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Research Article

Factors Influencing Seasonal and Daily Dynamics of the Genus *Stomoxys* Geoffroy, 1762 (Diptera: Muscidae), in the Adamawa Plateau, Cameroon

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The rangelands of the Vina Division on the Adamawa Plateau are densely infested with Stomoxyinae, but little is known about their species composition and ecology. A trap-transect survey was carried out in three villages: Galim, Mbidjoro, and Velambai, using Nzi ($n = 3$), Vavoua ($n = 3$), and Biconical ($n = 3$) traps, all baited with octenol. Three traps of each trap type were set in each of the study villages, and collections were carried out daily. In total, 3,762 *Stomoxys* spp. were collected from October 2016 to June 2017 and identified using standard keys into five species: *Stomoxys niger niger*, *S. calcitrans*, *S. niger bilineatus*, *S. omega*, and *S. xanthomelas*. Galim recorded the highest apparent density of stomoxyines (30 stomoxyines/trap/day) with a statistically significant difference ($p < 0.05$). The Vavoua trap was an ideal tool for Stomoxyinae collection. Stomoxyines abundantly occurred at the end of the dry season (March 2017) and beginning of the rainy season (May 2017). The monthly rainfall positively influenced monthly ADTs of Stomoxyinae. Their diurnal biting activity was bimodal in the rainy season and unimodal in the dry season. The daily activity peak was between 14 h and 16 h with a mean temperature of 31°C, a mean wind speed of 1.5 m/s, and a mean humidity of 50%. The daily trap catch was positively influenced by temperature and wind speed but negatively influenced by rainfall and air humidity. Weather variables influenced *Stomoxys* spp. monthly and daily ADTs.

1. Introduction

Muscoid flies are among the most important pests in livestock and poultry production. Stable flies (*Stomoxys* spp.) recently surpassed horn flies (*Haematobia* spp.) as the most important arthropod pest of cattle production [1]. They feed on blood from a wide range of hosts including mammals like rats, rabbits, monkeys, cattle, horses, and humans [2]. About 18 species of the genus *Stomoxys* have already been reported [3], but only *S. calcitrans* is cosmopolitan. The other 17 are tropical species: 12 of them can be found in the Ethiopian region (Africa and neighboring Islands), namely, *S. n. niger*, *S. varipes*, *S. ochrosoma*, *S. inornatus*, *S. boueti*, *S. transvittatus*, *S. pallidus*, *S. luteolus*, *S. xanthomelas*, *S. omega*, *S. stigma*, and *S. taeniatus*; four in the eastern region (Asia and Extreme-Oriental): *S. indicus*, *S. uruma*, *S. bengalensis*, and *S. pullus*; and one species in the two biogeographic regions: *Stomoxys sitiens*. Little is known about *Stomoxys* spp. of Cameroon, but the preliminary study of Sevidzem et al. [4] in the Sudan savanna of North Cameroon led to the identification of four species: *Stomoxys calcitrans* (Linnaeus, 1758), *S. n. niger* Macquart 1851, *S. n. bilineatus* Grünberg 1906, and *S. sitiens* Rondani 1873. Both sexes of *Stomoxys* are hematophagous (i.e., blood feeders), and the biology of these species has been described in several publications [2, 5].

A flight of *Stomoxys* spp. is influenced by weather parameters [6] as well as availability of host [7]. *Stomoxys* spp. population peaks under relatively wet conditions with moderate temperatures (daily maxima under 30°C). Precipitation and temperature have been reported to affect *Stomoxys* activity [8–10]. Several studies have indicated wetter or cooler than normal weather as being conducive to higher population levels [8, 11]. The peak season, i.e., late April through mid-June, was the period that stable fly populations in California positively correlated with precipitation [9]. Mathematical models have also been used to associate weather conditions with *Stomoxys* population [12]. Attempts to correlate population levels of *Stomoxys* with weather conditions have been limited. In the Sudan savanna of the Adamawa Plateau in Cameroon, two seasons occur, i.e., the rainy and dry seasons. The presence of multiple seasons indicates varying climatic conditions that suggest a fluctuating trend of *Stomoxys* spp. diversity, distribution, and abundance in different biotopes.

In order to develop an effective pest management system for flies in cattle herds, it is necessary to know as much as possible their biology and ecology [13]. The present investigation is aimed at associating weather factors with *Stomoxys* spp. abundance, distribution, and diurnal activity in different seasons in the Sudano-Guinean climate in order to provide baseline data for their control.

2. Materials and Methods

2.1. Study Site. The Adamawa Plateau extends across the middle of Cameroon and lays between latitudes 6°N and 8°N and longitudes 11°E and 15°E. The mountainous region has a Sudano-Guinean climate with two main seasons: a rainy season from May to November and a dry season from December to April. Most of the plateau lies between 1000 m and 2000 m (an average of 1000–1100 m above the sea level) and narrows down to 500 m in the valleys of Djerem and Mbéré [14]. The common economic activities of this region include agriculture, livestock, apiculture, and fishing [15]. Adamawa is the main livestock production basin of Cameroon with about 1,250,000 stocks [16], where cattle rearing is common. The Adamawa region possesses five divisions; Vina is one of them (Figure 1) and constitutes our study area. The study was performed in three villages: Galim (25 km to the south from the town of Ngaoundere on the Ngaoundere-Meiganga motorable highway), Velambai (15 km to the east on the Belel road), and Mbidjoro (15 km to the west on the Tignere road), situated in Ngaoundere I, II, and III subdivisions, respectively (Figure 1). Ecologically, Galim consisted of gallery forests and the Vina du Sud river. Valembai consisted of a lake and gallery forests, while Mbidjoro was a mosaic of gallery forests, secondary forests, and open grass savanna. Climatically, Ngaoundere in the Vina Division is characterized by an annual rainfall of 1177 mm/year. The coldest month was December (22°C), the hottest month was April (29°C), the wettest month was August (221 mm rainfall), the windiest month was May (9 km/hr), and the mean monthly temperature was 25.33°C ± 2.08.

2.2. Entomological Prospection. A trap-transect survey was carried out using three different traps: Nzi [17], Vavoua [18], and Biconical [19] traps. All different traps used in the study were baited with octenol. Nine traps were used, consisting of three traps of each type. Each study site consisted of three traps of each type. Trapping was made for three days consecutively per month in different sites. The three study sites were sampled at the same time, and the nine traps were set in different sites at the same time. The cages of all the nine traps were emptied daily in all the sites and labeled with information such as date, altitude, site, GPS coordinates, and season (end of the rainy season (November 2016), beginning of the dry season (January 2017), end of the dry season (March 2017), and beginning of the rainy season (May 2017)).

2.3. Daily Activity of Stomoxys spp. The activity of insects was measured by the total number of specimens collected at different periods of the day [20]. The number of traps (all baited with octenol), types, and trapping sites in this section were the same as those in Entomological Prospection. The flies were collected synchronously every two hours: 8 h, 10 h, 12 h, 14 h, 16 h, and 18 h. The captured flies were introduced into vials labeled with the collection time (6h–8 h, 8h–10 h, 10h–12 h, 12h–14 h, 14h–16 h, and 16h–18 h) in the dry season (March 2017) for three days and in the rainy season (May 2017) for three days. Meteorological factors such as temperature, humidity, and wind speed were recorded using a portable weather tracker (Kestrel 4500, USA). Rainfall data were collected from the Ngaoundere airport weather station. Five values of each parameter were taken after the fixation of trap cages, and the same number was registered before fly collection everyday. The reason for recording several values is to take an average value for each parameter in order to reduce the error margin. This is to have readings of the weather parameters of the points around traps pitched in different sampling sites.

2.4. Stomoxys spp. Identification. The identification of *Stomoxys* was carried out using the identification key of Zumpt [3]. Advanced morphological identification focused on the following landmarks: body color and pattern, leg color, frons and frontal index, curvature and setation of certain wing veins, occurrence or form of various bristles, and hairs on parts of the legs and on the genital structure [21].

2.5. Abundance, Diversity, and Distribution of Stomoxys spp. The abundance was defined by the apparent density per trap per day (ADT).

The ADT was calculated using the following formula:

$$\text{ADT} = \frac{\text{number of Stomoxys captured}}{\text{number of traps} \times \text{number of trapping days}}. \quad (1)$$

2.6. Data Analysis. Data were analyzed using the R statistical software (R version 3.4.0). The Kruskal–Wallis test was used to compare the ADT of *Stomoxys* in the prospected sites. The

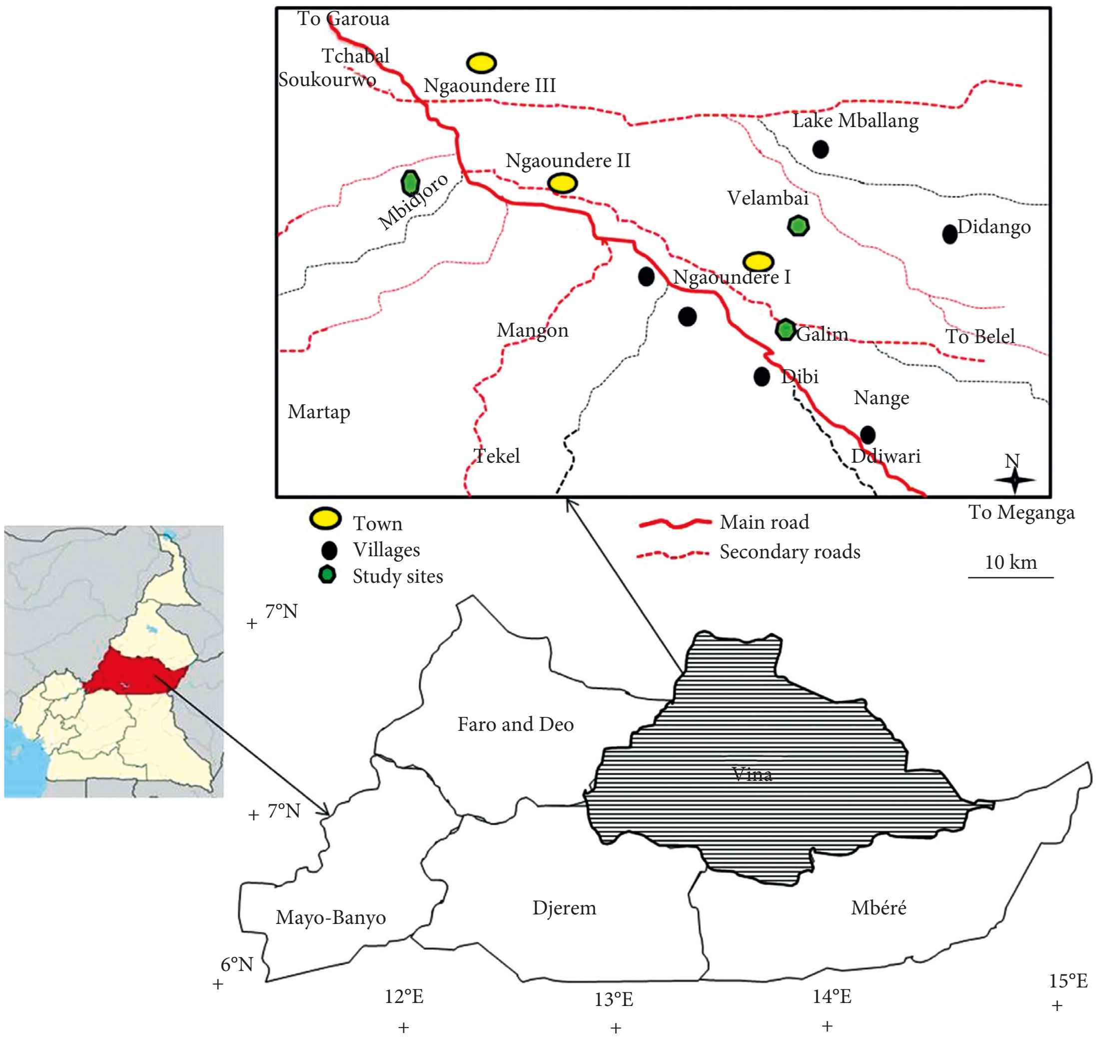

Figure 1: Map of the study area indicating the study sites.

chi-square test was used to compare the proportion of catches and trap type. Pearson's correlation was used to correlate the ADT of different *Stomoxys* spp. with each weather parameter. All the statistical tests were kept at the $p < 0.05$ significant level.

3. Results

3.1. Stomoxys spp. Abundance and Proportion of Catches with respect to Trap Type. The entomological survey resulted in 3,762 Stomoxyinae caught and identified into five species: *S. n. niger*, *S. calcitrans*, *S. n. bilineatus*, *S. omega*, and *S. xanthomelas*. The abundance of *Stomoxys* spp. was significantly ($p < 0.05$) higher in Galim (30.49 *Stomoxys*/trap/day) than in Mbidjoro (13.65 *Stomoxys*/trap/day) and in Velambai (7.78 *Stomoxys*/trap/day) (Table 1).

The number of Stomoxyinae caught was not the same for different trap types. It was noticed that the Vavoua trap was the most suitable trap for the collection of most *Stomoxys* spp., but *S. n. bilineatus* was the only exception with its highest proportion (69.9%) recorded with the Nzi trap (Table 2). From the chi-square test, there was no statistically significant difference ($\mathcal{X}^2 = 20$, df = 16, $p = 0.22$) in the proportion of catches of different *Stomoxys* spp. with trap types.

Table 1: ADT of *Stomoxys* spp. with respect to prospected sites.

Stomoxys spp.	Mbidjoro		Velambai		Galim		p value
	N	ADT	N	ADT	N	ADT	
Stomoxys niger niger	691	9.54	338	4.67	1178	19.19	0.00
Stomoxys calcitrans	206	2.39	146	1.70	370	6.46	0.01
Stomoxys n. bilineatus	157	1.56	104	1.32	321	4.22	0.04
Stomoxys omega	59	0.07	44	0.09	38	0.44	0.00
Stomoxys xanthomelas	26	0.09	38	0.00	46	0.18	0.00
Total	1139	13.65	670	7.78	1953	30.49	0.00

ADT: trap apparent density.

3.2. Seasonality of Stomoxys spp. All the five species identified were captured in both seasons, and *S. n. niger*

Table 2: The number and proportion of *Stomoxys* spp. with respect to trap type.

Species	Vavoua Number (%)	Nzi Number (%)	Biconical Number (%)	Total Number (%)
S. n. niger	1065 (48.3)	711 (32.2)	431 (19.5)	2207 (100)
S. calcitrans	541 (74.9)	113 (15.7)	68 (9.4)	722 (100)
S. n. bilineatus	113 (19.4)	407 (69.9)	62 (10.7)	582 (100)
S. omega	83 (58.9)	53 (37.6)	5 (3.5)	141 (100)
S. xanthomelas	73 (66.4)	26 (23.6)	11 (10)	110 (100)

dominated in the two seasons. It was noticed that the population of most *Stomoxys* spp. increased at the end of the dry season (March 2017) and sharply dropped in April 2017 (transition period from the dry to the rainy season) but increased in May 2017 (beginning of the rainy season). An increase in the population of most *Stomoxys* spp. occurred in May 2017 (beginning of the rainy season) except for *S. n. bilineatus* (Figure 2). There was a positive and nonsignificant correlation ($r = 0.066$, $p = 0.876$) between monthly rainfall and monthly ADT of Stomoxyinae in the study area.

3.3. Daily Activity of Stomoxys spp. in the Rainy Season. The daily activity rhythms of all the *Stomoxys* spp. captured during the rainy season showed that bimodal peaks and activity time intervals varied for each species such as *S. n. niger* and *S. n. bilineatus* (8 h–10 h and 14 h–16 h), *S. calcitrans* (8 h–10 h and 12 h–14 h), *S. omega* (10 h–12 h and 14 h–16 h), and *S. xanthomelas* (8 h–10 h and 14 h–16 h) (Figure 3).

3.4. Daily Activity of Stomoxys spp. in the Dry Season. During the dry season, most *Stomoxys* spp. showed a unimodal activity peak except for *S. xanthomelas* with a bimodal activity peak. Based on individual species, *S. n. niger* and *S. n. bilineatus* had overlapping daily activity, and their activity peak occurred between 14 h and 16 h. *S. calcitrans* was more active between 12 h and 14 h, while *S. xanthomelas* had a bimodal activity with peaks between 10 h and 12 h and between 16 h and 18 h (Figure 4).

3.5. Diurnal Activity Rhythm and Weather Variables. The weather variables such as temperature, humidity, and wind speed influenced the diurnal activity of *Stomoxys* spp. (Figure 5). The average temperature (31°C) of the afternoon (14 h–16 h) favored the peak abundance of *Stomoxys* spp. (Figure 5(a)). The average humidity (50%) between 14 h and 16 h in the afternoon led to the peak activity of *Stomoxys* spp. (Figure 5(b)). The sharp drop in the average wind speed (1.5 m/s) in the afternoon favored the activity of *Stomoxys* spp. that occurred between 14 h and 16 h (Figure 5(c)). There was a negative and nonsignificant correlation ($r = -0.012$, $p = 0.978$) between rainfall and diurnal catches.

The ADT of *S. n. bilineatus* was influenced by weather variables. There was a positive and nonsignificant correlation between the ADT of *S. n. bilineatus* and wind speed and

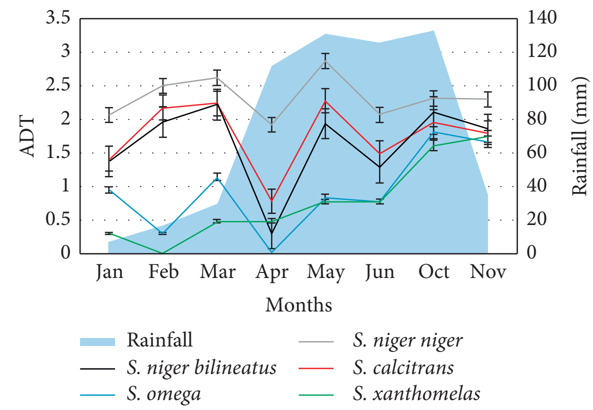

Figure 2: Monthly evolution of the ADT of *Stomoxys* spp. and rainfall. ADT: trap apparent density.

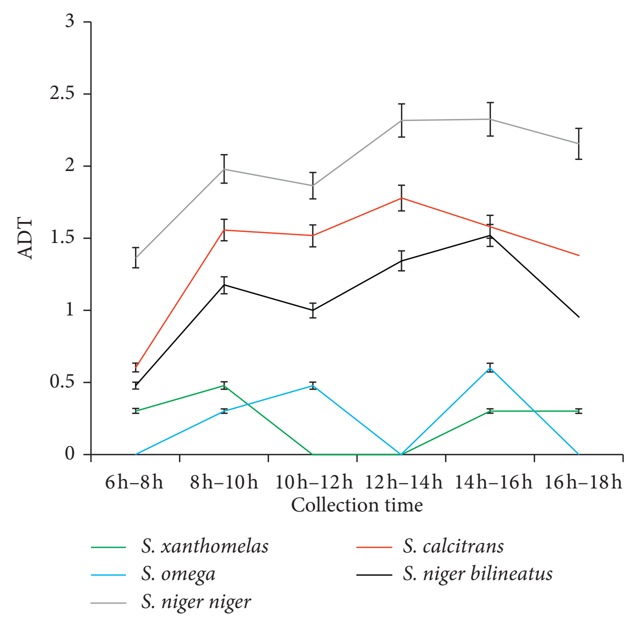

Figure 3: Daily activity rhythms of *Stomoxys* spp. in the rainy season (May 2017). ADT: trap apparent density.

temperature, but there was a negative and nonsignificant correlation between its ADT and air humidity (Table 3).

For *S. omega*, there was a positive and nonsignificant correlation between its ADT and wind speed, but there was a positive and significant difference between its ADT and temperature. There was a negative and significant correlation between its ADT and air humidity (Table 4).

For *S. calcitrans*, there was a positive and significant correlation between its ADT and wind speed and temperature, but there was a negative and significant correlation between its ADT and air humidity (Table 5).

For *S. n. niger*, there was a positive and nonsignificant correlation between its ADT and wind speed and temperature, but there was a negative and significant correlation between its ADT and air humidity (Table 6).

For *S. xanthomelas*, there was a positive and nonsignificant correlation between its ADT and wind speed and

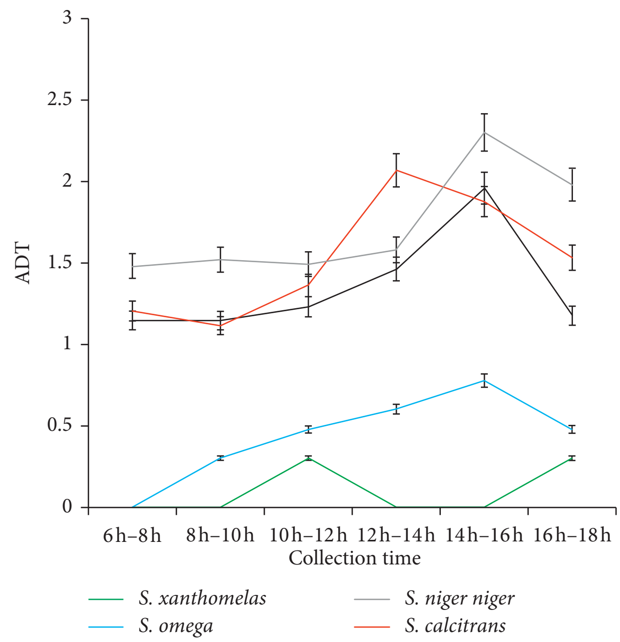

Figure 4: Daily activity rhythms of *Stomoxys* spp. in the dry season (March 2017). ADT: trap apparent density.

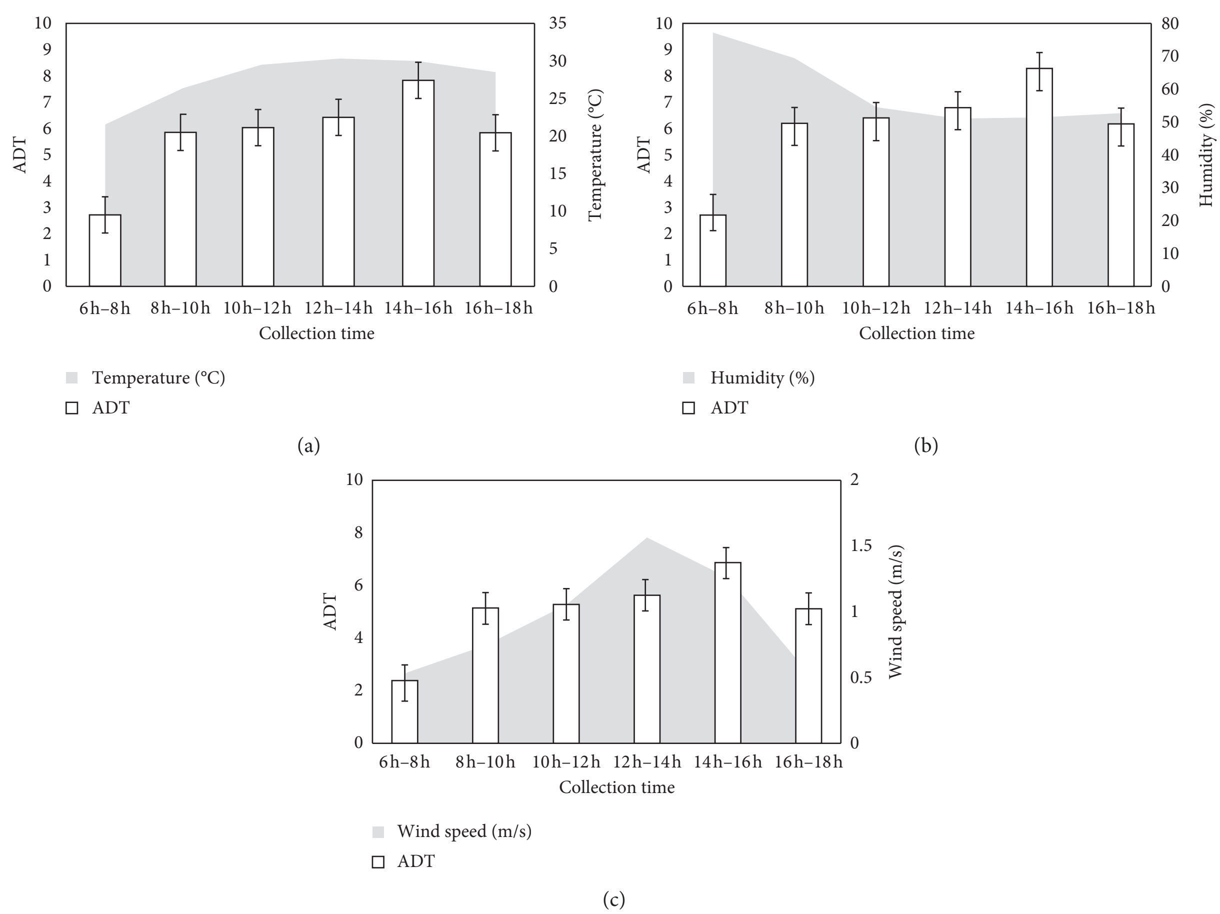

Figure 5: Association of daily activity rhythms with weather variables: (a) temperature; (b) humidity; (c) wind speed. ADT: trap apparent density.

Table 3: Correlation matrix of daily ADT of *S. n. bilineatus* with weather variables.

		S. n. bilineatus	Wind speed (m/s)	Humidity (%)	Temperature
S. n. bilineatus	Pearson's r	—			
	p value	—			
Wind speed (m/s)	Pearson's r	0.741	—		
	p value	0.092	—		
Humidity (%)	Pearson's r	−0.684	−0.895	—	
	p value	0.134	0.016	—	
Temperature (°C)	Pearson's r	0.671	0.888	−0.954	—
	p value	0.145	0.018	0.003	—

r: correlation coefficient.

Table 4: Correlation matrix of daily ADT of *S. omega* with weather variables.

		S. omega	Wind speed (m/s)	Humidity (%)	Temperature
S. omega	Pearson's r	—			
	p value	—			
Wind speed (m/s)	Pearson's r	0.722	—		
	p value	0.105	—		
Humidity (%)	Pearson's r	−0.819	−0.895	—	
	p value	0.046*	0.016	—	
Temperature (°C)	Pearson's r	0.901	0.888	−0.954	—
	p value	0.014*	0.018	0.003	—

*Statistically significant difference at $p < 0.05$; r: correlation coefficient.

Table 5: Correlation matrix of daily ADT of *S. calcitrans* with weather variables.

		S. calcitrans	Wind speed (m/s)	Humidity (%)	Temperature (°C)
S. calcitrans	Pearson's r	—			
	p value	—			
Wind speed (m/s)	Pearson's r	0.834	—		
	p value	0.039*	—		
Humidity (%)	Pearson's r	−0.876	−0.895	—	
	p value	0.022*	0.016	—	
Temperature (°C)	Pearson's r	0.933	0.888	−0.954	—
	p value	0.007*	0.018	0.003	—

*Statistically significant difference at $p < 0.05$; r: correlation coefficient.

Table 6: Correlation matrix of daily ADT of *S. n. niger* with weather variables.

		S. n. niger	Wind speed (m/s)	Humidity (%)	Temperature
S. n. niger	Pearson's r	—			
	p value	—			
Wind speed (m/s)	Pearson's r	0.785	—		
	p value	0.064	—		
Humidity (%)	Pearson's r	−0.823	−0.895	—	
	p value	0.044*	0.016	—	
Temperature	Pearson's r	0.812	0.888	−0.954	—
	p value	0.050	0.018	0.003	—

*Statistically significant difference at $p < 0.05$; r: correlation coefficient.

temperature, but there was a negative and nonsignificant correlation between its ADT and air humidity (Table 7).

4. Discussion

The pasture area of Vina Division of the Adamawa Plateau is densely infested with five species of Stomoxyinae: *S. n. niger* Macquart, *S. calcitrans* (Linnaeus, 1758), *S. n. bilineatus* Grünberg, *S. omega* Newstead, and *S. xanthomelas* Roubaud. The species composition of Stomoxyinae reported by the preliminary study of Sevidzem et al. [4] in the north savanna of Cameroon was *S. calcitrans* (Linnaeus, 1758), *S. n. niger* Macquart 1851, *S. n. bilineatus* Grünberg 1906, and *S. sitiens* Rondani 1873. The differences in the species composition/number in Adamawa and North Cameroon might be due to the differences in sampling protocols (trap numbers and types and trap height and location) and climatic conditions (temperature and

Table 7: Correlation matrix of daily ADT of *S. xanthomelas* with weather variables.

		S. xanthomelas	Wind speed (m/s)	Humidity (%)	Temperature
S. xanthomelas	Pearson's *r*	—			
	p value	—			
Wind speed (m/s)	Pearson's *r*	−0.614	—		
	p value	0.195	—		
Humidity (%)	Pearson's *r*	0.593	−0.895	—	
	p value	0.215	0.016	—	
Temperature (°C)	Pearson's *r*	−0.395	0.888	−0.954	—
	p value	0.438	0.018	0.003	—

r: correlation coefficient.

precipitation) [22–24] prevailing in the two regions during the respective collection time points since the north has a Sudano-Sahelian climate and Adamawa Plateau has a Sudano-Guinean climate with different weather conditions which could unequally influence *Stomoxys* spp. distribution and abundance in different bioclimatic zones of Cameroon. The Stomoxyinae's apparent density in the present study was superior to that reported by Mavoungou et al. [25] in Gabon. The differences could be due to trap types, trap numbers, and trapping periods in the two studies [17]. *S. n. niger* was the most abundant in all the prospected sites, and this is similar to the finding of Mavoungou et al. [25], Ahmed et al. [26], and Mihok and Clausen [27]. The nonsignificant difference in the distribution of different *Stomoxys* spp. in different sites of the study area could be explained by favorable environmental conditions especially for *S. n. niger* in Vina Division during the time of collection. However, according to Zumpt [3], *S. n. niger* is a common species in the savanna and humid tropical rainforests. Based on the sites surveyed, Galim recorded the highest number of *Stomoxys* spp. as compared to the other sites, and this could be due to the absence of insecticide and antiparasite applications on cattle and farms around Galim, but this practice is common in farms around Mbidjoro and Velambai [28, 29].

The proportion of *Stomoxys* spp. catches was influenced by trap type, and it was noticed that the Vavoua trap highly caught all the species identified than the other traps except for *S. n. bilineatus* that was highly caught by the Nzi trap. The high collection of most *Stomoxys* spp. by the Vavoua trap than the others was not astonishing because it has been reported to be efficient for the collection of Stomoxyinae [4, 30].

Different seasons bring about differences in the distribution and abundance of *Stomoxys* spp. It was observed that *Stomoxys* spp. population was dominant at the beginning of the rainy season (May 2017). This finding is parallel to the report of Masmeatathip et al. [31] which revealed that 80% of *Stomoxys* species were captured during the rainy season in Kamphaengsaen Campus, Nakhon Pathom Province, Thailand, in the southern Kaduna state of Nigeria by Ahmed et al. [26] and in the Faro and Deo Division of the Adamawa region by Sevidzem et al. [32]. In Brachyceran flies, an increase in flight activity often occurs immediately after rainfall [33, 34]. According to Muenwom et al. [35], the increase in rainfall causes a widespread increase in suitable breeding sites which is a critical factor for eggs to hatch and the larvae to survive and successfully develop to pupae and adults. There was a sharp drop in the population of Stomoxyinae in April. This observation is similar to that of Sevidzem et al. [32] who reported low occurrence of stable flies in the same area and period. The sharp drop could be associated with the start of emergence of adulthood or limited rainfall that could inhibit the development and survival of Stomoxyinae in the Sudano-Guinean climate.

The daily activity patterns of *Stomoxys* spp. change with respect to the geographical zone, with reasons such as the climate, collection method, physiological state of an insect, or season [33]. This daily activity varied from season to season with the rainy season portraying a bimodal activity (two peaks) in the morning between 8 h and 10 h and in the afternoon between 14 h and 16 h for most species. This bimodal activity in the rainy season is due to the interlocking periods of heavy rains and sunshine during this season. On the contrary, the activity of *Stomoxys* spp. was unimodal and the peak of the activity occurred in the late afternoons, but this was different from *S. xanthomelas* which is the only exception with two peaks of activity (bimodal activity). This activity model in both seasons was similar to that of Muenworn et al. [35] and Phasuk et al. [36] for *S. calcitrans*. It was noticed that rainfall during collection time had a negative and nonsignificant influence on the ADT of Stomoxyinae. This might be due to hindrance of rains on flight activity during collection time. However, the monthly rainfall had a positive and nonsignificant effect on the monthly ADT of Stomoxyinae. This observation on the positive link between weekly rainfall and ADT has already been reported by Semelbauer et al. [37]. This can be explained by the fact that the larvae of stable flies develop in the moist vegetable debris, a habitat expanded by rain. Temperature was one of the factors that were positively associated with the flight activity of adult *Stomoxys* spp. Zumpt [3] stipulated that maximal activity of these flies is attained when the surrounding temperature is 30°C and reduces when it goes above 34°C. The present study showed that maximum activity was attained at the temperature of 30.65°C which was closest to that reported by Zumpt [3]. The average monthly temperature of Vina Division for 2017 was 25.33°C ± 2.08 which is far from the limiting temperature (15°C) of Stomoxyinae. The relative humidity is another sensitive weather parameter which can influence the flight activity of stomoxyines [38, 39]. The mean humidity values between 30 and 50% are favorable for the flight activity of

Stomoxys spp. The relative humidity corresponding to the maximum activity of *Stomoxys* spp. (14 h to 16 h) was 49.67%. An increase in air humidity during diurnal collection time had a negative effect on the flight activity of different Stomoxyinae caught. This high humidity was provoked by rainfall and reduced the daytime population of adult *Stomoxys* spp. Humidity is less pronounced than temperature when considering daytime locomotory activities of most Dipterans, but it was observed in *Aedes aegypti* (L.) that its peak activity was attained with humidity between 30 and 90% [7, 40]. The peak of *Stomoxys* activity occurs when the wind speed is optimal and data on this parameter related to this group are rare, but our present findings recorded the activity peak of *Stomoxys* spp. at 1.46 m/s. Altitude was not significantly different in all the prospected sites. However, the activity peak of *Stomoxys* spp. occurred at an altitude of 1126.33 m. There is no information about the activity of *Stomoxys* at different altitudes. However, Gilles et al. [41] reported that altitude influences *Stomoxys* spp. diversity and not their abundance.

The pasture area of Vina Division, particularly in Ngaoundere I, II, and III, is densely infested by five species of *Stomoxys*: *S. n. niger*, *S. calcitrans*, *S. n. bilineatus*, *S. xanthomelas*, and *S. omega*. The most dominant species in all the prospected sites was *S. n. niger*. The daily activity of all the *Stomoxys* spp. showed a bimodal activity with two peaks during the rainy season and a unimodal activity in the dry season. There was a positive effect of rainfall on the monthly ADT of Stomoxyinae. Mean temperature, mean wind speed, mean relative humidity, and mean altitude that prevailed during the maximal daily activity (14 h to 16 h) for all species were 30.7°C, 1.5 m/s, 45%, and 1126 m a.s.l., respectively. There was a positive effect of temperature and wind speed on the ADT of Stomoxyinae in daytime collections. On the contrary, there was a negative effect of rainfall and humidity on the ADT of Stomoxyinae in daytime collections. The ideal trap for Stomoxyinae surveillance was Vavoua.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Sevidzem S. Lendzele and Mavoungou J. François designed the study. Sevidzem S. Lendzele, Mavoungou J. François, and Zinga Koumba C. Roland conducted the study. Sevidzem S. Lendzele, Koumba A. Armel, and Gérard Duvallet wrote the manuscript. All authors read and approved the final version of the manuscript.

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