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Diversity and Abundance of Insects at the Campus of Higher Polytechnic Institute of Manica, Mozambique

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

The aim of this study was to assess insect diversity and abundance at the Campus of Higher Polytechnic Institute of Manica, Mozambique. Collection of insects was carried out by pitfall traps a long linear transects and sweep nets during 21 days of October 2019. Data were analyzed using descriptive statistical and Shannon diversity index. A total of 1780 individuals of insects belonging to 8 orders, 15 families and 27 species were collected. Highest relative abundance was observed in Hymenoptera order (92.64%), and the least were Blattodea (2.70%), Diptera (2.13%), Coleoptera (0.82%), Orthoptera (1.52%), Phasmatodea (0.06%), Mantodea (0.28%) and Hemiptera (0.11%). The abundant specie was *Crematogaster peringueyi* (Hymenoptera) with 89.83% follwed by *Macrotermes natalensis (Blattodea)* and *Chrysonmya chloropyga* (Diptera) with 2.47% and 1.63% respectively. Higher insect diversity was observed in Orthoptera order (Shannon, H'=1.76), while the orders Coleoptera, Diptera, Hymenoptera, Blattodea, Phasmatodea, Hemiptera, had the lowest diversity (Shannon, H'<1). Further work need to be done in the study area, expanding the duration of the study and applying diversity sampling techniques.

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1. INTRODUTION

According to [1], in most habitats and ecosystems, the major components of animal diversity are the insects, they are adjudged the most diverse and largest group of organisms [2]. They make up more than 58% of the known global diversity. They can be found in various types of habitats and contribute to functions and stability of ecosystem [3]. Insects intervene in many biological processes: nutrient recycling, seed dispersal, and pollination, which contribute in an important way to maintaining the diversity and functioning of the majority of terrestrial ecosystems [4,5].

Insects inhabit all habitat types and play major roles in the function and stability of terrestrial and aquatic ecosystems [3].

However, there is poor dissemination, sharing and use of results of scientific research done in this area in Mozambique. The absence of information on the diversity of insects in national publications also noted in officials documents.

The objective of this study was to assess insect diversity and abundance at the campus of Higher Polytechnic Institute of Manica, Mozambique.

2. MATERIALS AND METHODS

The campus of Higher Polytechnic Institute of Manica (19° 3' 0"S; 33° 24' 0"E) is located at Vanduzi district, in Manica province, about 15 km from Chimoio city, has 400 hectares of land.

The climate is humid; the mountainous registers the annual levels in the order of 1000 and 1020 mm of rain [6]. In general, the distribution of rainfall is uneven throughout the year, observing the existence of two distinct seasons, a rainy season and drought. The rainy season starts in November and ends in April. Evapotranspiration is an annual measure of 1220 - 1290, which is higher than the average value of annual abstraction. Annual average of 21.2°C [7].

The Manica region is drained by the Revue river and its tributaries, which in turn drains its waters into the river Buzi which is the main watershed. The soils of Manica district show a close relationship with the geology and climate of the region, and are locally modified by topography and water regime, in general, they are basically deep, well-drained red or reddish red or brown clay soils. In addition to amphibians and reptiles, the fauna comprises small mammals (*Rattus rattus* Linnaeus, 1758; *Lepus saxatilis* Cuvier, 1823; *Paraxerus palliates* Peters, 1852; *Heliosciurus mutabilis* Peters, 1852), and birds. The vegetation consists mainly of grasses and plants such as (*Pennisetum purpureum* Schumach, 1827; *Panicum maximum,* Jacq 2003, *Cynodon dactylon* Linnaeus, 1775*; Hyparrhenia rufa* Nees, 1855; *Mangifera indica* Linnaeus, 1775; *Acacia ataxacantha* DC, 1778; *Lantana camara* Linnaeus, 1775*; Acacia nigrescens* Oliv, 1875; *Eucalyptus camaldulensis* Dehnh. 1832; *Kigelia Africana* DC, 1778 and *Acacia burkey* Benth, 1846).

2.1 Data Collection Techniques

2.1.1 Pitfall traps

These traps collect ground dwelling insects [8]. Twenty two pitfall traps where placed at line transects in study area. Each pitfall trap was consisted of 200 ml capacity plastic container were buried so that the top was flushed with the ground surface and filled with 4 cm of dishwashing soap and water solution to prevent escape by captured insects. Collection of insects was carried out by pitfall traps a long linear transects during 21 days and inspected after 24 hours and pitfall traps were visited every morning (9am) and afternoon (3pm) to collect any insect captured.

2.1.2 Sweep nets

This method is suited for sampling insects from ground layer vegetation [9]. The sweep nets were done during the morning from 8am to 11am three times a week along predetermined transects. The insect collected were temporarily transferred in the plastic bottles before taken to the laboratory for identification and preservation.

2.2 Identification of Insects

The insects collected were taken to the Laboratory of Biodiversity of Higher Polytechnic Institute of Manica for identification and preservation in the 70% ethyl alcohol. The identification was based on caparison using Field Guide to Insects of South Africa [10]. Also we used keys provided by [11].

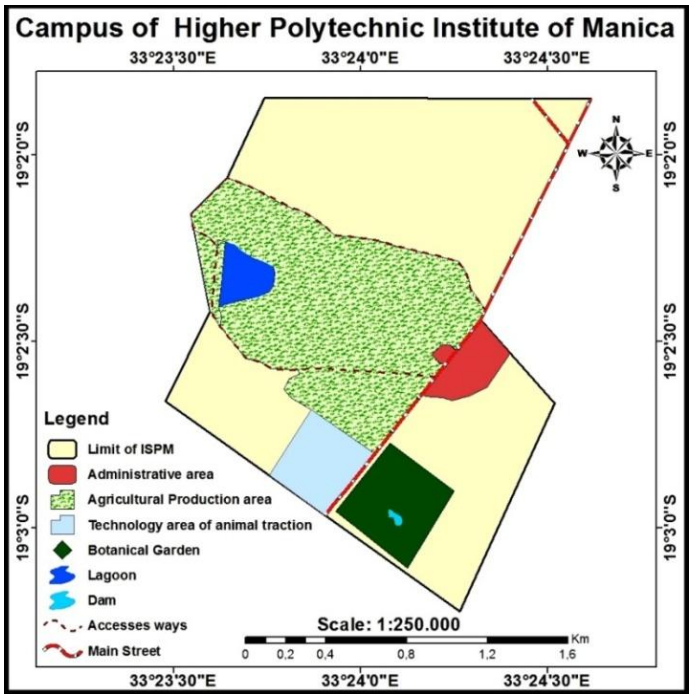

Fig. 1. Map of campus of Higher Polytechnic Institute of Manica

2.3 Data Analysis

Identified insects species were grouped into order, family and species. Data were analyzed using descriptive statistical and Shannon diversity index using the following equation:

$$H' = -\sum_{i=1}^{S} p_i \ln p_i$$

pi is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N), ln is the natural log, Σ is the sum of the calculations, and is the number of species [12]. The proportion of species relative to total number of species (pi) was calculated, and multiplied by natural logarithm of this proportion (lnpi). The results were summed across the species, and multiplied by-1.

3. RESULTS

A total of 1780 specimens of insects belonging to 8 orders, 15 families and 27 species were collected. In this study the highest relative abundance was observed in Hymenoptera order (92.64%), and the least were Blattodea (2.70%), Diptera (2.13%), Orthoptera (1.52%), Coleoptera (0.82%), Mantodea (0.28%), Hemiptera (0.11%) and Phasmatodea (0.06%).

The study showed that the abundant specie was *Crematogaster peringueyi,* Emery, 1895 (Hymenoptera) with 89.83% followed by *Macrotermes natalensis,* Havilans, 1898 (Blattodea) and *Chrysonmya chloropyga,* Wiedemann, 1818 (Diptera) with 2.47% and 1.63% respectively. The higher insect diversity was observed in Orthoptera order (Shannon, H'=1.76), while the orders Coleoptera, Diptera, Hymenoptera, Blattodea, Phasmatodea, and Hemiptera, had the lowest diversity (Shannon, H'<1).

4. DISCUSSION

A total of 8 orders, 15 families and 27 species were collected in the study area. The result of this study showed that the highest insect diversity was observed in Orthoptera (H'=1.76) although, is important to mention that the Hymenoptera order was most abundant. According to [5], the Hymenoptera is one of the four great orders with over 300.000 species as a conservative world total. In terms of individual numbers, we got many *Crematogaster peringueyi* (1599), this value can be related to the acacia tree and nest around collection site.

Table 1. Diversity and abundance of insects in the study area

Order	Family	Genus/specie	Abundance	Relative abundance (%)
Coleoptera	Scarabaeidae	*Hypopholis sommeri* Burmeister,1855	1	0.06
		Thermpohilum homoplatum Lequien,1833	1	0.06
Coleoptera	Tenebrionidae	*Anomalipus elepha* Fahraeus, 1870	2	0.11
		Gonocephalum simplex Fabrícius, 1801	4	0.22
		Tenebrio molitor Linnaeus, 1758	1	0.06
		Agelia peteli Gory, 1840	1	0.06
Diptera	Muscidae	*Musca domestica* Linnaeus, 1758	9	0.51
	Calliphoridae	*Chrysonmya chloropyga* Wiedemann, 1818	29	1.63
Hemiptera	Pyrrhocoridae	*Dysdercus nigrofasciatus* Linnaeus, 1758	1	0.06
		Cenaeus carnifex Fabrícius 1775	1	0.06
Hymenoptera	Formicidae	*Messor capensis* Mayr, 1862	20	1.12
		Myrmicaria natalensis Smith, 1858	15	0.84
		Pachycondyla tarsata Fabricius, 1798	15	0.84
		Crematogaster peringueyi Emery, 1895	1599	89.83
Mantodea	Thsepidae	*Hoplocoryphella grandis* Brancsik, 1895	3	0.17
	Mantidae	*Galinthias amoena* Saussure, 1871	1	0.06
	Thsepidae	*Hoplocorypha macra* Stal, 1856	1	0.06
Orthoptera	Gryllidae	*Teleogryllus wernerinus* Karny, 1907	3	0.17
		Gryllus bimaculatus De Geer, 1773	9	0.51
		Acanthogryllus fortipes Walker, 1969	4	0.22
		Cophogryllus maindroni Chopard, 1928	5	0.28
	Anostostomatidae	*Onosandrus splendens* Sjöstedt, 1913	2	0.11
	Pamphagidae	*Lamarckiana cucullata* Stoll, 1813	1	0.06
	Acridae	*Truxalis burtti* Fabricius, 1775	3	0.17
Blattodea	Blaberidae	*Macrotermes natalensis* Havilans, 1898	44	2.47
		Aptera fusca Thunberg, 1784	4	0.22
Phasmatodea	Heteronemiidae	*Zehntneria mystica* Wattenwyl, 1907	1	0.06
8	15	27	1780	

Table 2. Diversity indices and abundance between orders

Nr	Order	Species	Abundance (%)	Shannon (H')
1	Coleoptera	7	10 (0.56)	0.82
2	Diptera	2	38 (2.13)	0.54
3	Hemiptera	2	2 (0.11)	0.69
4	Hymenoptera	4	1649 (92.64)	0.16
5	Mantodea	3	5 (0.28)	0.00
6	Orthoptera	7	27 (1.52)	1.76
7	Blattodea	2	48 (2.70)	0.29
8	Phasmatodea	1	1 (0.06)	0.00
	Total	27	1780 (100)	

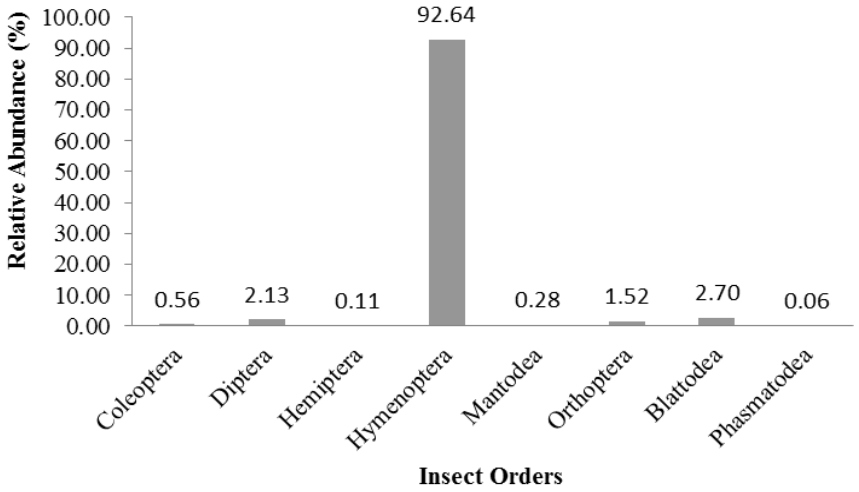

Fig. 2. Relative Abundance of insect orders

Similar results were found at the study of [1], the diversity indices of the orthoptera order had the highest Shannon diversity index (H' =2.438). The results showed that the higher abundance of insects was observed in Hymenoptera order. This finding is in contrast with [13] who reported Lepidoptera as the dominant insect Order in Gulbarga District, Karnataka, India.

5. CONCLUSIONS

The study of diversity and abundance of Insects at the campus of ISPM revealed high insect diversity. The result we present in this study is the first has done at the campus of ISPM, surely will provide baseline information on the diversity of insects at the ISPM campus. However, further studies should be done in different annual seasons and using different sampling techniques.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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