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Research Article

Species Diversity and Abundance of Tabanid Flies (Diptera: Tabanidae) and Its Potential Implications on Animal and Human Health in Osun State, Nigeria

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ABSTRACT
Tabanid flies (Diptera: Tabanidae) are important hematophagous vectors involved in the transmission of diseases affecting humans and animals, yet their diversity and distribution remain poorly documented in Osun State, southwestern Nigeria. This study investigated the species composition, abundance, and seasonal dynamics of tabanid flies across selected communities in the state. Entomological surveys were conducted from February 2025 to January 2026 in three local government areas namely Ife-South, Odo-Otin, and Ejigbo, using Nzi traps deployed in ecologically suitable habitats. Collected specimens were morphologically identified using standard taxonomic keys. Abundance was expressed as apparent density per trap per day (ADT), while spatial and seasonal variations were analyzed using descriptive statistics and the Kruskal–Wallis H test. A total of 135 female tabanid flies were collected, representing eight species across four genera: *Chrysops*, *Tabanus*, *Ancala* and *Haematopota*. *Chrysops* was the dominant genus (ADT: 0.340 flies/trap/day), with *Chrysops distinctipennis* constituting 63% of all captures. Ore recorded the highest abundance (ADT: 0.378 flies/trap/day), followed by Ifetedo (0.069) and Ife-Odan (0.021), although spatial differences were not statistically significant ($p > 0.05$). Tabanid abundance was strongly seasonal, with 89.6% of captures occurring during the wet season and peak densities observed in July and August (1.458 flies/trap/day). The predominance of *Chrysops* spp., recognized vectors of loiasis, indicates moderate to high transmission risk, particularly during the wet season, while the presence of multiple *Tabanus* species suggests potential implications for African animal trypanosomiasis. These findings provide baseline evidence for vector surveillance and integrated control strategies in Osun State.

Keywords: African Animal Trypanosomiasis; *Chrysops*; Loiasis; Osun State; Tabanidae; *Tabanus*

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INTRODUCTION

Tabanid flies (Diptera: Tabanidae) are among the most important groups of hematophagous insects of medical and veterinary importance worldwide (Baldacchino *et al*., 2014; Votýpka *et al*., 2019). Tabanidae is a highly diverse family, comprising 177 genera and 4667 species worldwide (Pape *et al*., 2011; Krčmar *et al*., 2022; Evenhuis & Pape, 2025]. Within this family, several subfamilies are recognized, notably Chrysopsinae, Pangoniinae, Scepsidinae, and Tabaninae, which are further divided into multiple tribes (Morita *et al*., 2015). Among these, members of the genera *Tabanus* Linnaeus, 1758; *Chrysops* Meigen, 1803; *Haematopota* Meigen, 1803 (often called horse flies, deer flies, and clegs, respectively) are particularly relevant in tropical and subtropical regions due to their strong association with humans and livestock (Sevidzem *et al*., 2021).

These insects are notorious for their persistent biting behaviour and painful blood-feeding, which result in considerable nuisance to humans, livestock, and wildlife (Baldacchino *et al*., 2014). Tabanids have been implicated in the transmission of some pathogens, including bacteria, viruses, protozoa and helminths, acting as both mechanical and biological vectors (Baldacchino *et al*., 2014; Sevidzem *et al*., 2021).

In sub-Saharan Africa, tabanids are of considerable importance due to their role in the transmission of African animal trypanosomiasis (AAT), a neglected tropical disease known to have considerable negative impact on livestock (Lendzele *et al*., 2022). Although tsetse flies are the primary biological vectors, tabanids contribute significantly to the mechanical transmission of trypanosomes, thereby sustaining disease transmission even in areas with low or absent tsetse populations (Lendzele *et al*., 2022). In addition, species of the genus *Chrysops* are responsible for the transmission of *Loa loa*, the causative agent of loiasis, which remains a significant health concern to humans in some part of West and Central Africa (Zoure *et al*., 2011; Whittaker *et al*., 2018).

In Nigeria, the diverse ecological zones ranging from rainforest to savanna ecosystems provides suitable habitats for a wide range of tabanid species (Imarhiagbe *et al*., 2020). This is possible due to the tropical climate in this region, characterized by distinct wet and dry seasons, which creates favourable conditions for the breeding and survival of these tabanid flies. Species diversity and abundance of tabanid flies have been investigated across various habitats, including farmlands, wildlife conservation areas, and national parks in parts of Nigeria (Odeniran *et al*., 2020; Omonona *et al*., 2021). Despite reports from several locations in southern Nigeria, there remains a paucity of data on these flies in Osun state. Evidence from early researches has shown that loiasis and other diseases transmitted by tabanids are endemic in Osun state (Ojurongbe *et al*., 2015; Brant *et al*., 2018; Odeniran *et al*., 2019). Thus, baseline entomological data on tabanid species diversity, abundance, and distribution across the state is crucial for determining the transmission risk of these infectious diseases. This study was therefore undertaken to investigate species diversity and abundance of tabanid flies in Ife-South, Odo-Otin and Ejigbo local government areas (LGAs) of Osun state, Nigeria. The findings are expected to contribute to improved vector surveillance and inform integrated approaches to the management of tabanid-borne disease risks in the region.

MATERIALS AND METHODS

Study Area

This study was conducted in Osun State, southwest Nigeria. The State lies between latitude 7°30N and longitude 4°30E, covering an area of about 14,875sqkm (Figure 1). The state is a major tourist destination due to its rich cultural exhibitions. The main source of livelihoods of the locals is agriculture and trading. The study was conducted across the three senatorial districts (Osun West, Osun East and Osun Central) of Osun State, Nigeria. In each of the three senatorial districts in Osun State, One LGA each was purposively based on the history of tabanid-borne diseases. In each of the selected LGAs, one village/community was randomly selected for the entomological survey based on its suitability to breed tabanid flies (Table 1). The study sites were visited in the wet (April - October) and dry (November - March) seasons.

Ethical consideration, community entry and mobilization

The ethical approval for this study was sought and obtained from the Osun State Ministry of Health Research and Ethics Committee (OSH–REC), reference number OSHREC/PRS/569T/812. In collaboration with the State and Local Government Neglected Tropical Diseases (NTDs) coordinators, visits were made to the selected communities before the study commenced to sensitize and inform the community leaders on the details and importance of this study. The village heads gave their informed consent before their communities were investigated. Our study was conducted in line with global ethical

standard. All data collected were kept confidential and used solely for the purposes of the study. Before conducting the entomological survey, the objectives of the assessment were clearly explained to the fly collectors and their oral informed consent was obtained. Selected fly collectors received training on fly collection and relevant information on vectors.

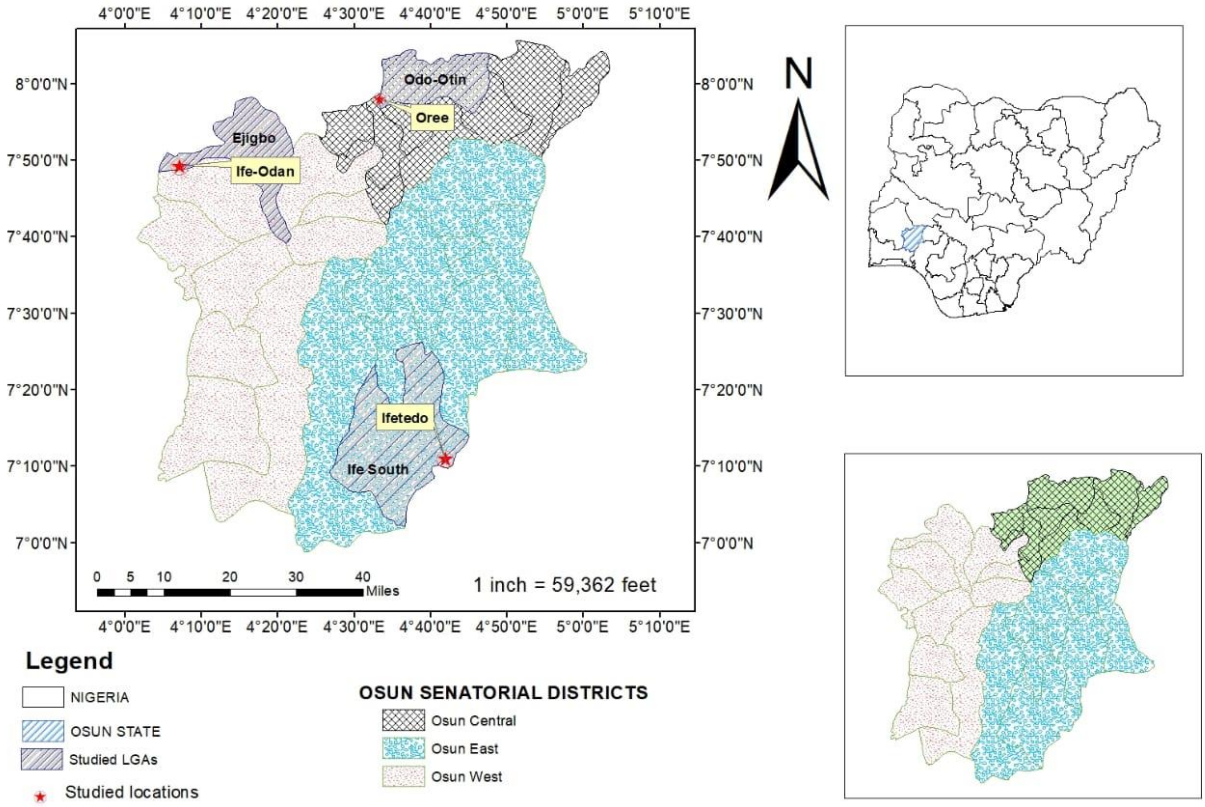

Figure 1: A map showing the study area

Table 1: Fly Collection Sites and their characteristics

Site Name	LGA (Senatorial District)	Longitude	Latitude	Sites Characteristics
Ifetedo	Ife-South (Osun East)	4.695273	7.181143	This is a typical rainforest zone with no wildlife observed. It consists of a small fenced cattle market surrounded by a secondary forest and cultivated areas.
Ore	Odo-Otin (Osun Central)	4.556330	7.966513	Tropical rain forest with secondary forest. Presence of cattle grazing routes, palm trees plantations, cultivated farmland and a large river system.
Ife-Odan	Ejigbo (Osun West)	4.118975	7.818173	A typical derived savanna zone, with presence of cattle grazing routes, cultivated grassland and streams

Trap design and construction

Six Nzi traps were constructed locally following the design of Mihok (2002). Each trap consisted of blue and black rectangular fabric panels made from Sunbrella® Pacific Blue and Sunbrella® Black solution-dyed polyester, respectively, which served as visual attractants, while white polyester mosquito mesh formed the trap body to intercept and retain flies entering through the front opening. An improvised plastic collecting jar was attached at the apex to

retain captured specimens. The traps were not baited with chemical attractants.

Fly collection and preservation

Flies were collected for 12 months from February 2025 to January 2026. Two traps were set at each study site in suitable tabanid habitats close to cattle grazing routes, farmlands and forested areas at 50 m equidistance from each other. A total of forty-eight (48) sampling days were used for the study; four days per month of collection for 12 months, cutting across both rainy and dry seasons. Traps were deployed daily from 08:00 to 18:00 hours. Trap positions were geo-referenced using a mobile GPS device (Table 1). Collected tabanid specimens were preserved in 80% ethanol during fieldwork and subsequently transported to the Molecular Epidemiology and Vector Biology Laboratory, Department of Animal and Environmental Biology, Osun State University, for identification and further analysis.

Fly identification

In the laboratory, all collected flies were counted, sorted, and examined under a digital microscope. Tabanid specimens were air-dried and identified to genus level using the taxonomic keys summarized by Baldacchino *et al*. (2014) with additional reference to Chainey (1993). Species-level identification was performed by examining diagnostic morphological characters including wing venation patterns, antennal structure, callus shape and colouration, leg banding, and abdominal patterning, following the descriptions and illustrations provided in the aforementioned keys. Voucher specimens for each identified species were deposited in the Entomological Collection of the Department of Animal and Environmental Biology, Osun State University, Osogbo, Nigeria.

Determination of abundance

The abundance of tabanids was expressed as apparent density per trap, calculated as the number of flies captured per trap per day, following Sevidzem *et al*. (2021).

$$ADC = \frac{NTC}{NT\ X\ ND}$$

Where ADT represents the apparent density per trap, NTC is the number of tabanids captured, NT is the number of traps deployed, and ND is the number of trapping days. Trapping effort was calculated as the product of the number of traps and the number of trapping days (trap-days).

Data Analysis

Data obtained were analyzed using descriptive statistics. Each species of trapped flies during the four consecutive days were added to form total specimens collected for the month. Species richness was defined as the total number of species recorded within each study site during the sampling period. Richness was estimated as the observed number of species (S) and used as a measure of species composition across study locations. To determine whether there were statistically significant differences in abundance, the assumptions of normality and homogeneity of variances were assessed using the Shapiro–Wilk test and Levene's test, respectively, with residual diagnostic plots generated for visual inspection. The Shapiro–Wilk test indicated significant departure from normality ($W = 0.718$, $p < 0.001$), and Levene's test revealed significant heterogeneity of variances ($F = 8.93$, $p < 0.001$). Neither log(x+1) nor square root transformations adequately resolved these violations. Consequently, the non-parametric Kruskal–Wallis H test was employed to compare tabanid abundance among the three study sites. Statistical analyses were performed using IBM SPSS Statistics, Version 21.

RESULTS

Species composition and abundance of tabanid flies in selected Communities of Osun State

A total of 135 female tabanid specimens were collected across the three study sites over the 12-month survey period, with 8 species identified and distributed among four genera: *Tabanus*, *Chrysops*, *Ancala*, and *Haematopota*, belonging to 2 subfamilies, the Chrysopsinae and Tabaninae (Table 2).

At the genera level, *Chrysops* spp. was the most abundant genus with an apparent density of 0.340 flies/trap/day, followed by *Tabanus* spp. (0.111 flies/trap/day), *Ancala* spp. (0.014 flies/trap/day) and *Haematopota* spp. (0.003 flies/trap/day) (Table 3). The three study sites revealed clear differences in tabanid apparent density and species composition. Although Ore recorded the highest apparent density (0.378 flies/trap/day), followed by Ifetedo (0.069 flies/trap/day) and Ife-Odan (0.021 flies/trap/day), the Kruskal–Wallis H test revealed a statistically significant difference in tabanid abundance among the three study sites ($H = 7.534$, $df = 2$, $p = 0.023$). In addition, species richness varied across sites with Ore harbouring six species from all four genera (Table 4). This is followed by Ifetedo, where five species were encountered from three genera (*Chrysops*, *Haematopota*, and *Tabanus*), while Ife-Odan had the lowest richness with only three species from two genera (*Chrysops* and *Tabanus*) identified (Table 4).

Monthly and seasonal distribution of tabanids in selected communities of Osun State

The tabanid flies exhibited pronounced seasonal variation, with marked differences between wet and dry seasons (Figure 2). Overall apparent density during the wet season months (May through October) averaged 0.842 flies/trap/day and was much higher than during the dry season (November through April), having recorded 0.097 flies/trap/day. However, the monthly apparent density data revealed distinct activity peaks, with the highest tabanids densities recorded in July (1.458 flies/trap/day) and August (1.458 flies/trap/day), that together represented the peak of tabanid activity. These months coincided with the height of the wet season when rainfall was abundant and temperatures were moderate. Conversely, the lowest apparent densities were observed during the dry season months of February (0.000 flies/trap/day), March (0.069 flies/trap/day), November (0.056 flies/trap/day), and December (0.347 flies/trap/day), with complete absence of captures at several sites during February and March. The mid dry season (January 2026) marked the resumption of tabanid activity at Ifetedo, with low apparent density (0.104 flies/trap/day) representing the beginning of a new activity cycle.

Table 2: Species Composition of Tabanid Flies Caught in Selected Communities of Osun State

Species	Ifetedo (%)	Ore (%)	Ife-Odan (%)	Total (%)
Ancala fasciatus (Fabricius)	0 (0)	4(3)	0 (0)	**4(3)**
Chrysops distinctipennis (Austen)	2 (1.5)	81 (60)	2 (1.5)	**85 (63)**
Chrysops longicornis (Macquart)	13 (9.6)	0 (0)	0 (0)	**13 (9.6)**
Haematopota pertinens (Austen)	1 (0.7)	0 (0)	0 (0)	**1 (0.7)**
Tabanus brucei (Ricardo)	0 (0)	1 (0.7)	0 (0)	**1 (0.7)**
Tabanus gratus (Loew)	0 (0)	10 (7.4)	0 (0)	**10 (7.4)**
Tabanus taeniola (Palisot de Beauvois)	3 (2.2)	10 (7.4)	2 (1.5)	**15 (11.1)**
Tabanus thoracinus (Palisot de Beauvois)	1 (0.7)	3 (2.2)	2 (1.5)	**6 (4.4)**
Total (%)	**20 (14.8)**	**109 (80.7)**	**6 (4.4)**	**135 (100)**

Table 3: Apparent Density (Fly/Trap/Day) of Genera of Tabanids Captured in Selected Communities of Osun State

Genera	Density (Fly/Trap/Day) of Tabanid Flies			
	Ifetedo	Ore	Ife-Odan	All Sites
Ancala	0.000	0.014	0.000	**0.014**
Chrysops	0.052	0.281	0.007	**0.340**
Haematopota	0.003	0.000	0.000	**0.003**
Tabanus	0.014	0.083	0.014	**0.111**
All genera	0.069	0.378	0.021	**0.469**

Table 4: Species Distribution and Apparent Density (flies/trap/day) of Tabanids Captured in Selected Communities of Osun State

Species	Density (Fly/Trap/Day) of Tabanid Flies		
	Ifetedo	Ore	Ife-Odan
Ancala fasciatus	0	0.014	0
Chrysops distinctipennis	0.007	0.281	0.007
Chrysops longicornis	0.045	0	0
Haematopota pertinens	0.003	0	0
Tabanus brucei	0	0.003	0
Tabanus gratus	0	0.035	0
Tabanus taeniola	0.01	0.035	0.007
Tabanus thoracinus	0.003	0.01	0.007

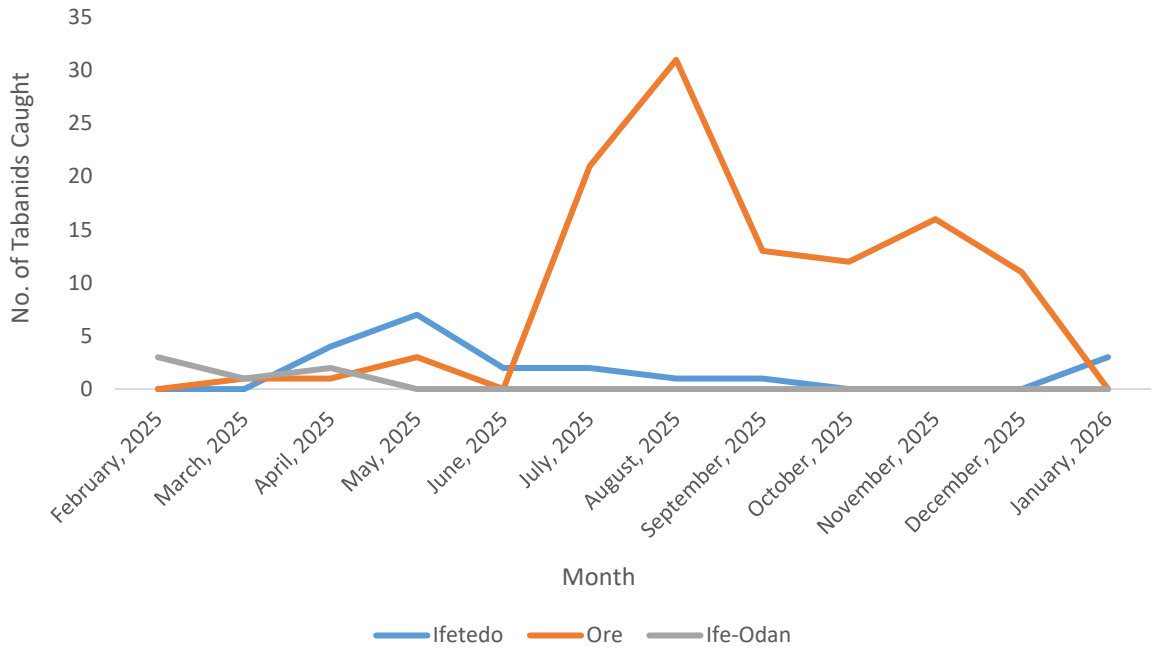

Figure 2: Monthly Catch Distribution of tabanids in the study sites

DISCUSSION

Vector-borne diseases continue to pose significant health threats to people and animals globally. Understanding the diversity, abundance, and distribution of their vectors is essential for assessing transmission risk. In this study, we recorded a total of eight tabanid species belonging to four genera; *Chrysops*, *Tabanus*, *Haematopota*, and *Ancala*. This is consistent with other studies done in other part of Nigeria, where the same four genera were reported (Odeniran *et al*., 2020; Omonona *et al*., 2021). However, the pronounced predominance of female tabanids observed in this study may be attributed to increased host-seeking activity, as females require blood meals for egg maturation (Krčmar & Marić, 2010).

Amongst the tabanid flies encountered in this study, the high proportion of *Chrysops* species is highly significant given their role as vectors of *Loa loa*, the causative agent of loiasis (Kelly-hope *et al*., 2017). The overall *Chrysops* apparent density recorded in this study, with peak wet season densities at some sites indicates a probable moderate to high loiasis transmission risk in the study area. This is especially relevant given that Osun State is recognized as loiasis-endemic, with documented human infections (Ojurongbe *et al*., 2015; Brant *et al*., 2018). These findings are consistent with previous reports from forest-fringe communities in southwestern Nigeria, where *Chrysops* populations are closely associated with transmission risk (Badia-Rius *et al*., 2019; Brant *et al*., 2018).

The two *Chrysops* species identified, *C. distinctipennis* and *C. longicornis*, exhibited distinct spatial and temporal patterns. *C. distinctipennis* was the most abundant species, with peak activity at Ore site during July–August. This species is widely recognized as a major loiasis vector in West and Central Africa (Kelly-hope *et al*., 2017), and its high apparent density at Ore suggests that this location may represent a transmission hotspot. In contrast, *C. longicornis*, although known to be both forest and savanna habitats, was restricted to Ifetedo (a forest zone), with peak activity occurring earlier in May. This localized occurrence suggests specific ecological requirements and breeding habitats. The absence of *C. silacea* and *C. dimidiata* in the study area is not unexpected, as these species are known to decline in dominance at ecological transition zones, where they are often replaced by other vectors (Kelly-hope *et al*., 2017). Similar patterns were reported in southern Sudan and parts of Central Nigeria, where *C. distinctipennis* predominates in savanna environments (Kelly-hope *et al*., 2017).

Furthermore, environmental factors such as vegetation type, canopy cover, proximity to water bodies, host availability, and human disturbance are key drivers of tabanid distribution (Baldacchino *et al*., 2014; Badia-Rius *et al*., 2019). The forest-fringe habitat with flowing streams at Ore likely provides optimal conditions for *Chrysops* larval development, which typically occurs in moist, organic-rich substrates along stream margins (Badia-Rius *et al*., 2019). Conversely, the lower densities observed at Ife-Odan may reflect less suitable environmental conditions for larval development and adult survival.

Seasonal variation was pronounced, with high tabanid captures occurring during the wet season and peak densities recorded in July and August. This pattern reflects the dependence of tabanids on favourable humidity and temperature conditions. The observed increase in abundance during the rainy season is consistent with previous studies indicating that peak vector biting densities occur during or shortly after periods of rainfall, when soil moisture and groundwater conditions are optimal for larval development (Suh *et al*., 2015; Bitome-Essono *et al*., 2015; Odeniran *et al*., 2020; Phetcharat *et al*., 2024). The increase in *Chrysops* density during the wet season suggests that transmission risk is highly seasonal, with increased human-vector contact during rainy months. The presence of two *Chrysops* species with different peak activity periods (*C. distinctipennis*: July - August; *C. longicornis*: May) suggests the possibility of extended transmission periods and spatially heterogeneous risk within the study area.

Four *Tabanus* species were identified in this study, with *T. taeniola* Palisot de Beauvois being the most abundant and showing the widest distribution among *Tabanus* species, with presence in all the three study sites, though with variable apparent densities. This species has been reported as one of the most abundant tabanids in Africa, with wide distribution (Sevidzem *et al*., 2021). Presence of this species across all study sites despite different ecological characteristics suggests high adaptability to varying environmental conditions. Importantly, *Tabanus* species are well-known mechanical vectors of *Trypanosoma vivax*, *T. congolense* and *T. brucei*, which cause AAT in livestock (Lendzele *et al*., 2022). The presence of multiple *Tabanus* species in the study area, particularly *T. gratus* and *T. taeniola* with their established vector competence, suggests potential risk for AAT transmission in cattle populations. Due to the species richness of certain *Tabanus* species at Ore, which coincide with cattle grazing areas, there is a need for further investigation into the epidemiological role of these vectors in livestock disease transmission in that locality.

The exclusive capture of *Ancala fasciatus* at Ore represents an important faunistic record. This species was previously reported as *Tabanus fasciatus* (Fabricius) in Nigeria (Odeniran *et al*., 2020). However, the low apparent density and sporadic temporal occurrence of *A. fasciatus* in our study may depict either low population levels or highly aggregated distribution patterns.

Haematopota pertinens Austen was the rarest species captured in this study, with only a single specimen collected at Ifetedo. This extremely low abundance contrasts with some reports from other part of Nigeria and West African countries where *Haematopota* species could be locally abundant (Ayuba *et al*., 2024; Ježek *et al*., 2019). The scarcity of *Haematopota* in our collections may reflect unfavorable habitat conditions in the sampled areas or genuine rarity of this genus in the study region.

CONCLUSION

The present study provides an important baseline data on tabanid diversity and abundance in some selected communities of Osun State. The pronounced predominance of *Chrysops* vectors indicates significant loiasis transmission risk, particularly during wet season months. Further studies integrating vector surveillance with parasitological surveys of human and animal populations, molecular characterization of vector species, and assessment of environmental drivers of vector distribution will be important for understanding the epidemiology and management of loiasis and animal trypanosomiasis in this region. Additionally, investigation of larval breeding habitats and adult host-seeking behaviour could identify critical intervention points for sustainable vector control programs.

Abbreviations

AAT: African Animal Trypanosomiasis
LGA: Local Government Area
NTDs: Neglected Tropical Diseases
OSH–REC: Osun State Ministry of Health Research and Ethics Committee

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Authors' contributions

Conceptualization: M.A., A.M., K.A., O.A., Q.O.

Investigation: Q.O., O.G., L.O., D.I., Z.O., G.O.
Supervision: M.A., A.M., K.A., O.A.
Formal analysis: Q.O., O.G., L.O., D.I., Z.O.
Writing – original draft: Q.O., O.G., L.O., D.I., Z.O.
Writing – review & editing: Q.O., A.M., K.A., O.A., M.A.

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Data availability
The dataset generated and analyzed during the study are included in the article.

Ethics Declarations
Ethics approval and consent to participate
This study received ethical approval from the Ethical Review Board of Osun State Ministry of Health (OSHREC/PRS/569T/812). Permission for the study was obtained from the community heads and consent was obtained from fly collectors before data collection, and only those who provided oral informed consent were engaged.

Consent for publication
All authors of this article have agreed to publish it.

Competing interests
The authors declare no competing interests

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