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Full Length Research Article

Species Diversity, Abundance and Seasonal Occurrence of Some Biting Flies in Southern Kaduna, Nigeria.

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Abstract

A survey of biting dipterans was conducted in Kaura LGA of Kaduna State between November 2000 and October 2001. Fifteen species of biting flies were caught in two families, Tabanidae and Muscidae distributed in the following 4 genera: *Tabanus* 10, *Haematopota* 2, *Chrysops* 1 and *Stomoxys* 2. The genus *Stomoxys* represented by *Stomoxys calcitrans* Linnaeus and *S. nigra* Macquart had the highest abundance (62.5%), followed by the Tabanus (34.6%), Haematopota (1.8%) and Chrysops (1.1%). Generally, more flies were collected during the wet (1431; 85.1%) than the dry season (250; 14.9%) with some species occurring all year round. The widespread presence of haematophagous dipterans in the study area suggest that they could be playing a greater role in disease transmissions than previously thought. Optimum temperatures that stimulate rapid reproduction appear to fall between mean temperatures of 22.8-24.1^{o}C. The species showed a general increase in relative abundance during the wet season and a decline in the dry season. No new country record was found.

Key words:
Haematophagous dipterans, Tabanus, Haematopota, Chrysops, Stomoxys, Kaura LGA, Nigeria

INTRODUCTION

Many species of *Haematophagous dipterans* are responsible for the spread of diseases in man and his livestock (Gruvel, 1980). They are categorized as those transmitting cyclically (Molyneaux & Ashford, 1983), mechanically (Dirie *et al*, 1989) or by regurgitation (Coleman & Gerhardt, 1988; Straif *et al*., 1990).

Studies on this group of insects are on the increase. In Africa, Okiwelu (1974, 1975 & 1976) studied various ecological aspects of *Tabanidae* in Zambia. Transmission of trypanosomiasis has been reported by members of the family Tabanidae in Kenya (Wilson & Stevenson, 1989) as well as in the pastoral zone of Sideradougou, Burkina Faso (Mattaush, 1990). Similarly, the flies are responsible for the transmission of *T. evansi* Steel, Balbiani among herds of camels in Mauritania (Diall et al., 1987, 1988). Transmission of trypanosomiasis in the complete absence of tsetse was also observed among camels in Somalia (Dirie et al., 1989).

In Asia, Hayakawa *et al*. (1984) and Yian & Weng (1984) reported on the various aspects of Tabanid fauna of Japan and China, while Wang Zunming, (1992), Xu Baohai & Xu Rongman, (1992) added new species to the genus Tabanus in China.

In the USA, Hogsette & Ruff (1985) observed the migration behaviour of *Stomoxys calcitrans* in relation to weather patterns and Douherty *et al*., (1993) presented data on the behaviour of adult cows from biting *S. calcitrans.* The seasonal distribution of *Tabanid* species in New York was ascertained by White *et al*., (1985). McCreada & Colbo (1985) conducted studies on the seasonal distribution of adult *Tabanidae* in western Labrador, Canada.

The Tabanidae of the Carribean was studied in French Guyana (Raymon *et al*., 1988) while the mechanical transmission of the stercorarian trypanosome of the sub genus. *megatrypanum* and the biting effects of Tabanids on grazing cows were studied in the Balkan area of Bulgaria (Bose *et al*., 1987; Nedelchev, 1988).

Despite the growing interests (Krinsky, 1976; Foil, 1989; Raspi & Belcari, 1989; Noireau et al., 1990), little is known of the faunal composition and species diversity of many species of biting insects in Nigeria as well as their role in disease transmission. This may account for the previous emphasis of vector control on mosquitos, glossina and ticks. This paper is aimed at updating our knowledge on the species diversity and seasonality of some biting insects from Kaura LGA in central Nigeria. A general checklist of members of Nigerian Tabanidae was produced more than 50 years ago (Roche, 1949) and since then, there has been no major review.

MATERIALS AND METHODS

This study was conducted in Kaura Local Government Area (LGA) of Kaduna State, which lies 8.30° E and 9.40° N, within the northern edge of the Southern Guinea Savanna zone (Keay, 1953) (Plate 1). The flies were caught together with tsetse during a planned survey for *Glossina* using biconical (Challier & Larvessiere, 1973) and nitse traps (Omoogun, 1994). The traps were baited with acetone and set for 5 days each month in 22 locations between November 2000-October 2001. Details of the study area have already been described (Ahmed, 2003). Caught flies were enumerated, preserved in 10% formalin (Dipeolu, 1977) and identified using structural differences described by Roche (1949).

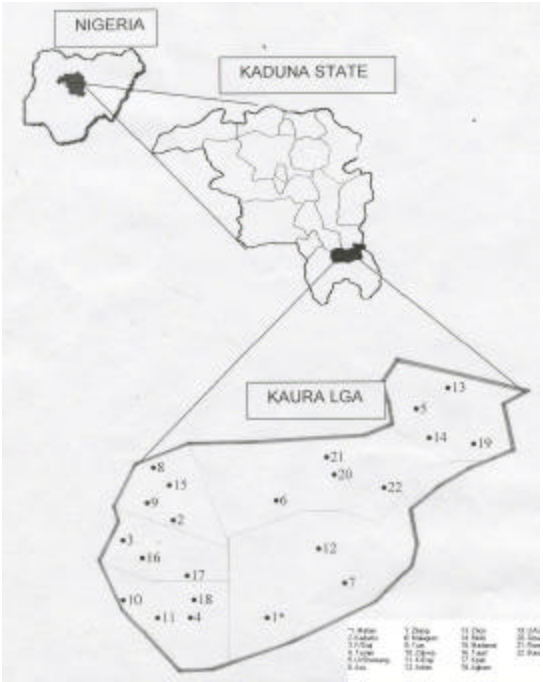

Plate 1:
Location of Kaura LGA (Study area) in Kaduna State, Nigeria showing sampling sites

RESULTS

Species Diversity and Abundance

A total of 1681 flies were caught, comprising 1433 males and 248 females belonging to two families: Tabanidae and Muscidae. The family *Tabanidae* comprised of three genera and thirteen species, while the family Muscidae comprised of one genus and two species (Table 1). Generally, more flies were collected during the wet 1431 (85.1%) than the dry season 250 (14.9%) (Table 1, Fig. 1). Females were represented in all the 15 species while males had 11 species.

Species Diversity and Abundance

The genus Tabanidae

This genus was represented by 10 species and accounted for 34.6% of the total collections. Three of the species were exclusively wet season dwellers and seven occurred in both wet and dry seasons (Fig. 1). The numbers of species caught varies seasonally, ranging from 4 in the late dry season to 10 in the early wet season. The total number of individuals caught in the wet season was 2 fold the total in the dry season. The most abundant species in this genus were *T. biguttatus* Wield. (12.0%), *T. albipalpis* Walker (6.2%), *T. pertinens* Walker (4.1%) and *T. taeniola* Pal. Beauvs (3.8%). Both *T. latipes* and *T. secedens* were rare and represent less than 1% of the total fly collections (Table 1).

The genus Haematopota

This genus was represented by 2 species and accounted for 1.8% of the total catch. *H. decora* occurs on only 2 occassions in the dry season, with sample size of 4 in early dry season (December) and 2 in the late dry season (February), while *H. puniens* Austen occurs in both seasons. *H. puniens* was predorminant in the mid wet season (September) with a sample size of approximately 20 (Table 1).

The genus Chrysops

C. distinctipennis Austen was the only species of chrysops collected and was exclusively a dry season dweller (Fig. 2). More were collected in the early (83.3%) than late (16.7%) dry season. This species had the least abundance, representing only 1.1% of the total fly collections (Table1).

Out of the 15 species collected, 3 had relative abundance of less than 1%, accounting for only 1.5% of the overall catch (Table 1). Of these, *T. latipes* Macquart and *H. decora* Walker occurs in both the dry and wet seasons while *T. secedens* Walker was an exclusive wet season dweller (Fig. 2).

Table 1:
Species Diversity, Abundance and Seasonal Occurrence of Biting Dipterans in Southern Kaduna State, Nigeria

Family/Genus/species	Dry seasons					Wet seasons						Total	RA (%)
	Early			Late		Early			Mid		Late		
	N	D	J	F	M	A	M	J	J	A	S	O		
Family:Tabanidae														
1. Genus*: Tabanus*														
T. albipalpis (Walker)	0	0	0	8	0	8	18	13	11	17	20	17	112	6.7
T. biguttatus (Wield)	3	0	0	0	9	12	32	22	30	39	30	24	201	12.0
T. gratus (Loew)	0	0	0	0	0	0	0	15	0	18	0	0	33	2.0
T. fasciatus (Fabricus)	0	0	5	0	0	2	0	4	6	0	1	1	19	1.1
T. fuscipes (Ricardo)	5	7	0	0	0	0	6	9	0	2	0	4	33	2.0
T. latipes (Macquart)	0	3	0	0	0	0	0	6	0	0	0	0	9	0.5
T. par (Walker)	0	0	0	2	0	0	10	8	0	11	0	0	31	1.8
T. pertinens (Walker)	2	0	0	0	3	5	13	11	0	15	11	9	69	4.1
T. secedens (Walker)	0	0	0	0	0	0	8	3	0	0	0	0	11	0.7
T.taeniola(Pal.Beauvois)	0	0	0	0	0	0	18	22	1	2	2	19	64	3.8
No. species/Total catch)		**5/25**			**4/22**			**10/245**			**8/216**		**582**	**34.6**
2. Genus: *Haematopota*														
H. decora (Walker)	0	4	0	2	0	0	0	0	0	0	0	0	6	0.4
H. puniens (Austen)	0	0	5	0	1	0	0	0	0	0	19	0	25	1.5
No. species/Total catch		**2/9**			**2/3**			**0/0**			**1/19**		**31**	**1.8**
3. Genus: *Chrysops*														
C. distinctipennis (Austen)	9	0	6	0	3	0	0	0	0	0	0	0	18	1.1
No. species/Total catch		**1/15**			**1/3**			**0/0**			**0/0**		**18**	**1.1**
Family:Muscidae														
1. Genus*: Stomoxys*														
S. calcitrans (Linnaeus)	22	18	10	8	6	19	37	44	58	109	87	66	484	28.8
S. nigra (Macquart)	32	29	16	15	17	29	42	48	59	98	102	79	566	33.7
No. species/Total catch		**2/127**			**2/46**			**2/219**			**2/513**		**2/145**	**1050**	**62.5**
Total sp/No. caught		**10/176**			**9/74**			**12/464**			**11/748**		**8/219**	**1681**	

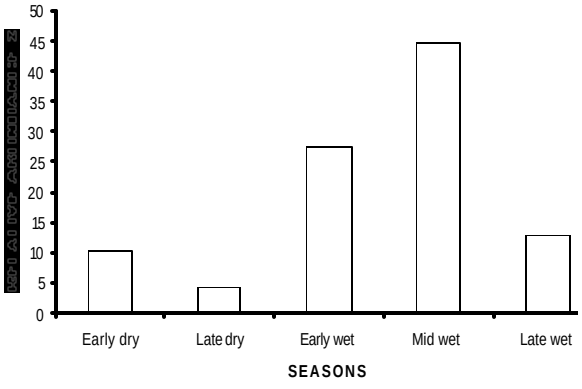

Fig. 1.
Seasonal Abundance of Biting Insects in Kaura Lga, Kaduna State

The genus Stomoxys
The genus had the highest abundance of 62.5%. Though the two species encountered occur in both dry and wet seasons, the total number collected in the wet season was 5-fold (83.5%) the number collected in the dry season (16.5%). Both *S. calcitans* and *S. nigra* had similar relative abundance (Table 1).

DISCUSSIONS

Haematophagous dipterans belonging to 4 genera were encountered during this investigation, namely Tabanus, Haematopota, Chrysops and Stomoxys. Considering the small size of the present study area, the number of species of the family Tabanidae collected was remarkably high compared to the number earlier recorded by Roche (1949) and Dipeolu (1977) for the whole country.

Of the 4 genera collected in this study, Chrysops was not in Dipeolus list. No reason could be given for this absence because 4 species had earlier been collected in different parts of Nigeria, including the areas sampled by Dipeolu (Roche, 1949). It is possible that the total number of insects caught will have been higher if collections were made in the vicinity of natural hosts such as livestock centres and the flies caught directly off

the animals (Dipeolu, 1975, 1977, Barros & Foil, 1999, Barros, 2001).

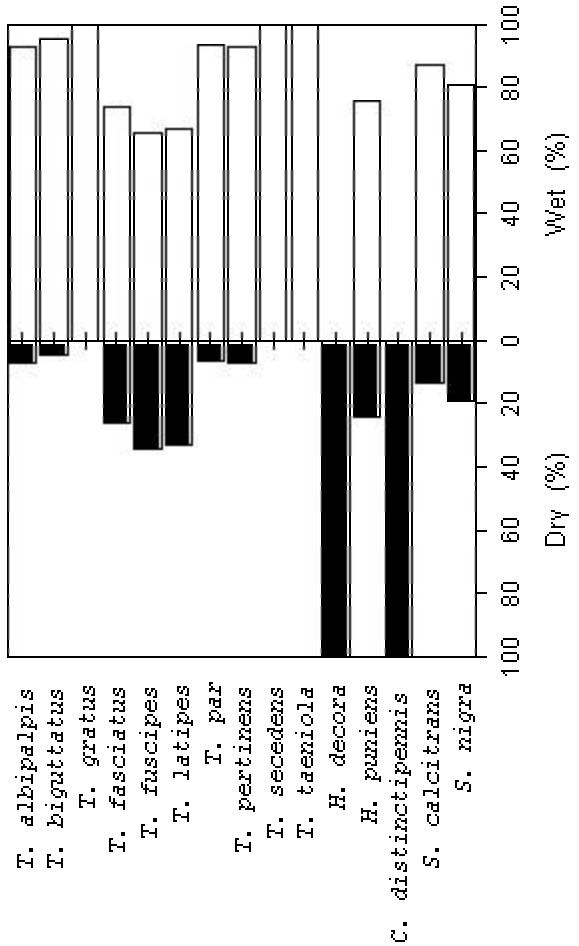

Fig. 2:
Percent of the Different Species of Other Biting Dipterans Caught In the Dry and Wet Seasons in Kaura LGA, Kaduna State, Nigeria.

Of the 15 species of blood sucking flies caught, the genus S*tomoxys* represented by *S. nigra* and *S. calcitrans* were most abundant, occurring throughout the year in large numbers. During his investigations on 29 livestock establishments in different towns across the country, Dipeolu (1977) also noted the dominance of S*tomoxys* spp over other haematophagous dipterans collected. This dominance may account for Dipeolu's (1975) earlier description of *Stomoxys* as a plague of cattle in Nigeria.

A total of 8 species of *Tabanus* were recorded during 2 year surveys of livestock centres across the country (Dipeolu, 1977), while 10 species were recorded in the current investigations; of the 10 species, only *T. biguttatus* and *T. pertinens* appeared in Dipeolus's list. The dominant *Tabanus* species in his collections was *T. taeniola,* while in the present study, *T. biguttatus* dominated. *T. pertinens,* earlier recorded in parts of Niger State and Southern Zaria in Kaduna State (Roche, 1949) were caught by Dipeolu (1977) at the Nsukka area (Derived savanna) and Maiduguri, Katsina and Birnin Kebbi (Sudan savanna). Records of *T. pluto* Walker described as a forest species at Ibadan, Oshogbo, Ilesha and Oyo (Roche, 1949), was caught by Dipeolu (1977) in Kano State and Talata Mafara (present day Zamfara State). This species is completely absent in the present findings.

The species of *H. berringeri* Austen, *H. cordigera* Bigot, *H. hastata* Austen and *H. pertinens* Austen in the genus *Haematopota* that were recorded in Kaduna and Zaria (same State as the present investigation)(Dipeolu, 1977) were not encountered in this study. The climate and vegetation of Nigeria had changed a lot in the last 40 years which might have affected the habitats of the flies.

These results show that these insects are not habitat-specific, in contrast to *Glossina.* A similar observation was made on other members of the *Tabanidae* in Brazil (Barros & Foil, 1979).

Analysis of the climatic data recorded at the Meteorological station of Government College Kagoro showed that the mean temperature between November 2000 and October 2001 was 24.8^{o}C. Mean monthly relative humidity within typical riverine sampling sites in the study area never fell below 50.0% due to the insulating effects of the vegetation. Both conditions could have provided a favourable environment for the survival and proliferation of the vectors.

The harsh climate of the dry season was continuous; the cold dry season (November-January) was characterized by wide variations, between 33-35^{o}C, and a mean minimum of 13-15^{o}C. The hot dry season (February-March) featured even higher temperatures. The extreme climatic conditions during the dry season which coincided with low minimum temperature below the minimum threshold of 22.0^{o}C resulted in a minimum relative abundance, in February-March (Fig. 2). The fly populations remain stable at a low relative abundance, beginning from the late wet season in October through the dry season (November-March), until the early wet season (April-June) when there was sudden increase in population (Fig. 2). It is apparent that optimum temperatures that stimulate rapid reproduction appear to fall between mean temperatures of 24.1^{o}C-28.6^{o}C. It therefore appeared that temperature was probably the most significant among the weather factors influencing variations in fly abundance in the study area.

The fluctuation in population is not similar for the 4 genera collected: Tabanus appears to attain a peak in early wet season; Stomoxys increase

gradually at the beginning of wet season, attaining a peak in late wet season in October. Although very few specimens of chrysops and haematopota were taken to allow for any meaningful discussions, chrysops reached peak abundance in the early dry season and declined thereafter. There was no clear pattern for haematopota, with the 2 species collected fluctuating in similar manner (Table 1).

Generally, the population increased at the beginning of the rains (April-June), attaining a peak in the mid wet season (July-September) and declined in late wet season (October) (Fig. 2). Irrespective of the seasons, there was no time that less than 8 different species of flies were collected for any sub-season.

The general increase in relative abundance in the wet season and a decline in the dry season is in consonance with the observations of Dipeolu (1975, 1977) on the general pattern of fluctuation in Tabanidae and other populations of biting insects in Nigeria.

The widespread presence of several species of blood-sucking dipterans in Kaura LGA, an important livestock producing area (Ahmed, 2003) portrays a silent danger to the livestock industry. Their presence all year round may be the route of transmission of various diseases to man and livestock. For example, *T. taeniola*, one of the species encountered was found capable of harbouring presumptive *T. congolense* Broden infections in Burkina Faso (Solano & Amsler-Delafosse, 1995). Both *S. calcitrans* and *Haematopota pluvialis* Linnaeus have been shown to transmit the virus causing bovine leucosis (Boulet, 1989), bovine diarrhoea (Tarry *et al*., 1991) and Streptothricosis (Hadrill *et al*., (1991) in livestock. *S. calcitrans* has also been implicated in the transmission of conjunctival habronemiasis (Rebhum, 1996). Haematopota species have been suspected as vectors of corynebacterial mastitis of cattle (Sol, 1983). Chrysops have been reported to transmit Loaloa in West Africa (Harwood, 1979). The species *C. discalis* Williston was linked to the transmission of *Francisella tularensis* causing zoonotic tularemia in man (Jellison, 1950, Craven and Barnes, 1991). Epimastigote stages of trypanosomes were isolated from Chrysops species in the Congo (Caubere *et al*., 1990), while Dirie *et al*., (1990) found trypanosomes in dissected *Tabanus bromius* Linnaeus and *Haematopota pluvialis* in Somalia. The biting menace of haematophagous dipterans has also been shown to hinder normal grazing in cattle (Bose *et al*., 1987; Nedelchev, 1988), resulting in reduced feed intake.

The increasing significance of biting insects as vectors of diseases, demands that tsetse and other workers coming across biting insects in the field should endeavour to identify their catch to species level instead of merely identifying the group as is commonly done. The current effort to eradicate tsetse from Africa by the Pan African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC) may also target this category of insects in view of their significance. No new country records have been found.

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