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Research Article

TERRESTRIAL MACROFAUNA OF THE DEVELOPED PLAINS OF THE MAYA-MAYA AIRPORT OF BRAZZAVILLE

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Abstract

In order to know the existing macrofauna of the developed plain of the Maya-Maya airport and to master the different invertebrate families that compose it. An environmental study on this macrofauna has been undertaken. The richness in these various fluctuations has been shown. This study allowed us to inventory 817 individuals belonging to 30 species, 9 genera, 37 families distributed in the manner divided into 17 orders, 5 classes and 2 branches. The family most represented as individuals is the Formicidae, i.e. 1747 ind / m2 in plot 4, followed by Blattelidae represented by the species Blattela Germanica 1188 ind / m2 in plot 2. This study allowed us to know the initial state of the macrofauna of the developed plain of the Maya-Maya international airport in Congo Brazzaville and to have an idea of the continental macroinvertebrates found in these environments.

Keywords: Macrofauna, Maya-Maya Airport, Plain, Wealth.

INTRODUCTION

Maya-Maya International Airport in Brazzaville is the largest airport in Congo. Its international code (IATA code) is BZV. Built in 1949 to the north-west of the old center of Brazzaville in the middle of an area at that time mainly forest, it has continued to see an increase in its air traffic of passengers and freight ever since. New neighborhoods have developed around it over time. Completely modernized and extended between 2010 and 2015, it is today one of the most modern airports on the continent. Its new terminal with a futuristic design, made of concrete, glass and steel, has a total area of 44,500m² and can accommodate more than 2 million passengers each year. The new telescopic gangways now allow fast and safe boarding and disembarking for passengers arriving and departing from Brazzaville. The largest latest generation aircraft such as the Airbus A380 can now fly to the Congo (https://www.aeroport-brazzaville.com/fr/aeroport_ international_de_brazzaville.php). As part of the certification process for Congo's airports, AERCO, through its DQSSE, undertook an environmental study on the macrofauna present in the landscaped plain housing the aircraft landing strip of the Maya-Maya International Airport. To this end, a study on the knowledge of invertebrates visible and identifiable with the naked eye was undertaken. Description of the initial state of this invertebrate macrofauna. In fact, habitat alteration and human-induced disturbances can lead to changes in the diets of wildlife species, behavior, vulnerability to zoonoses, as well as their abundance and distribution. These changes can have an impact on their short, medium and long term survival (IUCN, 2012). Furthermore, a relative abundance of macrofauna in the airport enclosure or its periphery may directly or indirectly compromise the normal performance of airport activities carried out by the company AERCO and other users of these environments.

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METHODOLOGY

Collection of biological material in the field

A period from July 15 to September 9, 2019 had made it possible to collect biological material within the study area. We worked on seven (7) plots distributed in the airport concession on the airside. Each plot had an area of 625 m2 or 25 m on a side. The choice of plots was made according to the accessibility of the environment and the vegetation found there. The following figure shows the arrangement of the sample plots at the level of the Maya-Maya developed plain. The sampling of the biological material took place in two main stages, which are mowing and trapping. On the one hand, a plot had nine (9) sampling or trap areas. The traps were distributed uniformly in all the plots. The trapping on the ground consisted of plastic cans cut on the upper part containing Casanova brand red wine as an attractive liquid. The open surface of the canister was 4.5cm in radius with a depth of 15cm. Trapping allowed us to collect the insects that wander on the ground (Coleoptera: Carabids, Staphylinids, Cerambycidae, Curculionidae, Tenebrionidae, etc.) the results being however different if the cans contain an attractive liquid of another nature. Setting up the trap consisted of digging a hole that could contain the trap, then placing the cut plastic bottle on its top into the hole. The soil was carefully packed around and then poured about 0.1 liter of attractant liquid into the container. After the liquid was spilled, three rods were pricked around the trap and then placed another larger plastic container on the rods to support the roof in inclement weather (Figure 2). The trap lasted twenty-four hours (24) underground and was raised the day after. When the traps are collected, the individuals drowned in the wine are sieved and sorted on a small mesh colander to finally be placed in a tin containing 70 ° alcohol. Figure 4 illustrates the arrangement of traps in a plot. On the other hand, in the course of this work, mowing using a mowing net was also the subject of one of the sampling methods used.

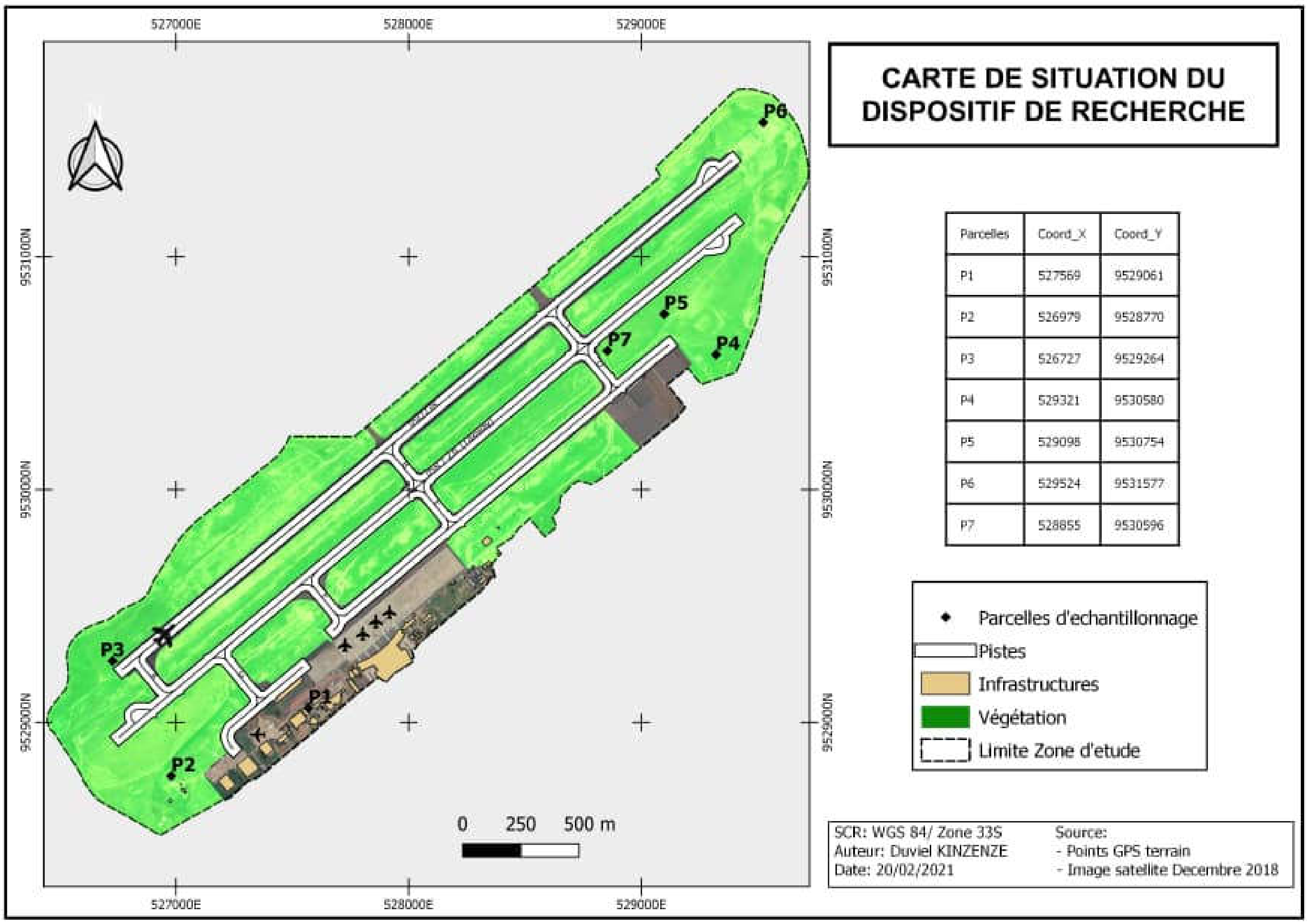


Figure 1. Data collection device

Figure 2. Invertebrate trap

As its name suggests, this net is used to mow the herbaceous, tree and shrub layer when they are at a mowing height. The mower net in action sweeps the vegetation with rapid movements from left to right, covering an area of one meter times twenty-five (1m × 25m), (Figure 3). The net consisted of three parts: the circle, the pocket and the handle. The circular shaped "circle" measured about 30 cm in diameter. It is made of iron, The pocket is made of standard mosquito net tulle. Mowing in the field was carried out in the 625m2 plots, the 25m transects along each side of the plots made it possible to mow the four (4) sides of each plot. Figure 3 shows us the mowing transects in a plot. Visual or selective sampling allowed us to complete the list of individuals in the surveys for each plot. The time required to complete the mowing sample was two (2) hours in a plot.

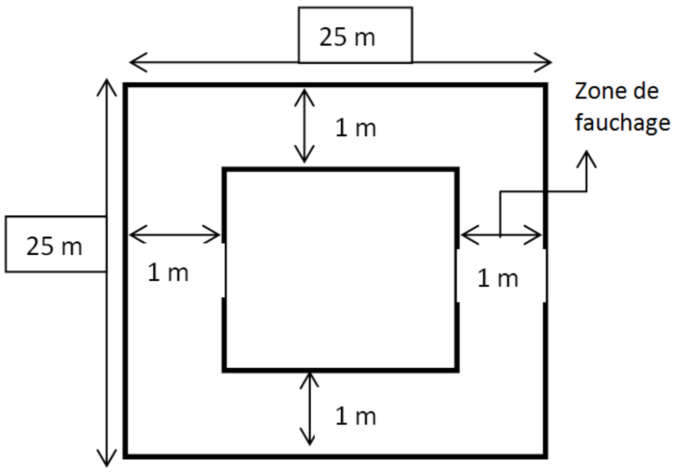


Figure 3. Transects de fauchage dans une parcelle

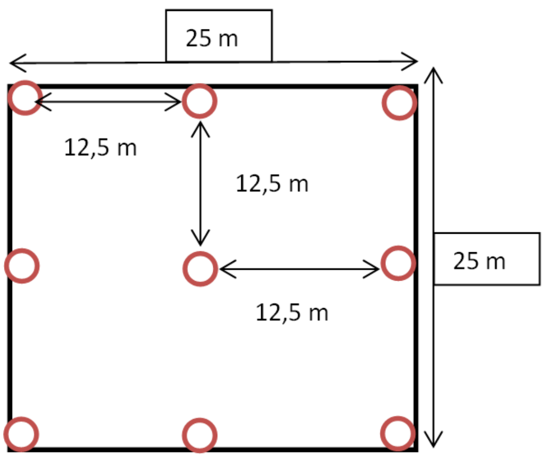


Figure 4. Disposition des pièges dans une parcelle

Data processing

Density and richness of environments

To determine the density of the fauna (number of individuals per m²), we carried out a count. The density is the average number of individuals of the different taxa collected at the level of the plots reduced to the square meter (m²). The average number of individuals is calculated by dividing the total number of individuals in the block by the number of plots. This average is reduced to the square meter. (Tamsire *et al.*, 2017). The use of the mower net and traps allowed quantitative and qualitative sampling. It was therefore possible to calculate the densities per unit area. The following formula made it possible to calculate the densities in the hay net and in the trap.

$$D = \frac{\text{Nomber of individuals}}{\text{Nomber of samples} \times \text{Area(trapped/swathed)}} (N/m^2) \text{Eq.(1)}$$

To detect any influence on animal distribution and stand composition (Mbete et *al*, 2020).

RESULTS

Macroinvertebrates or macroinvertebrates are all animals visible to the naked eye (generally larger than 0.5 mm) and which do not have a skeleton.

Richness and structure of the stands studied

Taxonomic composition: The field assessment allowed us to collect 817 individuals belonging to 30 species, 9 genera, 37 families distributed as follows: 17 orders, 5 classes and 2 branches. All the taxa collected are presented in Table 1.

Two branches were harvested:

- ✓ The Mollusca (Molluscs) phylum, made up of a class Gastropoda, an order (Stylommatophora), a family (Achatinidae) and a species (Achatina Fulica).
- ✓ The branch of Arthropoda (Arthropods), formed of 4 classes (Insects, Arachnida, Chilopoda and Diploda) with:
  - The class of Insects includes 12 orders, 32 families, 9 genera and 27 species,
  - The Diploda class includes 2 orders, 2 families, 1 genus and 1 species,
  - The class of Arachnida less rich in individuals includes only one order (Araneae),
  - The Chilopoda class includes 1 order, 1 family and a genus.

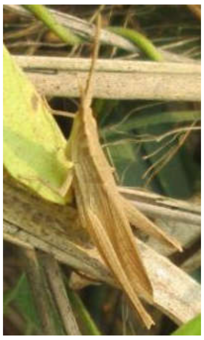
Taxonomic abundance

Figure 6 shows the importance of different classes in families. This figure reveals that the class of insects is the richest with 86.49% of the taxa encountered. The Diploda class with 5.41% While the three (2) other classes (Diploda, Chilopoda and Arachnida) represent respectively 2.70%, 2.70% and 2.70% of the taxa. Among all the branches, that of Arthropods with 80% is the richest in class. The Molluscs phylum represents only 20% of taxa.

Abundance by family of the different orders of Arthropods

Figure 7 shows that, the order Hymenoptera formed from families (Sphecidae, Halictidae, Crabonidae, Apidae, Formicidae) and the order Orthoptera formed from families (Pyrgomorphidae, Gryllidae, Acrididae, Tettigonoiidae, Gryllotalpidae) are the most representative of our samples with 13.51% of taxa collected by order. Lepidoptera, made up of the families (Nymphalidae, Pieridae, Lycaenidae, Sphingidae) and Coleoptera (Tenebrionidae, Cetonidae, Coccinelidae, Scarabaeidae) each represent 10.81% of cross taxa. The orders which follow those previously mentioned are those of the Hemiptera (Coridae, Pyrrhocoridae, Alydae) and of the Diptera (Muscidae, Sarcophagidae Calliphoridae) each represent 8.11% of the taxa encountered.

***Nomadacris Septemfasciata* (Acrididae)**



***Parga cyanoptera* (Acrididae)**

***Pyrgomorpha vignodii* (Pyrgomorphidae)**

***Chrotogonus senegalensis* (Pyrgomorphidae)**

***Onychostylus Sp* (Blattellidae)**

***Scolopendra sp* (Scolopendridae)**

Nid Adulte De *Cubitermes Sp* (Termitidae)

Aeranea Sp

***Larra bicolor* (Crabronidae)**

Figure 5. Some Crossed Macroinvertebrates.

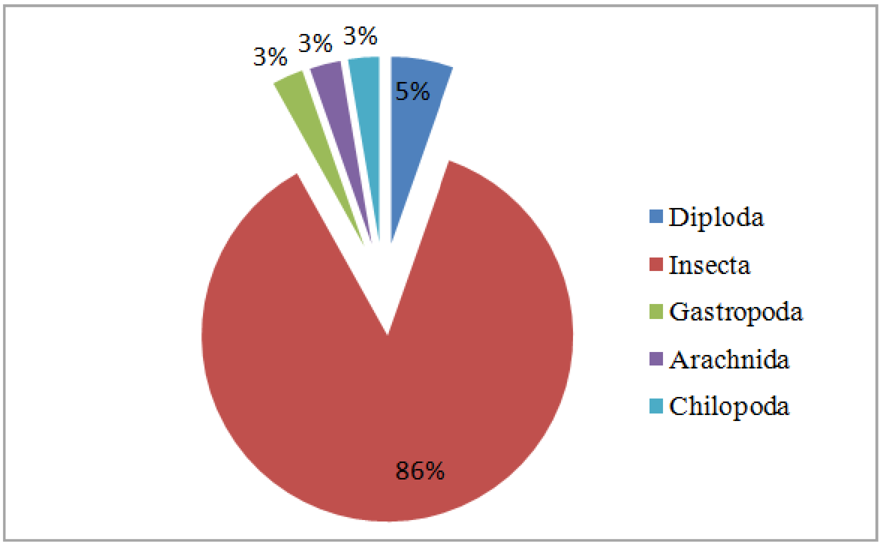


Figure 6. Abundance by family according to different classes

Table 1. Systematic composition of the fauna of the inventoried macro invertebrates

Phylum	Class	Order	Family	Species
			Coreidae	*Anoplocnemis Curvipes*
		Hemiptera	Pyrrhocoridae	*Dysdercus sp*
			Alydidae	*Alydidae sp*
				Pyrgomorpha vignaudii
			Pyrgomorphidae	*Chrotogonus Senegalensis*
				Atractuomorpha Acutipensis
			Gryllidae	*Acheta Domesticus*
				Brachytrupes sp
		Orthoptera		*Acrida Bicolor*
				Acanthacris Ruficornis
			Acrididae	*Nomadacris Septemfasciata*
				Parga Cyanoptera
				Oedaleus Decorus
			Gryllotalpidae	*Gryllotalpa Africana*
			Tettigonoidae	*Phaneroptera Nana*
		Odonata	Libellulidae	*Orthetrum Brunneum*
			Calliphoridae	*Calliphoridae sp*
		Diptera	Muscidae	*Musca Domestica*
			Sarcophagidae	*Sarcophaga Sp*
			Sphecidae	*Sceliphron Spirifex*
				Ammophilia Beniniensis
	Insecta		Halictidae	*Sphecode Ruficrus*
		Hymenoptera	Crabonidae	*Larra Bicolor*
Arthropoda			Apidae	*Xylocopa Appendiculata*
				Xylocopa Violacea
			Formicidae	*Anochetus Sp*
				Mirmica Sp
			Empusidae	*Idolomorpha Lateralis*
		Mantodae	Mantidae	*Mantis Religiosa*
				Tenodera Sp
		Isoptera	Termitidae	*Cubitermes SP*
			Sphingidae	*Sphingidae sp*
		Lepidoptera	Nymphalidae	*Junonia Oenone*
			Lycaenidae	*Luthrodes Pandava*
			Pieridae	*Eurema brigitta*
			Coccinellidae	*Cheilomenes sulphurea*
		Coleoptera	Tenebrionidae	*Lagria Cuprina*
			Scarabaeidae	*Scarabaeidae sp*
			Cetonidae	*Protaetia Sp*
		Blatodea	Blattellidae	*Blattela Germanica*
				Onychostylus Sp
			Blaberidae	*Pycnoscelus Surinamensis*
		Neuvroptera	Myrmeleontidae	*Myrmeleontidae Sp*
		Dermaptera	Forficulidae	*Forficulidae Sp*
	Arachnida	Araneae	Araneae sp	
	Chilopoda	Scolopendromorpha	Scolopendridae	*Scolopendra sp*
	Diploda	Julida	Julidae	*Cylindroiulus Punctatus*
		Glomerida	Glomeridae	*Glomeridae Sp*
Mollusca	Gastropoda	Stylommatophora	Achatinidae	*Achatina Fulica*

The other orders are poorly represented, notably the orders of Mantodae (Mantidae, Empusidae) and Blatodea (Blattellidae, Blaberidae) which each represent 5.41%. The orders very little represented, representing 2.70% each are:

- The Order of Stylommatophora formed from the Achatinidae only;
- The order of Julida represented by the julidae;
- The Order of Neuvroptera formed from Myrmeleontidae;
- The order Odonata represented by Libellulidae;
- The Order of Dermaptera formed by Dermapteridae;
- The order Scolopendromorpha formed by the Scolopendridae.

Distribution of families by plots

Plot 5 followed by plots 1, 6, and 7 has the highest number of families sampled by mowing and trapping and plot 7 has the smallest numbers at all other plots. On the other hand, with trapping, it is plot 2 and 1 have the highest number of families. Plot 7, it has the lowest number in family. Figure 8 shows the number of families sampled per plot.

Abundance of individuals per plot, all taxa combined

Figure 9 illustrates the predominance of the number of individuals sampled by trap and by mowing. Plot 4 with 220 individuals harvested by trap and by mowing is the plot most represented in individuals. The macroinvertebrates collected by traps in this plot are dominated by Formicidae which represent 45.45% of individuals consisting of the genera, Anochetus sp (58%) and Formicidae sp (42%). The dominance of Formicidae is followed by the family Blattellidae (Blattella Germanica) in this plot which represents 25.45% and Blaberidae (Pycnoscelus Surinamensis) which represents 14.1% of individuals. The rest of the families in this plot (P4) are less represented in individuals. The P2 plot is the second richest plot in individuals with the Blattellidae (36.96%) as the dominant family represented by a single Blattella Germanica species. The Blaberidae family with 27.72% of individuals is represented only by the species Pycnoscelus Surinamensis.

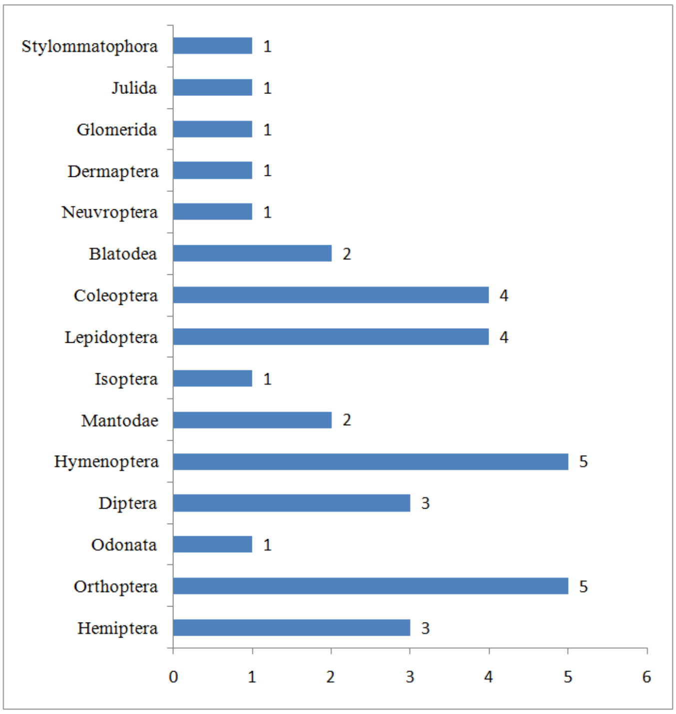


Figure 7. Family abundance of the different orders

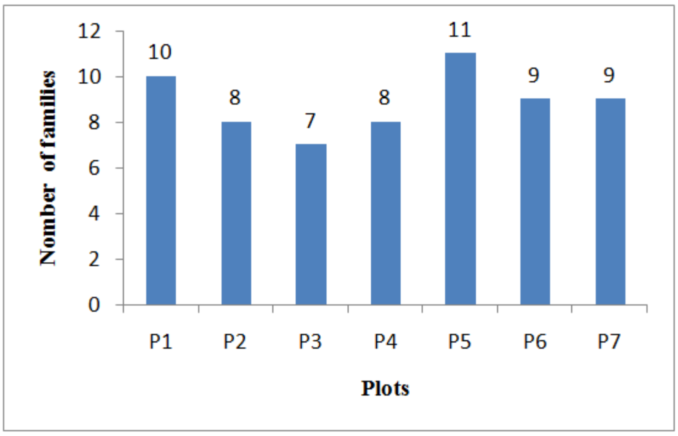


Figure 8. Number of families per plot

Plot P3 dominated by Pycnoscelus Surinamensis (Blaberidae) which represents 58% of the individuals collected in this plot followed by Formicidae sp are the most representative individuals in this plot. The invertebrates collected in P1 are dominated by the Blaberidae family (Pycnoscelus Surinamensis) which represents 35.71% of individuals harvested, followed by Blattellidae (Blattella Germanica) with 28.7% and formicidae sp 16.52%. Plot P5 dominated by Formicidae (53.47% of individuals harvested), followed by Acridae sp 14.85% of individuals. The invertebrates captured in plot P6 are dominated by the family of Blaberidae formed by Pycnoscelus Surinamensis 32.73% of individuals collected. After the family of Blaberidae, it is the family of Blattellidae (Blattella Germanica) that follows, the other families are only very poorly represented. The invertebrates collected in plot P7 by mowing are the weakest in individuals. The individuals represented in this plot are dominated by Pyrgomorphidae 22.73% formed of the species Chrotogonus Senegalensis (60%) and Pyrgomorpha Vignaudii (40%). The Acrididae sp are the second family most represented in individuals in this plot. The Formicidae, Lycaenidae, Pieridae, Mantidae, Coccinelidae, Nymphalidae are very little represented in individuals. The least represented plot in macroinvertebrates is plot 7 with 22 individuals. Populations low in individuals are observed in the plots (P7, P6, P5) (Figure 9).

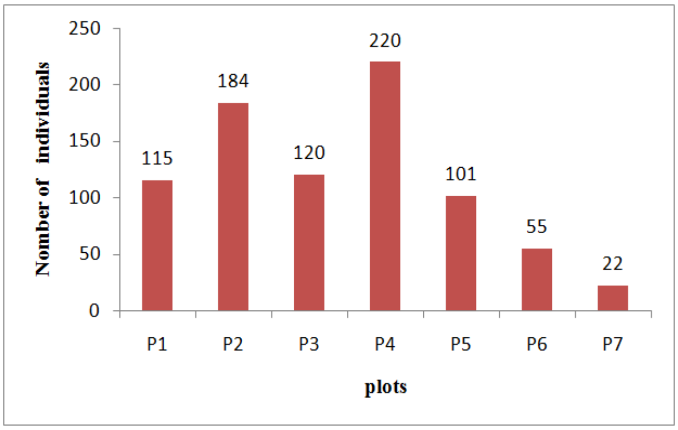


Figure 9. Global numerical abundance

Density of individuals per plot

The average densities of individuals, all taxa combined, per plot and per unit area. The highest density is observed in plot 4 with a density of 102 indi / m2 followed by plot 2 (87 indi / m2) and plot 3 with 57 indi / m2. On the other hand, the lowest densities are observed in plot 1, 5 and 6. Plot 1 with 51 ind / m2, plot 5 and 6 each with 48indi / m2 respectively are the plots less represented in individuals. The lowest densities observed in these plots are, its doubt due to regular grass cutting operations in these areas and to the quality of the vegetation found in these plots. Figure MM illustrates the densities of the sampled individuals.

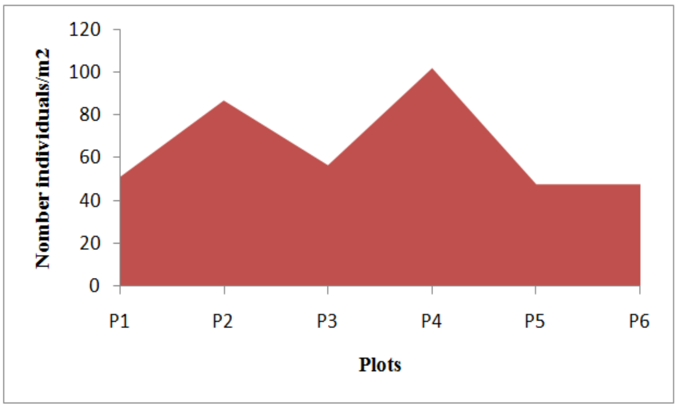


Figure 10. Numerical abundance by station and by trapped area

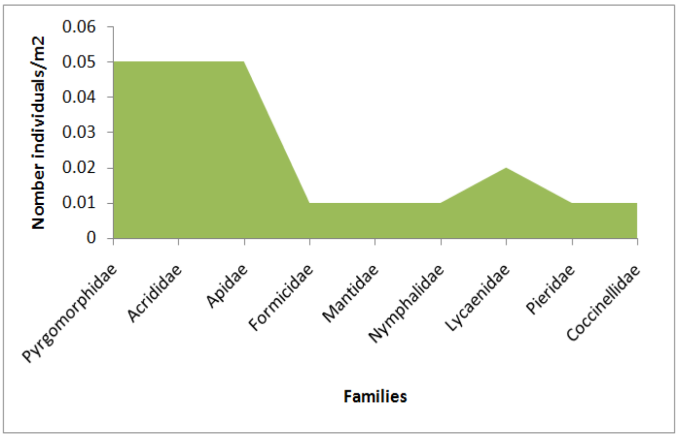


Figure 11. Abundance of taxa per mown area

The densities of individuals per mowing found in plot 7 are distributed as follows; the Pyrgomorphidae, Acrididae and Apidae families are the most represented in this plot with respectively 0.05 ind / m2 each. Besides the most represented families we observe in figure 18 the families of Formicidae (0.01 indi / m2), Mantidae (0.01 indi / m2), Nymphalidae (0.01indi / m2), Pieridae (0.01 indi / m2) / m2), Coccinellidae (0.01indi / m2) and Lycaenidae (0.02 indi / m2). This low number of individuals is the cause of grass cutting operations and the peak of the dry season at this time. The type of vegetation found at this location prevents a proliferation of the individuals observed.

DISCUSSION

Appearing more than 400 million years ago, insects are the oldest animals to have adapted to terrestrial life by becoming amphibians, and they are one of the rare terrestrial organisms to resemble their ancestors (taxonomic stability). They are also the first complex animals to have developed the ability to fly in order to move, being for 150 million years the only ones to have this means of locomotion (Johnson *et al.,* 2004). Equipped with wings, a rigid exoskeleton, a small size, a high reproductive potential and a pupal stage of metamorphosis, these factors favoring the colonization of many ecological niches explain their evolutionary success. They are now found in almost all climates and in continental terrestrial and aquatic environments. Only the sea has not been colonized (Poinsot *et al.,* 2018), Insects constitute 55% of species biodiversity and 85% of animal biodiversity defined by the number of species. (Mawdsley *et al.,* 1995). The taxonomic composition indicates that the major groups of organisms collected during this study are: Arthropods with 66% richness by class, Molluscs and Annelids represent only 17% and 17% of taxa. It therefore appears at the level of all these plots that the branching of Arthropods is the most important in families and individuals. Several factors influence the spatial distribution of terrestrial macroinvertebrates. Among the most important, the climate, vegetation, soil texture. Among Arthropods, the class of insects is the most represented in terms of orders than those of Scolopendromorpha, Arachnida, Diploda, Clitellata and Gastropoda. This is because insects represent the largest order of animals on the planet and are found in almost all ecosystems. Insects are the oldest animals to have adapted to life on earth by becoming amphibians, and they are one of the few terrestrial organisms to resemble their ancestors (taxonomic stability). They are also the first complex animals to have developed the ability to fly in order to move, being for 150 million years the only ones to have this means of locomotion (Norman *et al.,* 2004). Although he worked in an aquatic environment, (Mbete *et al.,* 2020) affirms that Among Arthropods, the class of insects is the most represented in terms of orders than those of Crustaceans, Gastropods and Oligochaetes in the Lagoon. Loya in Pointe-Noire. Knowing the density of a population is an essential demoecological parameter. Density is expressed as a number of individuals relative to the unit area or volume, the latter being chosen taking into account the greater or lesser abundance (Ramade, 1982). In this work, density is expressed as a number of individuals relative to the unit area. The number of individuals / m2 / plot during our study was dominated by the Formicidae family, ie 1747 ind / m2 in plot 4. The Blattelidae represented by the species Blattela Germanica 1188 ind / m2 in plot 2, followed of Blaberidae 1206 ind / m2 represented only by the species Pycnoscelus Surinamensis. The lowest densities were found in Alydidae 17 ind / m2, Cetonidae 17 ind / m2 and Scolopendridae ind / m2 in plot 6. Myrmeleontidae, Sphecidae and Muscidae each representing 17ind / m2 in plot 5.

Conclusion

As a result, the developed plain of Maya-Maya Airport in the city of Brazzaville is one of the busiest international airports in Congo. Its geographical location in the heart of the city, its place in the country's international airports allows for an inventory study of the macrofauna of its airport concession. The inventories carried out for this study make it possible to identify a very large majority of species of fauna (continental macroinvertebrates), but it is possible that certain species have not been observed and identified. On the other hand, the pressure of the field inventories is sufficient for a fairly reliable expertise for an additional study on these compartments. An inventory of continental macroinvertebrates was carried out there by sampling on seven (7) plots, various species of fauna.
This work made it possible to collect 817 individuals of continental macroinvertebrates belonging to 30 species, 9 genera, 37 families distributed as follows: 17 orders, 5 classes and 2 branches. The taxonomic composition indicates Arthropods with 80% richness per class, Molluscs only represent 20% taxa. The highest densities were observed in Formicidae, i.e. 1747 ind / m2 in plot 4. Blattelidae represented by the species Blattela Germanica 1188 ind / m2 in plot 2, followed by Blaberidae 1206 ind / m2 represented only by the species Pycnoscelus Surinamensis. This study allowed us to make an inventory of the fauna in the Maya-Maya airport concession, it also allowed us to know in a quantitative and qualitative way the different species. The results of this work were obtained from data collected during the dry season. It would be interesting to take other samples during the rainy season in order to follow the evolution of diversity following an annual cycle.

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REFERENCES

Johnson, N. and Triplehorn, C, A. 2004. Introduction to the Study of Insects 7th, Brooks/Cole, 888 p. (ISBN 978-0030968358)

Mawdsley, N. and Stork, N. 1995. Species extinctions in insects: ecological and biogeographical consideration. In : Insects in a changing environment, eds Harrington R. and Stork N, Academic Press. Pp. 321–369.

Mbete, V. C., Ibala-Zamba, A., Mbete, P Et Mamonekene, V., 2020. Inventaire et distribution des macroinvertébrés benthiques de la lagune Loya, dans Le Département de Pointe-Noire au Congo Brazzaville, in Afrique SCIENCE. 17(5), pp : 124 – 136.

Norman, F.J. and Triplehorn, CA. 2004. Introduction to the Study of Insects 7th, Brooks/Cole, (ISBN 978-0030968358), 888p.

Poinsot, D., Hervé, M., Le Garff, B., Ceillier, M. 2018. Diversité animale. Histoire, évolution et biologie des Métazoaires, De Boeck Superieur. 337p.

Ramade, F. 1982. Elément de l'écologie. McGraw-Hill. Paris, 452p.

Tamsire, S., Ababacar, C. and Baïla, N, A. 2017. Diversité de la macrofaune du sol dans les parcelles de reboisement de la grande muraille verte au Sénégal. Sénégal, V(13), 194p.

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