



Species Composition and Diurnal Activity Rhythm of Tabanids (Diptera: Tabanidae) at the Ivindo National Park and Its Environs

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Authors' contributions

This work was carried out in collaboration among all authors. Authors AOJM, SSL, ZKCR, MF and JFM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AOJM, SSL and MF managed the analyses of the study. Authors ZKCR, RM, KAA, MF, AYGL, MB and SSL managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

An entomological prospection to show the species composition and diurnal activity of tabanids was carried out using 15 Vavoua traps, during the rainy season (25th Sept-5th Oct and 21st Oct-9th Nov 2018), in the secondary forest [Ivindo National Park (INP)] and Village-Town sites in and around the biosphere reserve Ipassa-IRET Makokou in Gabon. In total, 839 tabanids were caught with 747 recorded at INP and regrouped under 11 species of the genus *Tabanus* [*T. taeniola* (57.76%), *T. ricardae* (26.32%), *T. par* (5.54%), *T. ruficrus* (3.74%), *T. socius* (3.74%), *T. disjunctus* (2.49%),

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T. marmorosus (0.28%) and *T. obscurehirtus* (0.14%)). However, two species of the genus *Chrysops* [*C. dimidiatus* (70.83%) and *C. silaceus* (29.17%)] and one species of the genus *Haematopota* [*H. pluvialis* (100%)] were only identified at INP. While in the Village-Town sites, 92 tabanids were caught and regrouped under five species of the genus *Tabanus* [*T. ruficrus* (14.13%), *T. taeniola* (9.78%), *T. ricardae* (73.91%), *T. par* (1.09%), and *T. marmorosus* (1.09%)]. Tabanids were more abundant in the forest (7.12 tabanid/trap/day) as compared to the Village-Town (0.77 t/d) with a statistically significant difference ($P<0.05$). At INP, tabanids showed a unimodal activity pattern with peak attained between 12-14H and in the anthropized milieu (14-16H) and dominated by females.

Keywords: Hematophagous flies; park; reserve; Vavoua traps; biotope; rainy season; Gabon.

1. INTRODUCTION

1.1 Background

Tabanids represent a large group of dipterous insects with 4400 species regrouped under 144 genera [1]. Tabanids are a neglected subject of research but are vectors of pathogens of medical and veterinary importance [1,2]. Tabanids are known mechanical vectors of animal *Trypanosoma* spp., like *T. vivax*, *T. theileri* etc. [3] as well as biological vectors (*Chrysops silacea* and *C. dimidiata*) of *Loa loa* filariasis [4,5,6].

In Gabon, there is no longitudinal study on tabanids, but the few existing reports on this group are cross sectional studies carried out in some protected areas and their environs [7,8,9, 10,11].

The biting activity pattern of tabanids have been established for forest and savanna groups [5, 12]. The activity patterns vary with conditions of micro-environment across seasons with activity peaks ranging from unimodal, bimodal, trimodal etc [1,5]. However, no information exists on the activity rhythm of tabanids with respect to sex at the Ivindo National Park (INP) and its environs. The present entomological prospection aims at determining the abundance and diurnal activity profile of tabanids at the Ivindo National Park and its surrounding.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Makokou, located in the Ogooué-Ivindo province in North-East Gabon. Trapping was carried out at the Institute of Research for Tropical Ecology (IRET) of Ipassa (0°.51'N; 12° 79'E) and its environs (0°.52'N; 12° 82'E) (Fig. 1), elevated at an altitude of 500m [13]. The climate is of the

equatorial and humid type with alternating rainy and dry seasons. The mean annual rainfall is 1600 to 1800mm while the mean annual temperatures are close to 24°C. The annual and daily thermal amplitudes are weak [7] and the main water body in the area is river Ivindo. The entomological prospection was carried out during the rainy season (25th Sept-5th Oct and 21st Oct-9th Nov 2018). The forest fauna of Gabon is rich and diversified and the Makokou region holds a significant share with one of the highest listed fauna in Gabon. It consists of 128 species of mammals, 424 species of birds, 65 species of reptiles, 47 species of amphibians among others [7].

2.2 Capture of Tabanids

Trapping was carried out using 15 Vavoua traps [14]. Vavoua traps have been reported to be efficient in the collection of tabanids [15]. Traps were set along a transect of about 17km, following the anthropogenic gradient from the secondary forest in the INP (non-anthropized environment), to the Village and Makokou town (highly anthropized environment). Trapping duration was 30 days. The 15 traps were divided into the two study areas, at a ratio of 7-8 traps per milieu. Trapping effort was: 15 traps × 30 days = 450 traps days. The traps were activated in the morning at 8 am and emptied at 6 pm. All trap cages were tagged with the trap number and date and returned to the laboratory. They were then placed in a freezer for 15 minutes to kill the insect prior identification. Identification was carried out using the dissecting microscope (LABOMED®, France) of the field station laboratory of IRET-Ipassa in Makokou.

2.3 Daily Activity Rhythm

The diurnal activity pattern of tabanids in the study area was carried out using three traps in each of the prospection site for three days consecutively during prospection days. The

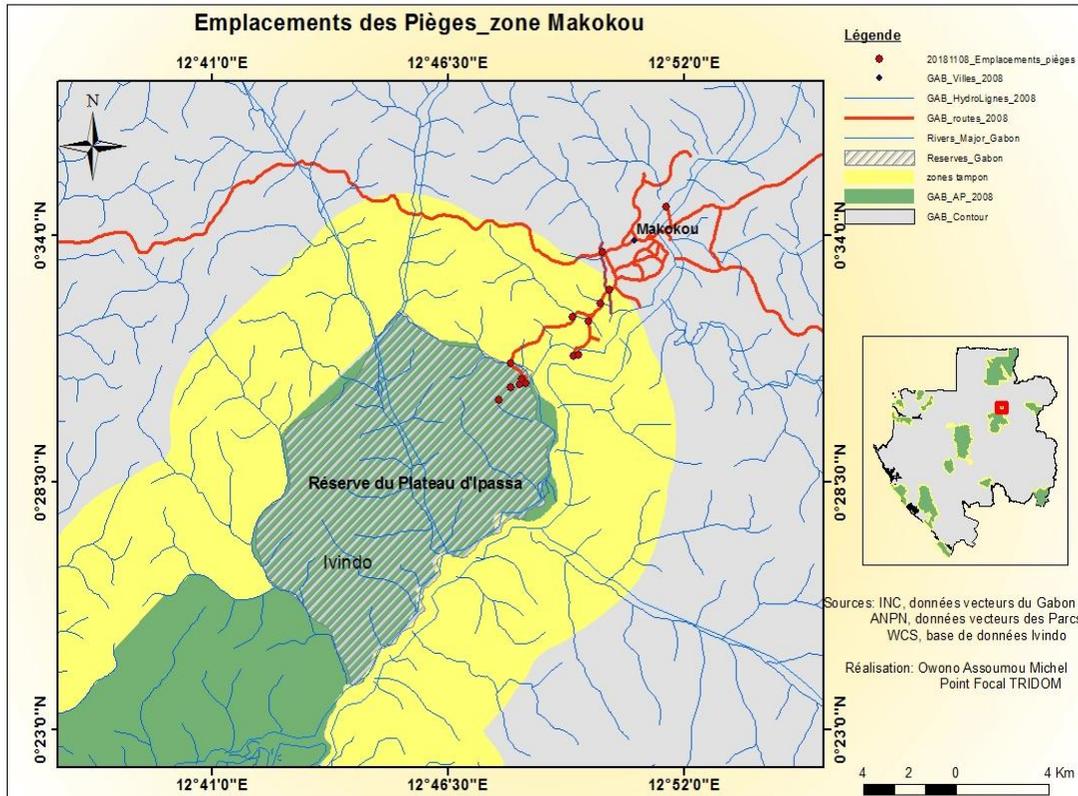


Fig. 1. Map of the study site showing the position of traps (red circles)

follow-up diurnal time ranges for this trial was 8-10H, 10-12H, 12-14H, 14-16H and 16-18H. Trap-tags consisted of date, location and time interval.

2.4 Fly Identification

The identification of tabanids was carried out using the identification key of Oldroyd [16].

The abundance was defined by the Trap Apparent Density (ADT) known as the number of tabanids caught per trap and day:

$$ADT = \frac{\text{Number of tabanids flies captured}}{\text{Number of traps} \times \text{Number of trapping days}}$$

2.5 Data Analysis

The statistical analysis was carried out using SPSS version 20. The one-way ANOVA on ranks was used to compare the ADT in the two prospection biotopes. The level significance was set at $P < 0.05$.

3. RESULTS

3.1 The Species Composition of Tabanids with Respected to Prospection Site

In total, 839 tabanids were caught with 747 collected at the INP which consisted of 11 species regrouped under three genera notably *Tabanus*, *Chrysops* and *Haematopota*. At the INP, *Tabanus taeniola* was the most frequent species while *Tabanus obscurehirtus* and *H. pluvialis* were very rare (Table 1). At the Village-Town trap-sites, only 92 tabanids were caught and five species identified and all belonged to the genus *Tabanus* (Table 1). In the Village-Town trap-sites, *T. ricardae* was the most frequent while *T. par* and *T. marmorosus* were very rare (Table 1).

3.2 Abundance of Tabanids with Respect to Prospection Sites

At the INP, *Tabanus taeniola* was the most abundant species of the genus *Tabanus* with

Table 1. Percentage of tabanids fly species in prospected locations

| Biotope | Genus | Species | Number | % |
|--------------------|------------------------------|------------------------------|--------|-------|
| INP | Tabanus (N=8) | <i>Tabanus taeniola</i> | 417 | 57.76 |
| | | <i>Tabanus ricardae</i> | 190 | 26.32 |
| | | <i>Tabanus par</i> | 40 | 5.54 |
| | | <i>Tabanus ruficrus</i> | 27 | 3.74 |
| | | <i>Tabanus socius</i> | 27 | 3.74 |
| | | <i>Tabanus marmorosus</i> | 2 | 0.28 |
| | | <i>Tabanus obscurehirtus</i> | 1 | 0.14 |
| | | <i>Tabanus disjunctus</i> | 18 | 2.49 |
| | Total Tabanus | | 722 | 100 |
| | Chrysops (N=2) | <i>Chrysops dimidiatus</i> | 17 | 70.83 |
| <i>C. silaceus</i> | | 7 | 29.17 | |
| Total Chrysops | | 24 | 100 | |
| Haematopota (N=1) | <i>Haematopota pluvialis</i> | 1 | 100 | |
| Total Haematopota | | 1 | 100 | |
| Village-Town | Tabanus (N=5) | <i>Tabanus ruficrus</i> | 13 | 14.13 |
| | | <i>Tabanus taeniola</i> | 9 | 9.78 |
| | | <i>Tabanus ricardae</i> | 68 | 73.91 |
| | | <i>Tabanus par</i> | 1 | 1.09 |
| | <i>Tabanus marmorosus</i> | 1 | 1.09 | |
| Total Tabanus | | 92 | 100 | |

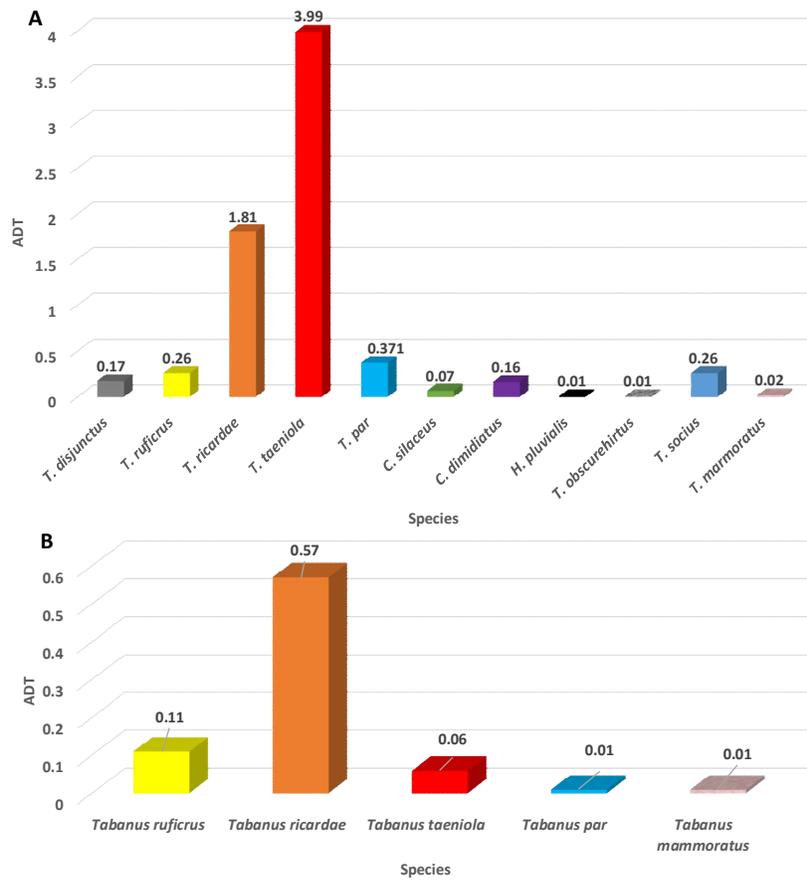


Fig. 2. The ADT of tabanids in INP (A) and village-town (B)

ADT of 3.99. In *Chrysops*, *Chrysops dimidiata* (ADT = 0.16) was the most frequent species in the present collections. However, in the genus *Haematopota*, only one species was identified with a low apparent density (ADT= 0.01) (Fig. 2A).

In the Village-Town sites, *Tabanus ricardae* was the most abundant species of the genus *Tabanus* with ADT of 0.57 (Fig. 2B). The other species notably *Tabanus ruficrus* and *Tabanus taeniola* were rarely captured. *Tabanus par* and *Tabanus marmoratus* were rarely caught (Fig. 2B). Generally, the ADT of tabanids was higher in the forest (ADT=7.12) as compared to the Village-Town (ADT=0.77) sites with a statistically significant difference ($P<0.05$).

3.3 Daily Activity Rhythm of Tabanids with Respect to Prospection Sites

At the INP, all the species of tabanids caught showed the same peaks of abundance between 12 and 14H (Fig. 3A). In the Village-Town sites, *Tabanus taeniola*, *Tabanus socius* and *Tabanus ruficrus* showed a unimodal daily activity with peak noticed between 14 to 16H (Fig. 3B). However, *Tabanus ricardae* was captured with the same abundance between 8 and 10H (Fig. 3B).

4. DISCUSSION

The apparent density per trap and day of tabanids was higher than that reported by

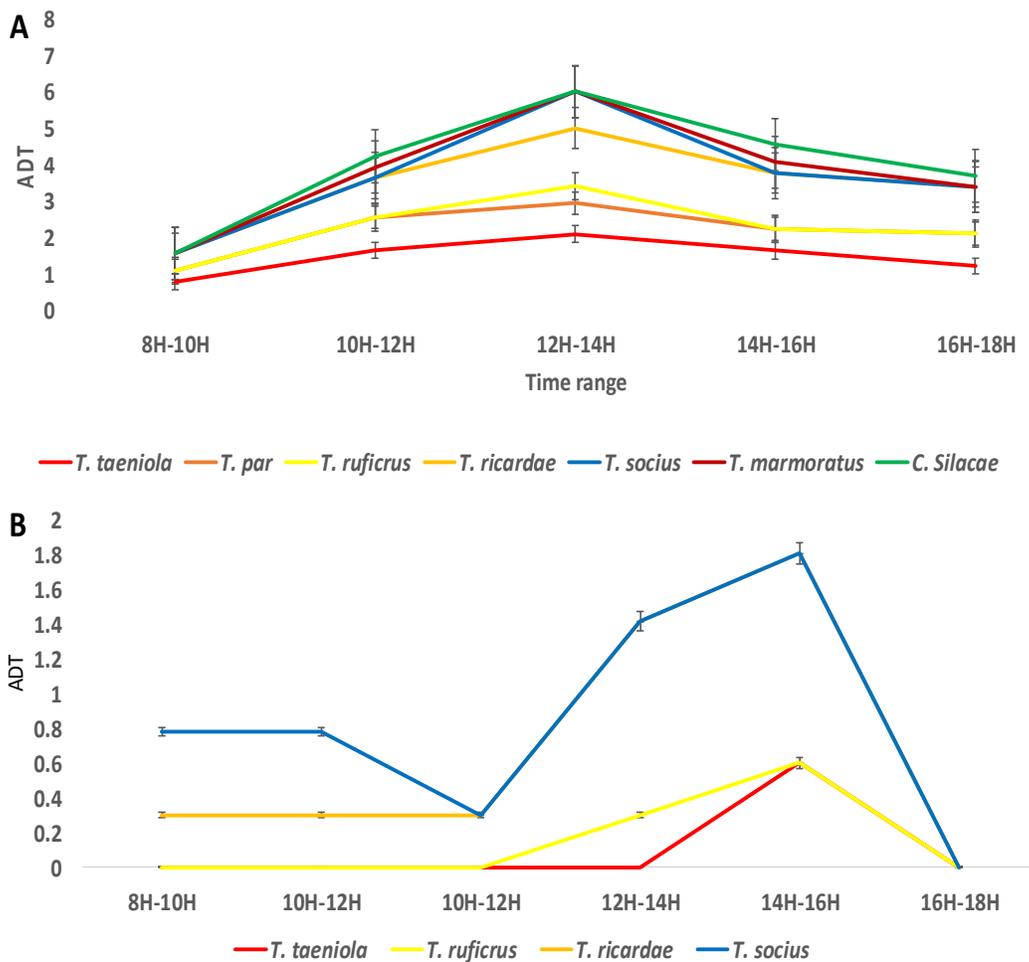


Fig. 3. Diurnal activity of tabanids with respect to site A(INP) and B (village-town)

Mavoungou et al. [7]. This difference could be related to the discrepancies in the trapping efforts. In total, 16 species of tabanids were identified and represented 22.5% of known species of Central Africa [17]. This low species richness in the present study could be related to the type of trap used. Because Mihok [18]; Acapovi [19] rather revealed that the Nzi trap was an efficient trapping system for tabanids. The Vavoua trap was used in this study for budgetary reasons i.e. it is cheap even though not efficient as compared to Nzi which is very expensive.

The tabanid species composition and ADT was higher at the INP trapping points as compared to the man-made areas. This difference in tabanid species composition and number has been reported for these type-localities [7]. The high ADT of tabanids at the INP could be linked to the favourable environmental factors such as ambient temperature, relative humidity, rainfall and high host density [1] prevailing in the site that fostered the high development and survival of this group. It was interesting to find out that during the prospection period, *C. silacae* and *C. dimidiata* were only caught by traps set-up in the secondary forest of the INP and never caught by traps fixed at the Village-Town sites. The presence of the two species of Chrysops which are main vectors of *Loa loa* filariasis [5] indicates the risk of the transmission of the parasite to the human population frequenting the INP as well as the adjacent villages.

The peak of activity of tabanids followed a unimodal pattern and occurred at different diurnal time ranges in the INP (12-14H) and Village-Town (14-16H). This result is like that obtained by Acapovi [20] who showed a unimodal activity peak for tabanids in the mentioned periods. The high tabanid abundance in the various diurnal time intervals could be related to the prevailing meteorological factors (ambient temperature, wind speed and relative humidity) during such periods that favoured their activity in the prospected sites. The mentioned weather variables have been shown to be the main modulators of the activity of tabanids [1] and such conditions are optimal between 14 to 16H [20].

5. CONCLUSION

The genus *Tabanus* was highly represented at the INP trapping sites with 8 species (with *Tabanus taeniola* as the most abundant species)

and less represented in anthropized environment with 4 species (with *T. ricardae* as the most abundant species). Three species notably *Chrysops dimidiata*, *Chrysops silacae* and *Haematopota pluvialis* were only identified in the secondary forest of the INP. The peak activity of tabanids in the Village-Town sites occurred between 14-16H while that at the INP occurred between 12-14H.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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