



Diversity and community structure of Butterflies of Mount Korhogo area (Poro region, Côte d'Ivoire)

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Abstract

A study to find the diversity and the community structure of Butterflies of Mount Korhogo area was carried out over a period of five months from August 2018 to December 2018. In each site, Butterflies were sampled along a transect with a length of 100 m. Butterflies were collected with a sweeping net. A total of 24 species belonging to three families including Pieridae, Nymphalidae and Papilionidae were recorded. Out of these, members of Pieridae were dominant with 12 species, followed by Nymphalidae (11 species) and Papilionidae (1 specie). The Site S1 recorded the most species richness with 18 Butterflies species. Concerning the abundance, a total of 386 individuals were collected. Family Pieridae recorded the most abundance. The site S4 with 111 individuals harvested was dominant among the study sites. *Catopsilia florella* was the most dominant specie. It followed by *Acraea serena serena*. This study was done to emphasize the importance of Butterflies.

Keywords: Abundance, Mount Korhogo, specie richness, Butterflies

1. Introduction

Butterflies are generally regarded as one of the best taxonomically studied group of insects [1]. They have a great aesthetic value as a symbol of beauty, awe, joy wonder, pleasure and grace on earth. The diverse ecological role performed by butterflies are pollinator, herbivores, and bio indicators of ecosystem [2, 3]. Among insects, butterflies are certainly most popular and eminent group. Butterflies occupy a vital position in ecosystems and their occurrence and diversity are considered as good indicators of the health of any given terrestrial biotope [4, 5]. Butterflies and moths (order Lepidoptera) offer good opportunities for studies on population and community ecology [6]. The department of Korhogo is part of the Savanna Region, bordering Mali and Burkina Faso. Korhogo is located 635 km from Abidjan, the economic capital and 500 km from Yamoussoukro, the political capital. Korhogo is characterized by a vast set of plateaus, surmounted by places of granite domes and hills. The most important among these hills is Mount Korhogo which is the subject of this study. The diversity of Butterfly communities has been studied in different habitat type in different parts of the world. However, there have been few studies on the diversity of butterfly communities around mount in Africa tropical area. These habitats may play an important role in conserving a portion of tropical biodiversity of wick insects are a major part. In Côte d'Ivoire, yet little data are available. The present study was started with a view to examine the diversity and community structure of Butterfly population in the Mount Korhogo area situated at the town of Korhogo, in the northern part of Côte d'Ivoire.

2. Materials and Methods

2.1. Study site

Korhogo is located at 9° 27' 41 " North latitude and 5° 38' 19 West longitude. Korhogo (Fig. 1) is the fourth largest city in Côte d'Ivoire (West Africa) in terms of population and economy. It is located in the northern region of the country. Korhogo is the chief town of the District of Savanna and the

Poro Region. Mount Korhogo (Fig. 2) is located at 9° 27' N and 5° 39'W with an elevation of 567m.

2.2. Sampling procedure

The survey was conducted from August 2018 to December 2018. The habitat sampling includes the degraded area around the mountain. Five sites were chosen. In each site, Butterflies were sampled along a transect with a length of 100 m. The samples were taken every month. Butterflies were captured during sunny days from 09 am to 11am and 03 pm to 05 pm (local time) when butterflies were more active [7]. The adult Butterflies were collected by sweeping technique. The identification of Butterflies follows [8, 9, 10]. The collected specimens of the Butterflies have been conserving in some entomological boxes.

2.3. Statistical analysis

The diversity and community structure of Butterflies were determined by using species richness, Shannon-Weiner index [11], Pielou evenness index [12], Margalef's index [13], Berger-Parker Dominance Index, abundance and relative abundance. The biodiversity indices were computed using Paleontological Statistics Software Package (PAST) 3.10. The statistical analysis employed Statistica version 7.1, one-way Anova was used to determine the differences in species richness, the abundance of species, the diversity, evenness and Margalef indices of Butterflies on each site.

3. Results & Discussion

3.1. Results

The present survey resulted in identification of 24 Butterfly species belonging to 12 genera and 3 families, from samples collected from the area around the Mount Korhogo (Table 2). These families were: Pieridae, Nymphalidae and Papilionidae. Family of Pieridae recorded the highest species richness. It was followed by family of Nymphalidae and the lowest species richness was unregistered by family of Papilionidae (Fig. 3). The largest species richness (18

species) was obtained in site 1. It was followed respectively by sites S2 and S4 while site S3 has the lowest specific richness (9 species). A total of 386 individuals were collected. The most abundant family was the Pieridae. This family was followed by the Nymphalidae. The less abundant family was Papiolinidae (Fig. 4). The most dominant specie was *Catopsilia florella*. This specie was followed by *Acraea serena serena*. The spatial variation in abundance showed that this parameter was highest in site 4 (111 ind.) and lowest in site 3 (42 ind.) (Table 3, Fig. 5). The Shannon-Wiener index was included between 1.91 and 2.38 bits for all sites. The Pielou evenness varied between 0.73 and 0.87. The Margalef index oscillated between 2.06 and 3.91. Berger-Parker Dominance index varied from 0.25 to 0.40. There no significance difference between the study sites for species richness, abundance, Shannon-Wiener index, Pielou evenness and Margalef index ($P>0.05$).

3.2. Discussion

The study revealed the occurrence of 24 species of Butterflies belonged to 12 genera and 3 families that were found. Among these, 12 species belonged to the family Pieridae, 11 species belonged to the family Nymphalidae, and 1 specie belonged to the family Papilionidae. The Butterflies settlement corresponds to that observed in previous work [14, 15]. The site S1 and S2 had the highest richness respectively. These sites which yielded higher diversity have very dense vegetation which provide a favourable habitat to the Butterflies. The number of species observed in our study is lower than that recorded by [16] in Mount Slamet who haversted 99 Butterflies species. These difference would be due to the fact that it study covers a period of 12 months while in our case, we study Butterflies diversity during only five months. Butterfly species richness was low, its might be due to high-level disturbance. Indeed, the process of urbanization of Korhogo city has intensified during this decade, so that today the surrounding grassy savanna of the mountain was destroyed at the expense of buildings. This work was done in the relics of the grassy savanna around the mountain. Environmental degradation due to anthropogenic activities including agricultural practices [17] and urbanization [18], greatly affect both Butterfly diversity and abundance. Kunte [19] reported high influence of human interferences, which was relatively reducing the Butterfly diversity. With the gradual decrease in

greenery and increase in pollution, Butterflies, birds and all wildlife are fast disappearing. The net result is a complete imbalance of the ecosystem and extinction of many species [20]. Human dominated landscape form a substantial and ever increasing amount of the earth’s surface. These modified habitats often influence Butterfly species and their dynamics [21, 22]. The least number of Butterflies were collected during the month of December when the adequacy of host plants and unfavourable climatic conditions were observed and when practically the spaces of all the study sites have been destroyed to the detriment of urbanization. Eventhough, the family Pieridae and Nymphalidae exhibited the maximum species diversity compared to Papilionidae family. Species dominance of Pieridae and Nymphalidae in Butterflies studies was reported by previous works [7]. Abundance is high at site S4 and low at site S3. The low abundance observed in the site S3 would be due to the fact that in this site was a field of corn. The owner uses plant protection products to spray his crops. These products could pollute the environment which would not be favourable for the development of Butterflies. This pollution could be a hindrance to Butterflies activity. The family Pieridae dominated the abundance of Butterflies harvested. This dominance is linked to the high abundance of *Catopsilia florella*. This species is followed by *Acraea serena serena* of the family Nymphalidae. Dominance of *Catopsilia florella* was noted by [16] in Mount Slamet (Indonesia). At the spatial level, the three families of Butterflies harvested dominated abundance at site S4. This situation would be due to the fact that the abundance of *Catopsilia florella*, *Eurema hecabe solifera*, *Acraea serena serena* and *Papilio demodocus demodocus* is high in this site. Biodiversity indices of the five sampling sites are shown in Table 3. High species diversity (>2.0) was observed in site S1 and S4 while moderate species diversity was observed in sites S2, S3 and S5. The distribution of Butterflies was relatively even in all the sampling sites.

Table 1: Coordinates and elevation of the study sites.

Sites	Coordinates		Elevation
S1	09°27.08'2''N	05°39.01'8''W	421m
S2	09°26.47'2''N	05°39.01'3''W	414m
S3	09°27.12'6''N	05°38.31'3''W	411m
S4	09°27.20'4''N	05°39.05'3''W	392m
S5	09°26.51'6''N	05°38.58'9''W	426m

Table 2: List and individuals number of Butterflies recorded in Mount Korhogo area.

		Sites				
Families	Taxa	S1	S2	S3	S4	S5
Pieridae	<i>Catopsilia florella</i>	22	31	11	29	16
	<i>Eurema hecabe solifera</i>	7	13	8	12	14
	<i>Eurema desjardinsii regularis</i>	4	1	1	8	12
	<i>Eurema senegalensis</i>	2	0	0	0	1
	<i>Eurema floricola leonis</i>	4	0	0	0	0
	<i>Belenois calypso calypso</i>	1	0	0	0	0
	<i>Belenois zochalia connexiva</i>	0	0	0	1	0
	<i>Mylothris yulei</i>	1	4	0	2	1
	<i>Mylothris hilara hilara</i>	6	2	6	8	5
	<i>Nepheronia buquetii buquetii</i>	2	1	2	6	0
Nymphalidae	<i>Appias epaphia epaphia</i>	0	2	5	11	5
	<i>Appias epaphia contracta</i>	3	1	1	2	0
	<i>Precis octavia octavia</i>	1	0	0	0	0
	<i>Acraea serena serena</i>	11	10	7	22	20
	<i>Acraea caecilia caecilia</i>	1	0	0	0	0
	<i>Acraea egina egina</i>	0	1	0	0	0

	<i>Acraea pseudogina</i>	2	0	0	0	0
	<i>Acraea encedon encedon</i>	7	5	0	4	3
	<i>Junonia chorimene</i>	1	0	0	0	2
	<i>Junonia hierta cebrene</i>	0	1	0	1	0
	<i>Junonia sophia sophia</i>	0	2	0	0	0
	<i>Phalanta phalanta aethiopica</i>	0	1	0	2	0
	<i>Hypolimnas misippus</i>	1	0	0	0	0
Papilionidae	<i>Papilio demodocus demodocus</i>	1	2	1	3	0

Table 3: Taxa richness, abundance and diversity indices of Butterflies recorded in Mount Korhogo area.

Parameters	Sites				
	S1	S2	S3	S4	S5
Taxa	18	15	9	14	10
Abundance	77	77	42	111	79
Shannon-Wiener	2.38	1.98	1.91	2.19	1.94
Pielou Evenness	0.82	0.73	0.87	0.83	0.84
Margalef	3.91	3.22	2.14	2.76	2.06
Berger-Parker	0.28	0.40	0.26	0.26	0.25

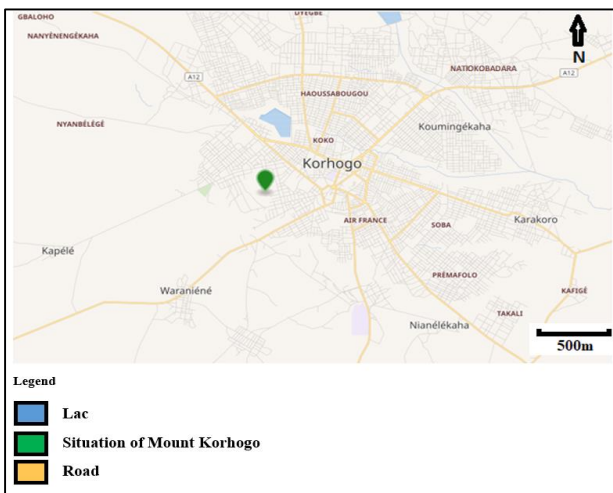


Fig 1: Situation of Mount Korhogo (Source Wikipédia).



Fig 2: Mount Korhogo (Source Wikipédia).

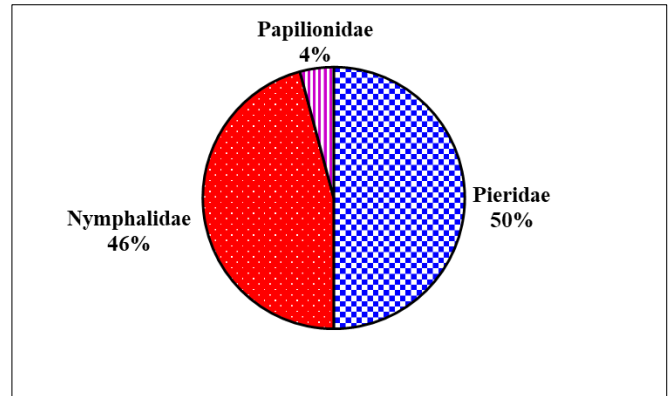


Fig 3: Richness proportion (%) of Butterflies families recorded in the different sites.

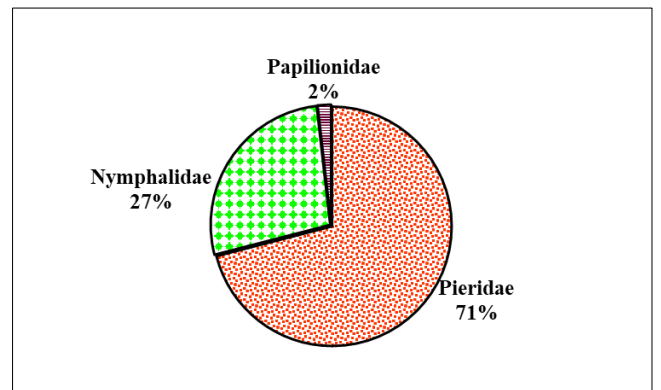


Fig 4: Relative abundance of Butterflies families harvested in the different sites.

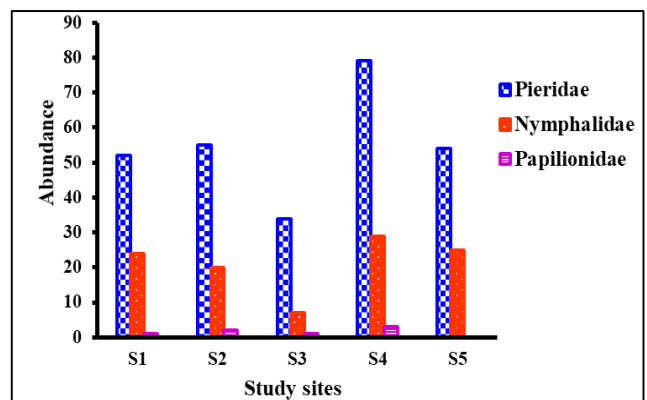


Fig 5: Spatial variation in abundance of Butterflies recorded.

4. Conclusion

This study allowed us to identify 24 taxa of Butterfly in the Mount Korhogo area. They were from the families Pieridae, Nymphalidae and Papilionidae. Family Pieridae and Nymphalidae recorded the highest number of species. During this study, Butterflies encountered were 386 individual. The most abundant family was the Pieridae. The present field investigation revealed that the Mount Korhogo area is rich in faunal wealth including Butterflies.

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6. References

1. Robbins RK, Opler PA. Biodiversity II, understanding and protecting our biological resources. Joseph Henry Press, Washington DC, 1997.
2. Uniyal VP, Mathur PK. Diversity of butterflies in the Great Himalayan National Park, Western Himalaya. *Indian Journal of Forestry*. 1998; 21(2):150-155.
3. Tiple A, Deshmukh DVP, Dennis RLH. Factors influencing nectar plant resource visits by butterflies on a university campus: implications for conservation. *Nota Lepidopterologica*. 2006; 28:213-224.
4. Aluri, JSR, Rao SP. Psychophily and evolution consideration of *Cadaba fruticosa* (Capparaceae). *Journal of the Bombay Natural History Society*. 2002; 99(1):59-63.
5. Kunte KJ. *India a Lifescape Butterflies of Peninsular India*. Universities Press (India) Limited, 2000.
6. Pollard E. Monitoring Butterfly Numbers; in *Monitoring for Conservation and Ecology* (ed.). F.B. Goldsmith (London: Chapman and Hall), 1991, 87.
7. Rajagopal T, Sekar M, Manimozhi A, Baskar N, Archunan G. Diversity and community structure of butterfly of Arignar Anna Zoological Park, Chennai, Tamil Nadu. *Journal of Environmental Biology*, 2011, 201-207.
8. Larsen TB. *Butterflies of West Africa*. Plate volume, Apollo books, Stenstrup, Denmark, 2005, 270.
9. Woodhall S. *Field guide to Butterflies of South Africa*, Struik Nature, Cape Town, South Africa, 2005, 439.
10. Penney D. *Field guide to Butterflies of the Gambia*, West Africa, Siri Scientific Press, Manchester, 2009, 80.
11. Shannon CE, Weaver W. *The mathematical theory of communication*. Urbana Illinois Press (USA), 1949, 117.
12. Pielou EC. The measurement of diversity in different types of biological collection. *Journal of Theoretical Biology*. 1966; 13:131-144.
13. Margalef R. *Information Theory in Ecology*. *General Systematics*. 1958; 3:36-71.
14. Dilla J, Senthilkumar P. Preliminary Report on the Butterfly Diversity of Muttom Panchayath, Idukki District, Kerala, India. *International Research Journal of Biological Sciences*. 2016; 5(6):23-30.
15. Nuñez KJM, Nuñez OM, Dupo ALB. Species Richness of Lepidoptera in Bega Watershed, Prosperidad, Agusan del Sur, Philippines. *Bulletin of Environment, Pharmacology and Life Sciences*. 2016; 5(8):83-90.
16. Widhiono I. Diversity of butterflies in four different forest types in Mount Slamet, Central Java, Indonesia. *Biodiversitas*. 2015; 16(2):196-204.
17. Schtickzelle N, Turlure C, Bagnette M. Grazing management impacts on the viability of the threatened bog fritillary butterfly *Proclossiana eunomia*. *Biological Conservation*. 2007; 136:651-660.
18. Tropek R, Kadleca T, Hejdic M, Kocarek P, Skuhrovec J, Malenovsky I. Technical reclamations are wasting the conservation potential of post-mining sites, A case study of black coal spoils dumps. *Ecological Engineering*. 2012; 43:13-18.
19. Kunte KJ. Seasonal patterns in butterfly abundance and species diversity in four tropical habitats in northern Western ghats. *Journal of Biosciences*. 1997; 22:593-603.
20. Gascon C, Lovejoy TE, Bierregaard RO, Malcolm JR, Stouffer PC, Vasconcelos HL, Laurance WF, Zim MB, Tocher M, Borges S. Matrix. Habitat and Species Richness in Tropical Forest Butterflies. *Biological Conservation*. 1999; 91:223-229.
21. Ricketts TH, Daily GC, Fay JP. Country side Biogeography of Moths in a Fragmented Landscape: Biodiversity in Native and Agricultural Habitats. *Conservation Biology*. 2001; 15:378.
22. Fernandes B, Kini A, Varkey J, Subramanjan S, Achary P. Study of Diversity and Current Status of Butterflies (Rhopalocera) at Vasai Fort, Dist-Palghar, India. *International Research Journal of biological science*. 2016; 5(3):11-19.