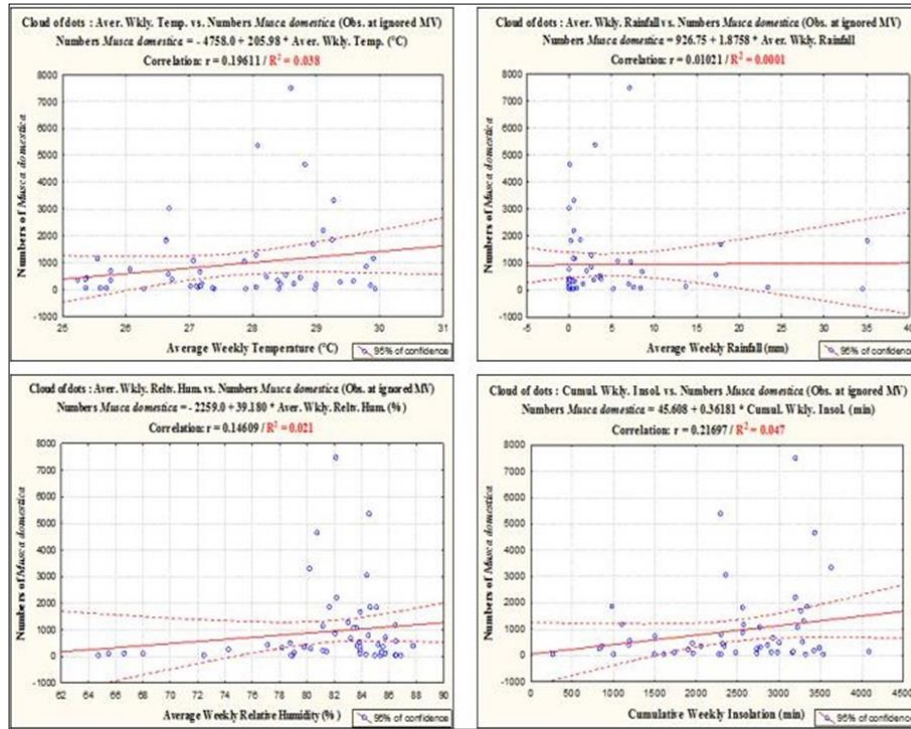


Fig 11: Absence of correlation between the weekly evolution of *Musca domestica* numbers and climatic parameters of temperature, rainfall, relative humidity and insolation, recorded from August 26, 2015 to August 23, 2016.

3.3.3 Family of Sarcophagidae

Throughout the year, the captured species belonging to the Sarcophagidae family, were *Sarcophaga carnaria* and *Sarcophaga africa*. Of the total catches made, *S. carnaria* was the most abundant species. The weekly numbers of this latter ranged from 7 (w10) to 451 trapped individuals (w29) (Fig.

12). Those of *S. africa* fluctuated between 2 (w9) and 296 captured individuals (w29). The statistical analyzes carried out showed that there was also no correlation between the evolution of the weekly numbers of these two species, and the conditions of temperature, rainfall, relative humidity and insolation, recorded during 52 weeks of catches made (Fig. 13).

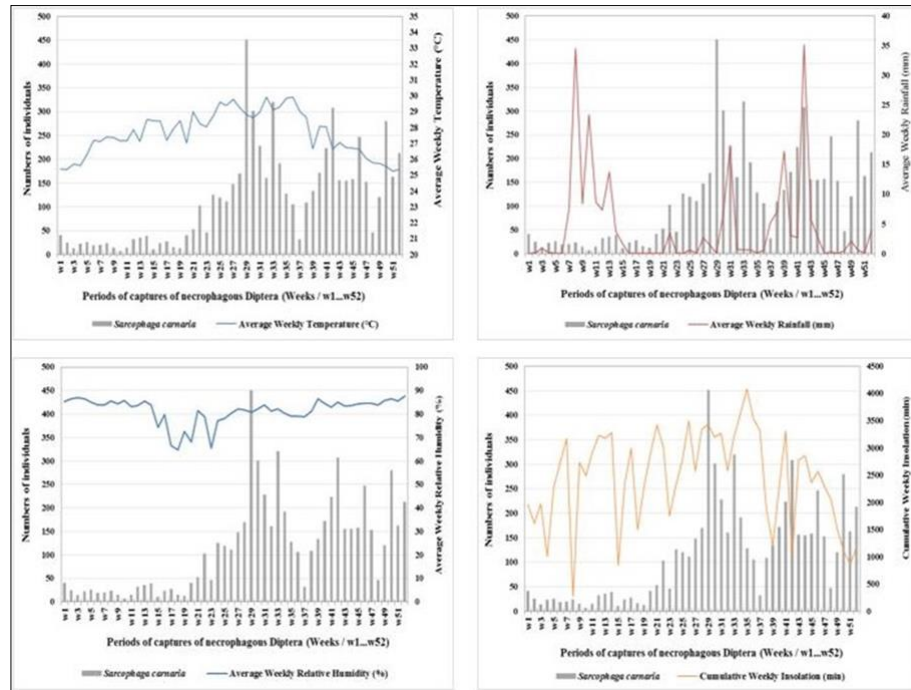


Fig 12: Weekly evolution of population levels of *Sarcophaga carnaria* under conditions of temperature, rainfall, relative humidity and insolation, recorded from August 26, 2015 to August 23, 2016.

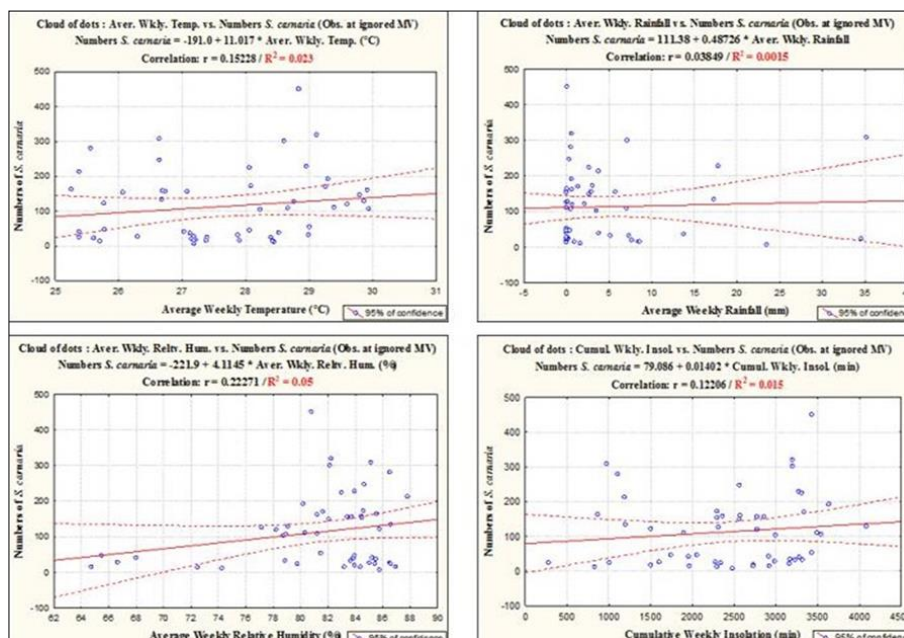


Fig 13: Absence of correlation between the weekly evolution of *Sarcophaga carnaria* numbers and climatic parameters of temperature, rainfall, relative humidity and insolation, recorded from August 26, 2015 to August 23, 2016.

The experimental site chosen for the weekly trapping sequences of necrophagous Diptera, is located in a locality (Abidjan) which benefits a subequatorial climate, hot and humid. During the 52 weeks of trapping, mean weekly maximum temperatures ranged from 27.5 (w50-51) to 32.9 ° C (w25), while the minimums ranged from 22.5 (w17-20) to 27.8 ° C (w32). Thus, the average weekly temperature oscillated between 25.3 (w51) and 29.9 ° C (w32-35-36). These temperature data recorded on the experimental site are very close to those of the city of Abidjan, published by <https://fr.wikipedia.org/> [22]. The subequatorial climate that characterizes our experimental site, includes a great rainy season (May-June-July), a small rainy season (September-November) and two dry seasons. The long dry season starts from December and ends at the end of March. Precipitation is abundant: more than 1500 mm of water per year. In the rainy season, it can rain continuously for several days in a row or rain intensely for an hour, followed by a very strong sun. The temperature is almost always around 27 ° C and the average annual hygrometry is above 80% (www.weatherbase.com) [23]. In most countries in Europe or North America, where winter and summer are two distinct seasons, summer temperatures are frequently above 20 ° C, while winter ones regularly reach lower values below 10 ° C. Thus, it can be noted that the average daily temperatures of the hot and humid sub-equatorial zones are very close to the summer ones of France for example. However, among the various atmospheric climatic parameters, temperature is the factor that significantly influences the activity of insects in general, and those of necrophagous Diptera in particular.

As far as our experiments are concerned, the trapping device used was inspired by that of Upton (1991) [9]. The use of a portion of porcine liver or viscera, as bait, appears to be a good alternative to the use of a whole rat or rabbit cadaver, as have, for example, Charabidze *et al.* (2012) [3]. The delay of one week to replace the used bait with a new one, seems to be

equally reasonable. Because, according to our observations, the bait always seemed to remain attractive. Even after a week of exposure, the liver portion still emitted a strong odor of putrefaction. This good attractiveness of the bait could be one of the causes of the high total number of necrophagous Diptera caught during our experiments all year round. This abundance of captures is consistent with the results obtained by Charabidze *et al.* (2012) [3]. In fact, during weekly and seasonal trapping conducted in the north of France, the latter observed that the number of insects caught (all species combined) was 12.5 times higher during the warm period than during the cold period. Our results also match those of Tomberlin & Adler (1998) [2], who, in a comparative study conducted in rural areas in South Carolina, in USA, on rat cadavers in summer and winter, demonstrated the existence of seasonal variations in the populations of necrophagous insects harvested. Indeed, the number of eggs of Calliphoridae (the most represented family in their experiments) collected during their experiments, was ten times larger in summer than in winter, thus reflecting a presence and a reproductive activity of these species much more important during the summer. In addition, Archer (2003) [24] confirmed, during a series of surveys conducted on pig carcasses for two consecutive years, the existence of both seasonal and annual variations of the process of colonization of a cadaver. The high number of necrophagous Diptera harvested during our experiments, could therefore be explained by the fact that, during the annual period of the catches made, the average weekly temperatures did not vary much, and could therefore, to correspond to the summer seasons of the countries of Europe or North America, where these authors mentioned above, realized their experiments. The weekly catches made during this work, have highlighted the presence in this area, several families of necrophagous Diptera and Coleoptera. But, in this study, we did not take into account the Diptera Piophilidae and Coleoptera Cleridae, because, not only were they most often

absent from the numbers of individuals harvested, but also, because they were very small in number when they were among the trapped insects. The most representative Diptera families were those of Calliphoridae, Muscidae and Sarcophagidae. The family Calliphoridae has the largest number of taxa (8 out of 11 taxa), and the largest number of individuals (150845 out of a total of 207275 individuals harvested). The Muscidae family was second in terms of the number of individuals captured. These results are consistent with those of Charabidze *et al.* (2012) ^[3] who, during nine months of similar trapping in northern France, found that Calliphoridae were the most numerous with 33.8% of the total numbers. Still according to their results, Muscidae came in second position with 20.2% of the total.

Within this Calliphoridae family, *Chrysomya albiceps* was the most abundantly harvested species. These results are consistent with those of Souza *et al.* (2008) ^[25] and Carvalho and Linhares (2001) ^[26]. Studies by Biavati *et al.* (2010) ^[27], Rosa *et al.* (2011) ^[28], Faria *et al.* [(2013) ^[29] in the open natural environment of the Cerrado in Brazil, on pig carcasses exposed to the open air, also revealed an important abundance of *Chrysomya albiceps*. Similarly, these results confirm those already obtained by Koffi *et al.* (2018) ^[8], who during their work on the inventory of necrophagous insects in the Guinean zone of Côte d'Ivoire, found in Calliphoridae, a significant abundance of *Chrysomya albiceps*.

In addition, although weekly mean temperatures and relative humidity did not vary significantly, the weekly numbers of necrophagous Diptera harvested, meanwhile, experienced strong variations during the year. The proportions of females within these specific total numbers varied from 59.56 to 74.14%. These results are close to Charabidze *et al.* (2012) ^[3], who also obtained proportions of about 80% of necrophagous Diptera females harvested, for *C. vomitoria*, *C. vicina* and *L. sericata* species. These results could be explained by the good attractiveness of the baits used, and the fact that, the necrophagous Diptera species would seek to colonize a fresh corpse, much more to lay their eggs than to use them as a nutrient.

The statistical analyzes carried out showed that there was no correlation between the weekly evolutions of the numbers of captured necrophagous Diptera, and the climatic conditions of temperature, rainfall, relative humidity and insolation recorded during the 52 weeks of trapping. These results are different from those obtained by Archer (2003) ^[24] and by Charabidze *et al.* (2012) ^[3]. These authors observed that during their experiments, the fluctuations of the numbers of certain necrophagous Diptera were correlated with the environmental thermal fluctuations and the variations of intensity of sunshine. This difference could be explained by the fact that their study areas were bathed by very marked seasons of winter and summer, with great thermal variations, and where the passage from one season to another, results in significant thermal amplitudes. A study conducted under controlled conditions on several species of common necrophagous Diptera, by Hedouin *et al.* (1996) ^[30], indicated varying needs according to species and functions: activity, flight and egg-laying. These authors have shown for three Calliphoridae species (*P. terraenovae*, *C. vomitoria* and *L. sericata*), that they were only active at temperatures above 10

° C. Thus, the very small variations in temperature and relative humidity recorded at our experimental site (25.3 - 29.9 ° C / 64.7 - 87.8%) had no significant influence on variations in population levels of the main necrophagous Diptera of medicolegal interest. Similarly, no correlation has been observed between weekly fluctuations in population levels of collected Diptera and pluviometry and insolation data. This is contrary to the observations made by Charabidze *et al.* (2012) ^[3] in the north of France, according to which, insolation is at the origin of the triggering of Calliphoridae spawning activities. This difference in the results could be explained by a difference in the catch periods. Indeed, Charabidze *et al.* (2012) ^[3] carried out daily trapping on the one hand, and during daily time slots on the other hand. They were able to observe that some peaks of insolation in the course of the day corresponded to increases in population levels of Calliphoridae. While our trapping, they were weekly and could not, therefore, highlight hourly and daily fluctuations in population levels of necrophagous Diptera harvested. Thus, the strong variations observed in the weekly numbers of the necrophagous Diptera harvested during our experiments, could be due to other non-climatic natural factors: it could be, among others, the coincidence of the development cycle of these Diptera present in the middle, with the moment of exposure of the baits. In addition, it has happened that at times, some baits have deteriorated much faster than usual. For example, the short Harmattan period (north-easterly wind, very hot during the day, colder at night, very dry and most often dusty), which occurred in January 2016, severely dehydrated the baits, after 48 hours, making them suddenly less attractive for subsequent catches. This naturally resulted in a very small number of necrophagous Diptera caught in this period for most species.

4. Conclusion

When a corpse is exposed to the open air, in the natural environment in general, and in the southern forest zone of Côte d'Ivoire in particular, its ability to be quickly colonized by necrophagous insects depends in part on the prevailing climatic parameters in the said environment. The presence or not, as well as the activity of the necrophagous Diptera that can be found in a given environment, are strongly influenced, both by the attractiveness and accessibility of the corpse, and by the different natural climatic parameters that can be recorded. Capture experiments in Europe and North America have shown that population levels of necrophagous Diptera can vary very well, both hourly and weekly, and seasonally and annually. In the Guinean zone of Côte d'Ivoire, experiments have shown a significant variation in weekly numbers of the main necrophagous Diptera of forensic interest, during the year. However, the weekly variations of these numbers were not directly influenced by the different climatic parameters recorded (temperature, rainfall, relative humidity, insolation). Thus, it appears from the catching experiments, that the main necrophagous Diptera of medicolegal interest, belonging to the families Calliphoridae, Muscidae and Sarcophagidae, were present throughout the year, from August 26, 2015 to August 23 2016. In the framework of an entomological expertise to date deaths, the information relating to the population dynamics of the

necrophagous Diptera of medicolegal interest, are very important. Thus, it follows from the results obtained, from the trapping that we carried out, that a body exposed to the open air in the Guinean zone of Côte d'Ivoire, is likely, whatever the time of the year, to be colonized by the necrophagous Diptera of forensic interest.

5. Declaration of interest

The authors declare that they have no conflicts of interest in relation to this article.

6. Acknowledgment

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