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Spatial and Temporal Distribution of Tabanids (Diptera: Tabanidae) in Akwa Ibom State, Nigeria

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Abstract Rapid Assessment Surveys confirmed the endemicity and widespread occurrence of the tabanid-transmitted human disease, Loiasis in Akwa-Ibom State, Nigeria, but data on the species composition, seasonal abundance and distribution of tabanids in the State was non-existent. A study was therefore undertaken over a 12-month period, covering wet and dry seasons, at rural and urban sites to determine the occurrence, seasonal abundance of known and potential tabanid species across the eco-vegetational zones (Mangrove Swamp Forest, Freshwater Swamp Forest, Lowland Rainforest, Moist Savanna Woodland) in the State. The Malaise trap was the sampling tool. Distribution of tabanids was across all eco-vegetational zones; however, most were collected from the mangrove swamp forest. The mangrove and fresh water swamp forests yielded more than 90% of all tabanids. The total number of tabanids was 2,790; eleven species in four genera (*Tabanus, Chrysops, Haematopota, Hippocentrum*). The genus *Chrysops* was dominant, constituting 65.4% of all tabanids; *Chrysops silacea*, a known vector of Loiasis was the most abundant and widespread species, 32.4% of all tabanids. More than 80.0% were collected in the wet season. Most species occurred in both seasons, with the exception of *Tabanus atratus* and *Chrysops pikei* recorded in the wet season only. More than 60.0% of all tabanids were from rural locations. The endemicity and widespread occurrence of loiasis in the State ie: probably maintained by the widely distributed *C. silacea* and other factors. The rainy season can be considered as the period of potentially higher risk of transmission, particularly in the rural mangrove and fresh water swamp forests.

Keywords Tabanids, Loiasis, Distribution, Eco-vegetational zones, Akwa-Ibom State, Nigeria

1. Introduction

Loiasis is a tabanid-transmitted helminth disease of Central and Western Africa[1, 2]. The diurnally periodic microfilariae are usually absent from peripheral blood of people at night, but appear during the day, particularly in the morning. The microfilariae are therefore readily picked up by the primary tabanid vectors which bite during the day[3]. Loiasis has been established as endemic and widespread in Akwa-Ibom State, Nigeria[4-6]. There have been anecdotal records of tabanids in the State. A study was therefore undertaken over a 1-year period to determine variations in species composition, relative abundance and distribution of tabanids in rural and urban locations across the eco-vegetational zones in the State.

2. Materials and Methods

2.1. Study Area

Akwa Ibom State is located in the south eastern region of Nigeria, 4.32^0 -5.33^0N and 7.25^0 - 8.25^0E. There are four vegetation zones: mangrove swamp forest, fresh water swamp forest, Lowland rainforest and moist savanna woodland. The mean annual rainfall is 2000-2500mm and the temperature range, 27 - 32℃. There are two seasons: rainy (April - October) and dry (Nov - March).

2.2. Study Sites

Two Local Government Areas (LGAs), each from an urban and a rural location were randomly selected in each of the four eco-vegetational zones; the LGAs were: Eket, Onna, Etinan, Nsit Atai, Uyo, Ibesikpo Asutan, Ikot Ekpene and Ibiono-Ibom. The geographical coordinates of the study towns and villages appear in Table 1.

2.3. Vector Collection, Handling and Identification

The Malaise trap, effective for the collection of tabanids[7] was used. Tabanids were collected fortnightly, 07.00-19.00hrs; data were pooled to obtain monthly relative abundance.

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Table 1. Study Sites and their Geo-Coordinates

SITE	ECO-VEGETATION ZONE	LATITUDE	LONGITUDE
URBAN			
Ikot Ebok (Eket)	Mangrove Swamp Forest **(MS)**	$04^0$38.525'N	$007^0$55.418'E
Edisong (Etinan)	Fresh Water Swamp forest **(FWS)**	$04^0$50.735'N	$007^0$50.732'E
Iba-Oku (Uyo)	Lowland Rainforest **(LF)**	$05^0$02.466'N	$008^0$01.097'E
Ibiakpan (Ikot Ekpene)	Moist Woodland Savanna **(MWS)**	$05^0$10.665'N	$007^0$42.786'E
RURAL			
Abat (Onna)	Mangrove Swamp Forest **(MS)**	$04^0$37.340'N	$007^0$51.675'E
Odot (Nsit Atai)	Fresh Water Swamp forest **(FWS)**	$04^0$49.517'N	$008^0$02.174'E
Nung Udoe (Ibesikpo Asutan)	Lowland Rainforest **(LF)**	$04^0$55.173'N	$007^0$57.962'E
Oko-Ita (Ikpa) (Ibiono Ibom)	Moist Woodland Savanna **(MWS)**	$05^0$11.523'N	$007^0$54.395'E

( ) Local Government Areas - LGA

During collections, the collecting jar was sprayed with pyrethrum-based insecticide, opened after one minute and insects harvested. Tabanids were transferred to containers with soaked cotton wool on filter paper. The top of the container was closed and labeled with date and study site. The container was transferred to a cooler containing ice-packs. The cooler was taken to the laboratory and species identified by standard keys[8-10]. The Identified species were compared with type-specimens at the Insect Museum, Department of Animal and Environmental Biology, University of Port Harcourt, Port Harcourt.

2.4. Data Analyses

SPSS (Graph path) was used for data analyses. The Students't-test and the Analysis of Variance (ANOVA) were used to analyze seasonal, rural-urban and vegetational data. All statistical tests were performed at 5% (0.05) level of significance.

3. Results

3.1. Tabanid Distribution across Eco-vegetational Zones

The total number of tabanids collected in the 4 vegetation zones was 2790. The mangrove swamp produced the highest number 1650 (59.1%); the least was from Lowland rain forest, 70 (2.5%) (Table 2). Differences in numbers across eco-vegetational zones were not significant ($F = 0.61 < 4.35$, df 3, 4; $P = 0.05$).

3.2. Distribution of *Tabanids* in Rural and Urban Locations

More *Tabanids* were collected from the rural areas, constituting 63.0% of all collections. This pattern was observed in all species, except *C. fuliginosus* which was confined to urban locations (Table 3). However, the difference in rural-urban numbers was not significant ($t = 1.98 < 2.131$; $df = 15$, $P > 0.05$).

3.3. Seasonal Abundance of Tabanids

In the wet season, April, - September, 2329 (83.5%) were collected, while 461 (16.5%) were recorded in the dry season (October-March). This seasonal activity pattern was observed in all species, except *Chrysops fuliginosus* (Table 4). Some species were absent in some months of the dry season: *C. univattatus* (February), *C. silacea* (December-February). *C. longicornis* (February -March); *C. fuliginosus* (January-June), *H. exiguicornatum* (January-February); *H. decora* (November-February) and *Hippocentrum vesicolor* (December-February). However, the overall seasonal differences were not significant ($t = 1.64 > 2.447$; $df = 6$, $P > 0.05$).

4. Discussion

The preponderance of tabanids in the mangrove and freshwater swamps is not surprising because the oviposition sites overhang or are adjacent to the larval habitats, which are often muddy, aquatic or semi-aquatic habitats[3]. They are also known to breed in brackish swamps[11]. The more complex rural locations in these eco-vegetational zones were also preferred[2]. Species richness of tabanids was found to negatively correlate with large open habitats and positively with patch-shape complexity[12]. Rains provide ideal breeding grounds and the higher numbers in the wet season have also been observed in other studies[13-17]. The population peak of most species including those with higher vector potential suggests that the rainy season can be considered as the period of potentially higher risk of transmission[12].

Table 2. Numbers of Tabanids collected across Eco-vegetational Zones

Vegetation zones	No of species	No collected	% of Total collection
Mangrove Swamp	5	1650	59.1
Fresh water swamp	5	894	32.0
Lowland Rain forest	4	70	2.5
Moist woodland savanna	4	176	6.3
Total	18	2790	100

Table 3. Tabanid species at Rural and Urban locations across Eco-vegetational Zones

SPECIES	MS		FWS		LRF		MWS		Total (%)
	Abat (Rural)	Ikot Ebok (Urban)	Odot (Rural)	Edisong (Urban)	Nung udoe (Rural)	Iba-oku (Urban)	Oko-ita (Rural)	Ibiakpan (Urban)	
Tabanus									
T. seledens	184	143	-	-	-	-	41	-	**368 (13.2)**
T. biguattatus	-	-	131	45	-	-	-	-	**176 (6.3)**
T. atratus	-	-	-	-	-	-	-	-	**-**
Sub-total	**184**	**143**	**131**	**45**	**-**	**-**	**41**	**-**	**544 (19.5)**
Chrysops									
C. univitattus	241	165	147	-	-	-	-	-	**553 (19.8)**
C. silacea	298	222	156	109	24	10	85	-	**904 (32.4)**
C. longicornis	-	146	136	67	5	-	-	-	**354 (12.7)**
C. fuliginosus	-	-	-	-	-	-	-	13	**13 (0.5)**
C. pikei	-	-	-	-	-	-	-	-	**-**
Sub-total	**539**	**533**	**439**	**176**	**29**	**10**	**85**	**13**	**1824 (65.4)**
Haematopota									
Ha. exiguicornatum	161	90	-	-	-	-	37	-	**288 (10.3)**
Ha. Decora	-	-	64	39	5	3	-	-	**111 (4.0)**
Sub-total	**161**	**90**	**64**	**39**	**5**	**3**	**37**	**-**	**399 (14.3)**
Hippocentrum									
Hi vesicolor	-	-	-	-	8	15	-	-	**23 (0.8)**
Sub-total			**-**	**-**	**8**	**15**	**-**	**-**	**23 (0.8)**
TOTAL	**884**	**766**	**634**	**260**	**42**	**28**	**163**	**13**	**2790**

Table 4. Seasonal abundance of Tabanidae (April 2002 – March 2003)

GENERA	SPECIES	NUMBER		TOTAL
		WET %	DRY %	
Tabanus	*T. seledens*	297 (80.7)	71 (19.3)	368
	T. biguattatus	147 (83.5)	29 (16.5)	176
	T. atratus	-	-	-
	Sub-total	**444 (81.6)**	**100 (18.4)**	**544**
Chrysops	*C. univitattus*	433 (78.3)	120 (21.7)	553
	C. silacea	743 (82.2)	161 (17.8)	904
	C. longicornis	323 (91.2)	31 (8.8)	354
	C. fuliginosus	5 (38.5)	8(61.3)	13
	C. pikei	-	-	-
	Sub-total	**1504 (82.5)**	**320 (17.5)**	**1824**
Haematopota	*H. exiguicornatum*	257 (89.2)	31 (10.8)	288
	H. decora	106 (95.5)	5 (4.5)	111
	Sub-total	**363 (19.0)**	**36 (9.02)**	**399**
Hippocentrum	*H vesicolor*	18 (78.3)	5 (21.7)	23
TOTAL		**2329 (83.5)**	**461 (16.5)**	**2790**

The primary vectors of *Loa loa* were incriminated in a series of studies in the 1950s in the Congo Region of equatorial Africa, which includes parts of the Democratic Republic of Congo, Congo-Brazzaville, Gabon, Cameroon and Southern Nigeria[18]. *Chrysops silaceus* and *Chrysops dimidiatus* particularly attracted to people near fire were the primary vectors. One of these, *C. silaceus*, was recorded in the study. It was also the only species that was distributed across the four eco-vegetational zones. The high dispersal ability of tabanids[13] would enhance their role in transmission. Further studies are planned in the State to determine the infection rates of known and potential vectors of *Loa loa*.

5. Conclusions

The favourability of muddy habitats for tabanids oviposition is reflected in their preponderance in swamp forests. The patterns of spatial distribution of *Chrysops silacea* suggest that the disease may be more prevalent in rural communities in the wet season. The endemicity and widespread occurrence of loiasis in Akwa Ibom State is

probably maintained by the widely distributed *C. silacea* and other vectors, enhanced by their high dispersal ability.

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REFERENCES

[1] Foil D. 1989. Tabanids as vectors of disease agents. Parasitology Today. 5:88-96.

[2] Mullens B. A. 2009. Horse Flies and Deer Flies (Tabanidae). *In* Medical and Veterinary Entomology. 2nd Edition G. R. Mullen and L. A. Durden (Eds). Academic Press. San Diego. 637pp.

[3] Service M. 2008.Medical Entomology for students. 4th Edition. Cambridge Press. Cambridge. 289pp

[4] Braide E. I., Agagak E., Aimankhu P. and Udofia V. 2002. Assessment of level of endemicity of Loiasis in Akwa-Ibom State, Nigeria. A report presented to the African Programme for Onchocerciasis Control (APOC). 30pp.

[5] Braide E. I., Oyene U.E., Ekpo U.F., Adie H. I., Atting I. A., Okpara K. N., Udoudung N. I., Aimankhu P. I. and Itina V. I. 2006. Rapid Assessment of Endemicity of Loiasis in Ini and Ibiono Ibom LGA, Akwa-Ibom State, Nigeria. Nigerian Journal of Parasitology 7:85-89.

[6] Braide E.I., Udoidung N., Ekpo U., Maurice C. and Itina V.I. 2010. Rapid Assessment of Loiasis (RAPLOA) in Onna LGA of Akwa-ibm State, Nigeria. Report submitted to African Programme for Onchocerciasis Control.

[7] Triplehorn C. A. and Johnson N. F. 2005. Borror and Delong's Introduction to the study of Insects. 7th Edition. Brooks/Cole Belmont. USA. 864pp.

[8] James and Harwood 1969, Herms's Medical Entomology. 6th Edition. MacMillan. NY. 484pp.

[9] Oldroyd H. 1957. Horseflies of the Ethiopian Region. I-III. London-British Meseum of Natural History.

[10] Godwin J.T. 1982. The Tabanidae (Diptera) of Mali: Miscellaneous Publications of the Entomological Society of America. 13: 1-141.

[11] McMahon and Gaugler R. 1993. Effects of salt marsh drainage on the distribution of *Tabanus nigrovittatus* (Diptera: Tabanidae). Journal of Medical Entomology 30:474-476.

[12] Baldacchino F., Porciani A., Bernard C., Jay-Robert P. 2013. Spatial and temporal distribution of Tabanidae in the Pyrenees Mountains: the influence of altitude and landscape structure. Bull. Entomol. Res. 25:1-11.

[13] Barros A.T.M. 2001. Seasonality and Relative Abundance of Tabanidae (Diptera) captured on horses in Pantanal, Brazil, Memorias do Institudo Obswaldo Cruz. 96 (7):917-923.

[14] Barros A.T.M. and Foil I.D. 2007. The influence of distance on movement of tabanids (Diptera: Tabanidae) between horses. Vetrinary Parasitology. 144: 380-384.

[15] Ahmed A.B., Okiwelu S.N. and Samdi S.M. 2005. Species diversity, abundance and seasonal occurrence of some biting flies in Southern Kaduna State, Nigeria. African Journal of Biomedical Research 8:113-118.

[16] Cheke R. A., Mas J. and Chainey J.E. 2003. Potential vectors of loiasis and other tabanids on the island of Bioko, Equatorial Guinea. Medical and Veterinary Entomology. 17:221-223.

[17] Kremar S. 2005. Seasonal abundance of horse flies (Diptera:Tabanidae) from two locations in eastern Croatia. J. Vector Ecol. 30:316-321.

[18] Krinsky W.L. 1976. Animal disease agents transmitted by horse flies and deer flies (Diptera:Tabanidae). Journal of Medical Entomology 13:225-275.