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Assessment on the relative abundance of chrysops (Diptera: Tabanidae) across underserved communities in Okigwe Region, Imo State, Nigeria

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Abstract
The relative abundance and biting patterns of chrysop (Diptera: Tabanidee) were conducted in the communities of Okigwe, between January and December 2023. A better understanding of the vector distribution and transmission dynamics at a local scale is essential for implementing and evaluating vector control strategies. Capture nets specifically designed by a trained volunteer entomological scout to capture insects on flight monthly. Adult flies were also collected for one monthly using human bait and insect net. A total of 1432 flies were captured to estimate the seasonal relative abundance. More flies were caught dry the wet season accounting for 472 (33%) than the dry season 960 (67.0%). The lowest monthly fly abundance was recorded mostly in the dry season in January, February, November and December. There was a significant variation (p<0.05) in the seasonal punctual and peripheral pattern of distribution. The result showed that 495biting flies were captured by 2 fly collectors, daily biting cycle showed a peak during the late morning and early afternoon of the rainy season, which is between 10am and 4pm. The study has established the abundance existence, as well as the biting activities of chrysops in the Okigwe region. The public health implications of the existence and biting activity of the tabanids are obvious. Constant global climate change may lead to outbreaks of some neglected diseases such as loiasis. A timely intervention approach by government and health care providers in the region will be of immense benefit saving the vulnerable population from possible infections and disease outbreaks.

Keywords: Okigwe, tabanids, chrysops, abundance biting activities loa

Introduction
Chrysops (Diptera: Tabanidse) are among the most described species of any family of blood - feeding dipterans. They are Cosmopolitan comprising about 4400 species (Raybould and Roskor, 2013; Coscaron and Philip, 1979; Lessard, 2014) [17-19]. They are quite large and heavy bodied measuring in length from 6 to 10mm. They are notorious pests of livestock, particularly cattle and horses (Lessard, 2014) [19]. They cause extreme annoyance and blood loss due to feeding and oozing (Foil, 1989) [10]. Feeding and puncture areresponsible for additional blood loss from natural oozing Chrysops app are the biological vectors of the filaria *L. loa* the agent of human loiasis known as the tropical eye wormand associated with Calabar swelling. The parasite is limited to equatorial rain forest of Africa (Kelly *et al*., 2012) [20] where the biting population is abundant. Moreover, transmission is more common near rivers and densely forested regions. Individuals living or travelling to endemic areas are at risk of loiasis. (Foil, 1989) [10] Local population, particularly those engaged in activities like faming, fishing and logging, have a higher likelihood of exposure to Chrysops bites and subsequent infections (Mohamed *et al*., 2020) [12].
Female Chrysops require blood meal to develop eggs, (Nwoke *et al*., 1992; Ojurongbe *et al*., 2015) [13,14]. They typically bite during the day with their feeding habits associated, with diurnal activities of humans and animals. (Fassnella *et al*., 2010) [21] Humans are accidental hosts and consequently their roles in disease transmission. They are known to breed invarious whole bodies Eggs are laid normally in mashes frequently on over hanging water or saturated soils, cryptic larvae are restricted to aquatic and semi aquatic habitats (Boussinesq, 2006) [6]. Chrysops deposit L3 larvae at the bite site when taking blood meal Amy (2017) [23] the larvae penetrates the wound. The L3 larvae molt twice to become adult in the sub-cut- a nous tissues, occasionally, adult worms will migrate to the eye. Mated female worms release microfilaria which circulates in the blood during the day.

A series of research works conducted by researchers such as made it possible to study on the biting behavior of chrysops in this study area where there are recurrent cases of emergent and re-emergent disease of the tropics which are evidently neglected in disease in surveillance in some remote areas of Imo state.

The present study was carried out to determine the biting activities of Chrysops based on their ecology and habit in Okigwe area of Imo State which will form a baseline for population density of Chrysops and determine the effectiveness of control measures.

Materials and Methods

This study was carried out in some remote areas of Okigwe, Imo State Nigeria. It is located between 5.483ºN and 7.55 "E. it is lies between the Port Harcourt and highlands of Enugu -Menduguri rail line. It has a population of 132,237 (2005 census) most of the population is made up of migrant workers. The main economic activity in this area is subsistence farming include animal rearing. Some of the populations are also involved in small scale trading. The average animal temperature is 25.9 °C and estimated mean annual rainfall of 11.650mm an average away humidly of 75%. There are two major seasons of the year wet season (April to October) and dry season (November) the month of December and February. These may vary due to climate change.

Study sites were selected based on previous surveillance and available information and data on the presence of Chrysops in the study area. 12 study sites were mapped out in the 6 communities within the study area.

Selection of flies was made in 2 phases; for estimating the relative abundance and assessing the bites patterns and behavour of chysops. Use of capturing nets by trained volunteer entomological scouts was employed to capture insects on flight in the study sites. The nets were specifically designed to approach the flies slowly and quietly to avoid scaring them away by swinging the nets in a horizontal figure - eight patterns to catch the flying insects.

Human bait method was used to trap the insects to assess the biting behaviours/patterns. Aspirators were used by volunteer entomological scouts to trap flies that land on their legs for blood meal. The traps were operated for eight hours 10am to 4pm. Captured insects were transferred into the collecting vials/containers as soon as possible to prevent damage or escape. The vials were labeled with relevant collection information for morphological identification by Oldroyd (1957) [22] and Chainey and Oldroyd (1980) [7].

Ethical approval for the study was obtained from the ethics committee of state ministry of health and the Department of Environmental and Applied Biology, Imo State University. Consents were sought and obtained from the village heads and the participants from the community.

Data were analyzed by chi-square using EPI in for 6 computer software.

Results

Table 1 shows the monthly abundance of Chrysops in the various study sites. As shown, a total of 1432 flies were captured using capturing nets from January to December 2022 472 (33%) flies were captured during the day seasons while 960(67.0%) flies were captured during the wet season. The highest number of chrysops 349 (24.6%) were collected in April while the lowest number 11 (0.76%) was captured in the month of September. Statistical analysis of the data using chi-square showed significant difference (p<0.05) in the abundance of Chrysops between the day season and raining season. The numbers of chrysops were more at the beginning of the raining season and decreased during the dry season. Density of chrysops shows peaks between April and May (687).

Table 2 shows the monthly biting rate of chrysops determined per hour at the study sites A total of 495 flies were captured by 2 fly collectors for the months of January to December 20 Biting activity was higher between the hours of 11am to 5pm No flies were captured during the early hours of the day. i.e. between 7am and 10am throughout the year. Fewer biting flies were collected in the months of January to March. There was a remarkable break in the biting activities between 12 noon and 3pm.

Table 1: Monthly abundance of chrysops in the various study sites

School year	Monthly abundance of chysops												
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Octo.	Nov.	Decem.	Total
1A	3	10	6	62	75	2	3	3	3	2	16	25	210
B	10	2	6	10	16	-	15	2	-	3	25	-	89
2A	5	2	5	22	15	-	10	16	-	-	27	-	102
B	10	5	5	23	14	-	6	17	3	-	42	10	135
3A	9	10	4	32	31	2	-	25	3	2	31	8	157
B	8	15	7	33	22	3	2	3	2	16	10	4	125
4A	-	8	6	44	21	4	2	14	-	21	2	12	134
B	-	10	2	20	32	-	-	15	-	22	3	1	105
5A	-	3	5	21	45	-	-	17	-	22	2	12	124
B	-	10	12	24	28	1	-	12	-	2	2	13	104
6A	4	34	2	28	25	-	-	3	-	4	4	14	87
B	2	2	8	30	10	1	-	4	-	3	-	-	60
Total	51	90	68	349	334	13	38	131	11	97	164	99	1432
	3.6%	6.28	4.7	24.4	23.3	0.90	2.65	9.1	0.76	6.77	11.4	6.91	

(P < 0.05)P = 6.27

Note Highest monthly Abundance =349 (24.4%) = April

Lowest monthly Abundance=13 (0.9%) = June

Table 2: Monthly biting rate of chrysops determined per hour at the various study sites

B 1	Monthly biting rates %												
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Octo.	Nov.	Dec.	Total
9-10	-	-	-	2	-	-	-	-	-	2	-	2	6
10-11	1(25)	2	-	-	-	-	-	2	-	-	-	-	5
11-12	-	-	-	2	-	4	-	-	4	-	-	-	10
12-1	2(50)		1	12	2	2	-	2	1	1	4	1	28
1-2	-	-	4	10	6	1	2	2	-	2	4	-	27
2-3	-	-	-	4	-	4	3	-	3	-	-	1	15
3-4	-	-		2	2	-	-	-	1	-	-		5
4-5	1(25)	-	-	-	-	2	-	-	-	2	-	-	5
Total	4	2	5	32	10	13	5	6	9	7	8	4	
MBR	0.8	0.4	1.01	6.5	2.02	2.6	1.01	1.21	1.81	1.41	1.61		

Table II monthly biting rate of chysops determined per hour at the study sites
Note: Total biting chrysops
Highest monthly biting rate -32 (6.5%) = April
Lowest monthly biting rate - 02 (0.4%) = February

Discussion

This study was conducted to assess the distribution and biting patterns of chrysops in Okigwe area, Imo State. The overall pattern of distribution of the flies in the study sites shows that they have representatives of individuals throughout the year, this diversity and abundance of the flies fauna might result from favourable environmental conditions such as climate, vegetation and host availability (Baldachino*et al*.,2014) [4]. They are most abundant in area with suitable breeding habits which include moist and marshy areas, river banks and areas with livestock and wildly populations (Cilek, 1996) [8]. There is a clear variation in the number of flies collected in both seasons. The extent to which Chrysops population increases throughout the year depends climate with significant climate changes in temperature and precipitation. This is similar with the results of studies carried out in Malaysia and Zambia (Al-Talethe*et al*., 2018, Tovoè*et al*., 2017) [2, 15] from the result of the study more flies were captured at the beginning of the rains and less during mid dry months of November and December. This is in consistence with laboratory studies of haematophagous insects which have shown that temperature, moisture and oxygen are the most important stimuli for initiating proper feeding activities through a substrate membrane (Nwoke *et al*., 1992;Depaguit*et al*., 2016) [13, 9]. Flies are typically active during the day time with peak feeding activity occurring late morning to late afternoon. This is similar with studies carried out by and are attracted by movement and presence of carbon-dioxide which lead them to their potential hosts. From the result of the studies, they are more active during the rainy season when breeding sites are more abundant as well as the availability of their potential hosts. Chrysops are known vectors of Loaloa and other disease including African horse sickness which primarily affects the Mules and donkeys (Metzger, 2014) [11]. Rare cases of human infections with diseases transmitted by Chrysops (loiasis) filariasis have been reported in Nigeria (Zoure *et al*., 2011; Akue, 2011; Bouchaud *et al*., 2020) [16, 1, 5].

To mitigate Chrysops bites, individuals can use personal protective measures such as wearing light coloured long-sleeved clothing, application of insect repellent and avoid outdoor activities during peak feeding times. Additionally, proper insect control measures such as the use of insecticides can be employed in areas with high tabanid populations to reduce their numbers and minimize their impact on both humans and animals.

The high density and abundance of Chrysops in the study area of the rainforest region Okigwe strongly suggest a risk for the mechanical transmission of dangerous pathogen. Further studies on the micro biota they harbor are proposed, with the aim to establish their potential epizootic urological role in the transmission of diseases in the study area and beyond.

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