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Occurrence and Distribution of *Chrysops* Species in Akamkpa Community of Cross River State, Nigeria

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Abstract: *Chrysops* species have been recognized for its role as vectors in the transmission of human loiasis in Nigeria. This investigation was aimed at studying the occurrence and distribution of *Chrysops* species in Akamkpa community, cross river state. Two fly boys were used as human baits in the collection of adult *Chrysops* from each of the various villages in Akamkpa community, cross river state, Nigeria. Two species of *Chrysops* were identified. *Chrysops dimidiata* recorded significantly higher prevalence of 69.7% than *Chrysops silacea* 30.3% in all the sampling sites ($p<0.05$). Out of the 1299 *Chrysops* species caught in the entire study, the highest prevalence was reported during the late rainy season 916 (70.5%), while the least prevalence of 137 (10.6%) was reported during the late dry season ($p<0.05$). Two biting peaks 9-10 am and 3-4 pm were identified for *Chrysops* at all the sampling sites. Fly abundance was found to be higher in the morning hours than in the afternoon. The knowledge of the occurrence and distribution of *Chrysops* vectors will aid in the ongoing control program for human loiasis in Nigeria and the neighbouring countries where the vectors exist.

Key words: Occurrence, distribution, *Chrysops* species, akamkpa community, cross river state

INTRODUCTION

Chrysops are important vectors of filarial worms called *Loa* which cause the disease known as loiasis. Loiasis parse hardly kills, but becomes a public health concern where it co-exists with onchocerciasis. Loiasis is a major obstacle to ivermectin treatment for onchocerciasis control and lymphatic filariasis elimination in Central Africa. Zoure *et al.* (2011) confirmed that communities with a high level of loiasis endemicity had a significant risk of severe reaction to ivermectin treatment. In Nigeria, the prevalence of *Chrysops* and the disease have been documented in Niger Delta (Boussinesq and Gardon, 1997), Sapele rubber plantation (Kershaw, 1951), in between Niger Delta and Benin (Ogunba, 1971, 1972), Ahoada, Degema, Opobo and Okirika-Eleme (Udonsi, 1986; Arene and Atu, 1986) and Gongola State (Akogun, 1992). The African Program for Onchocerciasis Control (APOC) undertook large scale mapping of loiasis in 11 potentially endemic countries using a Rapid Assessment Procedure for Loiasis (RAPLOA) and confirmed Nigeria as one of the endemic countries (Zoure *et al.*, 2011).

Karshima *et al.* (2011) in their survey of biting flies in three local government areas of Taraba state, Nigeria reported 223 (24.5%) *Chrysops* out of 908 biting flies collected. Oku *et al.* (2011) found 16% *Chrysops* in their study of the distribution of day time biting Diptera in Rhoko forest in Akamkpa, Cross River State, Nigeria. Wanji *et al.* (2003) observed that *Chrysops* species were more prevalent during the wet season than dry season in their studies of five contrasting bioecological zones in Cameroon.

Takougang *et al.* (2002) reported up to 18% prevalence of *L. loa* from certain parts of Cross River State. Similarly, Anosike *et al.* (2004) confirmed *L. loa* and *M. perstants* as part of the 14 parasitic infections recorded among nomadic fulanis of South Eastern Nigeria. The report of the presence of *L. loa* indicated that its *Chrysops* vectors also coexisted in these areas.

In Cross River State, a Baseline information on the parasite had been documented by WHO (2001) in various language groups such as Utung Enyin or Uhira in Efik, Iraboni Egen in Biase, Butum or Izanga in Bahumono, Liyon in Yakurr and Unyangutunashi or Ugi-Utorshi in Bette. Adie (2003) observed the presence of *Chrysops* in 17 local government areas in Cross river state but with no detailed documentation of its distribution. A knowledge of the vector and its transmission potentials of human loiasis in Cross river State will assist officials of Community-directed Treatment with Ivermectin (CDTI) program in the distribution of the drug in communities in

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Akamkpa local government area, where onchocerciasis co-exist with loiasis. The objective of the present study was to determine the occurrence and distribution of *Chrysops* species in Akamkpa community, Cross river state, Nigeria.

MATERIALS AND METHODS

Study area: Studies on the occurrence and distribution of *Chrysops* species in Akamkpa community of Cross river state was carried out between September, 2009 to February, 2010. Cross river state is one of the 36 states of Nigeria located in the South Eastern region of the country. Within Cross river state, there are 18 local government area each with several communities. Three villages in Akamkpa community were randomly chosen for this study viz., Njagachang, Ekonganaku and Osomba (Cross River State Gazette, 1996).

Njangahang is located in the Western part of Akamkpa community. Osomba is located in the North-Eastern part of the community towards Cameroon, while Ekonganaku is located in the South-Eastern part of Akamkpa community. Hence, these three villages represented a cross section of the entire Akamkpa community.

Akamkpa community is a rainy zone with a yearly average rainfall of about 360 mm. The natural vegetation is dense tropical rainforest, which extends from Obudu through Akamkpa to Cameroon. This rainforest is one of the highest biodiversities in the world and it is of agricultural importance. The area is drained by a multitude of streams and rivers in an East-Westerly direction.

Sampling techniques: Two fly boys were used as human baits (Duke, 1960) or the collection of adult *Chrysops* in two shifts each day, from 8.00 am-12 noon (morning session) and from 12 noon to 6 pm (afternoon session). Sampling was restricted to between 8 am to 6 pm because anthropophilic *Chrysops* are inactive at night (Duke, 1960). Blood seeking female *Chrysops* flying near or landing on fly-boys were caught with sweep nets (Caubere and Noireau, 1991). *Chrysops* species were identified on the basis of their morphological features as described by Oldroyd, 1957 and Squitier, 2011.

The hourly and Daily Biting Densities (DBD) of *Chrysops* on the fly boys were recorded and expressed as the arithmetic mean of their biting densities. The monthly and seasonal abundance of *chrysops* was also recorded. The seasons were classified as late rainy season-September-October, early dry season-November to December and late dry season-January to February (Wanji *et al*., 2002).

Data analysis: The data were subjected to statistical analysis to check if there was any significant difference in species diversity and distribution within the various seasons as well as the distribution of species among the various villages sampled.

RESULTS

The number and percentage prevalence of the flies for the sampling periods-September, October, November, December, January and February were as followed: 554 (42.7%), 362 (27.8%), 157 (12.1%), 89 (6.9%), 69 (5.3%) and 68 (5.2%), respectively (Table 1). Out of the 1299 *Chrysops* species caught in the entire studies, 916 (70.5%), 246 (18.9%) and 137 (10.6%) were reported in the late rainy season, early dry season and late dry season, respectively (Table 3). Chi-square test confirmed that there was a significant difference in the distribution of the flies during the late rainy season compared to other seasons ($p<0.05$) (Table 3).

Two peaks of biting periods were observed in the entire study (the morning and afternoon peaks). The morning biting peak period was 9-10 am recording a total of 280 *Chrysops* species while the afternoon biting peak period was 3-4 pm recording a total of 181 *Chrysops* species (Table 1). The two peaks of biting periods (9-10 am and 3-4 pm) were observed in September and October which were the late rainy Season. There was a decline in the biting density immediately after 10 am, with a depression between 12 noon and 1 pm, followed by a sharp increase from 1 p.m. with a second peak between 3 and 4 pm, which finally declined till night fall.

Table 1: Monthly distribution of *Chrysops* in the three villages in Akamkpa community, Cross river state throughout the sampling period

	Time of collection/Number of flies collected											
Month	8-9 a.m.	9-10 a.m.	10-11 a.m.	11-12 noon	12-1 p.m.	1-2 p.m.	2-3 p.m.	3-4 p.m.	4-5 p.m.	5-6 p.m.	Total	Percentage
Sept.	101	124	72	42	24	19	27	71	48	26	554	42.7
Oct.	54	93	35	23	12	14	36	62	23	10	362	27.8
Nov.	42	30	17	6	4	3	11	29	12	3	157	12.1
Dec.	15	13	11	7	8	6	8	9	7	5	89	6.9
Jan.	9	9	12	7	6	7	5	5	6	3	69	5.3
Feb.	11	11	8	10	3	6	5	5	7	2	68	5.2
Total	232	280	155	95	57	55	92	181	103	49	1299	100

Table 2: Monthly distribution of *Chrysops* species in the three villages in Akamkpa Community, Cross River State, Nigeria

	Village/species identified							
	Njagachang		Ekonganaku		Osomba		Total No. of fly species collected	
Month	*C. silacea*	*C. dimidiata*	*C. silacea*	*C. dimidiata*	*C. silacea*	*C. dimidiata*	*C. silacea*	*C. dimidiata*
Sept.	13	121	69	139	95	117	177 (31.9)	377 (68.1)
Oct.	8	83	42	101	61	67	111 (30.7)	251 (69.3)
Nov.	6	35	16	39	21	40	43 (27.4)	114 (72.6)
Dec.	4	25	11	19	6	24	21 (23.6)	68 (76.4)
Jan.	6	21	6	14	7	15	19 (27.5)	50 (72.5)
Feb.	4	18	10	15	9	12	23 (33.8)	45 (66.2)
Total No. prevalence	41 (3.2)	303 (24.0)	154 (11.9)	327 (26.0)	199 (15.3)	275 (21.2)	394 (30.3)	905 (69.7)

Values in brackets are percentage

Table 3: Number and seasonal prevalence of *Chrysops* in Akamkpa Community, Cross river state, throughout sampling period (September 2009-February 2010)

		No. prevalence of each species collected per season	
Season	Total No. prevalence of *Chrysops* collected	*C. silacea*	*C. dimidiata*
Late rainy season	916 (70.5)	288 (31.4)	628 (68.6)
Early dry season	246 (18.9)	64 (26.0)	182 (74.0)
Late dry season	137 (10.6)	42 (30.7)	95 (69.3)
Total No. *Chrysops* collected	1299 (100.0)	394 (30.3)	905 (69.7)

Values in brackets are percentage

The two species of *Chrysops* identified in the study area were *Chrysops silacea* and *Chrysops dimidiata* (Table 2). The result showed that *Chrysops dimidiata* dominated in all the three villages recording 69.7%, while *C. silacea* recorded 30.3% (Table 2). Student t-test analysis confirmed that there was a significant difference in the prevalence between *Chrysops silacea* and *Chrysops dimidiata* in Akamkpa, Cross river state, Nigeria ($p<0.05$). They were identified by their characteristic brilliant color and brown abdomen; mottled wings and large head and eyes as revealed by the dissecting microscope. These two species were differentiated by the brownish colouration of the abdominal segments which was more indented in *C. dimidiata* than in *C. silacea*.

The number and percentage prevalence of 41 (3.2%), 154 (11.9%) and 199 (15.3%) were identified as *C. silacea* from Njagachang, Ekonganaku and Osomba villages respectively while 303 (24%), 327 (26%) and 275 (21.2%) were also reported for *C. dimidiata* in all the three villages (Table 2). There was however no significant difference in distribution of the two species among the three villages ($p>0.05$).

DISCUSSION

This study revealed that two species of *Chrysops* (*Chrysops dimidiata* and *Chrysops silacea*) were prevalent in Akamkpa Community. This observation support the work of Adie (2003), who worked on the identification and distribution of human biting *Chrysops* species in Cross river state, Nigeria and found *Chrysops silacea* in the area.

Observation from our study revealed that 905 (69.7%) of *Chrysops* caught were *Chrysops dimidiata* in the three village in Akamkpa community. In a related study Adie (2003) reported over 90% of *C. dimidiata* in Cross river state.

The results of our investigation indicated that 30.4% prevalence was reported for *C. silacea* in this present study. Hence, *C. dimidiata* with 69.7% prevalence was more dominant in this study. The dominance of *C. dimidiata* over *C. silaeca* was confirmed statistically using student t-test analysis ($p<0.05$). Noireau *et al*., (1990) however, reported that *C. silacea* was the dominant species in Cameroon along the Eastern border of Akamkpa community. One could be tempted to wonder why such a difference in species abundance in the same ecological area, bearing in mind that the forest at the Western border of Cameroon was an extension of the tropical rainforest from Obudu through Akamkpa, in Cross river state.

The difference could be explained on the basis that *C. dimidiata* is a vector indigenous to the great rainforest, and so more abundant in Akamkpa community of Cross river state, Nigeria. But *C. silacea* is a vector indigenous to the mangrove forest and therefore abundant along the eastern border of Akamkpa community, where the tropical rainforest is succeeded by the mangrove forest. It was also observed from this study that *C. silacea* occurrence increases as one leaves the Western part of Akamkpa community (Njagachang) towards Cameroon the Eastern border of Akamkpa community. This observation supports the work of Noireau *et al.* (1990) who also indicated the abundance of *C. silacea* towards Cameroon.

Two peak biting periods were observed in the entire study. The morning peak was between 9-10 am recording 280 flies while the afternoon peak was between 3-4 pm recording 181 flies. This study showed more fly abundance in the morning hours than afternoon and evening. This observation was similar to that of Wanji *et al*. (2002) in South-West Cameroon who found that many flies got their blood meal in the morning, and went back to rest in the afternoon, probably because of heat and irradiation. The biting cycle peak observed in the morning is probably due to the cool and non-sunny nature of the weather at this time. This observation confirms the works of Connal and Connal (1922) and Davey and O'Rourke (1951) who revealed that *C. silacea* seldom attack in bright sunlight, preferring shade and trees or shelter of verandas. One could now deduce why the drop in aggressiveness observed in the afternoon period.

The highest prevalence of *Chrysops* species reported in the entire study was 916 (70.5%) observed during the late rainy season while 137 (10.6%) was found during the late dry season ($p<0.05$). The rainy season provided a more conducive environment for the breeding of the flies due to the presence of high moisture, humidity and very low temperature (Wanji *et al*., 2002; Squitier, 2011). This observation was further confirmed by Ahmed *et al*. (2005) who generally collected more flies 1431 (85%) during the wet season than 250 (15%) in the dry season.

As mentioned earlier, peak prevalence was reported in the present study during the late rainy season, this contradicts the observation of Ahmed *et al*. (2005) who found peak abundance of *Chrysops* in the early dry season in their studies of some biting flies in Southern kaduna, Nigeria. The difference in peak abundance could be due to climatic difference between Akamkpa community located in Southern Nigeria while Kaduna is in Northern Nigeria. The cold harmattan wind of the early dry season associated with low temperature contributed to the peak abundance in Kaduna compared to the peak prevalence observed during the late rainy season in the present study.

From this study, it could be inferred that the occurrence and distribution of *Chrysops* in the study area was influenced by the time of the day, month of the year and the season. A knowledge of the occurrence and distribution of the vector and its transmission potentials of human loiasis in these villages, will assist officials of Community-Directed Treatment with lvermectin (CDTI) programme in their distribution of the drug to villages in Akamkpa community. Recently, it has also been found that there is adverse drug reaction in areas where there is coexistence of human loiasis and onchoceriasis. This study will help in proper management of patients with both loiasis and onchocerciasis when ivermectin is administered to them.

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