A COMPARATIVE STUDY OF DIVERSITY OF SPECIES OF BUTTERFLIES IN PROTECTED AND UNPROTECTED HABITATS OF OKWU OGBAKU FOREST RESERVE IN MBAITOLI L.G.A., IMO STATE, NIGERIA

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ABSTRACT

Butterfly diversity at the Okwu Ogbaku forest reserve, Mbaitoli local government area of Imo State, Nigeria was investigated by the use of sweep nets along transects in two types of habitats (unprotected and protected). A total of 201 butterflies belonging to 28 genera and 5 families were identified in this study. Members of the families Lycaenidae, Pieridae and Satyridae were more dominant than Nymphalidae and Papilionidae which were scarce in the study area. Abundant species of butterfly recorded in this study include Ypthima (Satyridae), Hypokopelates (Lycaenidae) and Eurema (Pieridae). The number of butterflies in the protected habitat were more than those in the unprotected habitat, though not statistically significant. The distribution of butterfly genera in the two habitats showed a significant difference. This suggested the effect of grazing and agriculture activities on the ecosystem. The species recorded in this study currently amount to 3.0% of all butterflies recorded in West Africa.

Keywords: *Butterfly, Diversity, Ogbaku Forest, Sweep nets, Protected Habitat, Ecosystem.*

INTRODUCTION

Undoubtedly, tropical forest ecosystems are globally under much pressure and such stress on disturbed forests is very likely to escalate (Terborgh, 1999 and Lewis, 2002). However, even the best protected areas may not be sufficient to maintain the original ecosystems because of their little magnitude and difficult political and social circumstances (Terborgh, 1999 and Najam, 2002). In deed, concern for the status of the Earth's biodiversity (to which butterflies are part) is on the increase (Okali, 2010) and arises from the observation that biodiversity is being rapidly depleted, seriously threatening the continued support that nature

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provides for human existence and development. Although, the magnitude of biodiversity present on Earth is largely unknown (Dobson, 1995) and its estimates remain highly controversial (Stork, 1988 and May, 1990), it is known that most of the global diversity strictly in terms of number of species is represented by arthropods inhabiting tropical rainforests (Wilson, 1988).

The estimation of such diversity (species richness) of an organism within a given habitat, community or area is necessary for biological assessment of the environment. No wonder Vane- Wright, Humpheries and Williams (1991) recorded that the knowledge of biodiversity is needed to understand and appreciate the natural world as well as the natural and artificial changes it may experience. Butterflies, which belong to the Phylum Arthropoda; class Insecta and order Lepidoptera are however, comparatively well and easily studied (Sundufu and Dumbuya, 2008). Moreover, they have outstanding ecological and economic importance (Southwood, 1973). Specifically, in agriculture, butterflies are important pollinators (Vane-Wright, Humpheries and Williams, 1991). In industries, they play significant role as silk producers for textile products (Erhardt, 1985). They are also good indicators of the ecological quality of a habitat; as they are important components of the food chain, particularly as Larvae (Devries, 1988). In Addition, butterflies are benign and aesthetically pleasing that they are greatly appreciated in ecotourism (Thomas, James and Warren, 1992).

Incidentally, Bernard (1982) describes seventeen families in the Lepidopteran order with only eight comprising the butterfly group. In West Africa, about two thousand species of butterfly abound with Nigeria alone habouring greater than one thousand species (about 50%) (Viejo, Paul and Curie, 2000). In the study area, no data exist on butterfly diversity, a situation which in part, provided the rationale of the present study. In fact, butterflies (useful specimens in biodiversity studies) whose small body size and dispersal ability enable create and occupy dimensions are equally exposed to a wide range of environmental influences. Pollard (1988) recorded that they are highly sensitive to changes in climatic factors such as rainfall, temperatures, wind, humidity and altitudes. Recently, studies have suggested a range of factors that affect the pattern of distribution of butterflies. These include competition, predation, numerical abundance of species, food web structure, genetic factors, short and long-term aspects of evolutionary rates and size of the insect (Thomas, James and Warren, 1992 and Charles, 2001). More works have attempted to specifically pin down the factors that affect biodiversity of butterflies.

For instance, Brown (1997) identifies plants to play key role in butterfly biodiversity, stressing that the value of the diversity of any ecosystem is viewed in terms of number of species interacting among themselves and with their physical environment. Holling, Schindler, Walker and Roughgarden, (1995) maintained that the removal of certain species seems to have minimal effects on the functioning of the ecosystem while the deletion of others induces a serious transformation from one ecosystem type to another. Moreover, rising human influence and associated degrees

of pressure and shocks on the ecosystem have resulted into changes, which many creatures (including butterflies) cannot adapt to. When the change involves the composition of species and major structuring processes of the ecosystem, Schindler (1990) ascertained that it could have negative implications on the ability of such ecosystem to provide economically valued ecological services. Therefore, this necessitates the need to develop sustainable resource management policies for these ecosystems based on an understanding and appreciation of the ecological processes involved. This will definitely help in ensuring the realisation of the maximum yield potentials of the forest ecosystem. It is now obvious why Nylin (1995) suggests the need for techniques to monitor changes in populations caused by ecosystem degradation and regeneration aimed at improving and sustaining environmental quality.

Establishing the biodiversity of an organism in an area in order to gather baseline information for environmental quality and control respectively is scientifically necessary. However, species richness and habitat preferences of butterflies as documented by various researchers in different parts as well as in the same part of the world seem to be controversial. For instance in southern Nigeria, Larsen, Riley and Cornes (1979) found a surprisingly rich butterfly fauna in mixed secondary growth within the rainforest zone. In a study in Benin, Nigeria, overall butterfly species richness was higher in clearings than closed forest (Fermon, Schulze and Waltert, 2001). In the Eagle Owl Gully Forest Reserve of Amurum, Jos East, Plateau, Nigeria, higher diversity of butterfly species was recorded in the protected area (Akwashiki, Amuga, Nwansat and Ombugadu, 2007).

In Madagascar, disturbed forest habitat and edges were found to be richer in butterfly species than undistributed area (Kremen,1994) while higher butterfly diversities were recorded in unprotected tropical forest by Thomas (1991); Hill, Kramer, Lace and Banham (1995), Brown (1997) and Hammer and Hill (2000). The above records show that butterfly diversity varies from one location to another and provide the rationale for locating specific analysis to inform biodiversity status/control measures (or policies). This speculation that habitat type determines richness and kinds of butterfly deserve further investigation. Therefore, this study sought to compare and document the diversity of species of butterflies between the unprotected and protected habitats of the Okwu Ogbaku Forest Reserve in Mbaitoli, Imo State, Nigeria. The forest was significantly observed to habour a lot of birds, and that could be very relevant in the study of insectivorous birds.

MATERIALS AND METHODS

The study was carried out at the Okwu Ogbaku Forest Reserve, Mbaitoli L.G.A, Imo State, Nigeria. Imo State (South Eastern part of Nigeria) is located in the rain forest region of Nigeria on latitude 603^{l}N and longitude 7036^{l}E. The vegetations of the area range from typical rain forest through degraded forest to mosaic forest interphase. The mean total annual rainfall is 2000mm and the atmospheric temperature

ranges from 26^0C-40^0C. The Okwu Ogbaku Forest Reverse, characterized by three different types of habitat (the gallery, the scrubby forest and the grassland area) is about 200 hectares in size. Two sites were selected for this study: (a) the unprotected area, which is an area outside the forest reserve that is open for human influence (that is, a farm-bush habitat cultivated for different crops) and animal grazing, and (b) the protected area, which is an area inside the forest reserve that is protected against cultivation and also unavailable to grazers. Both categories of sites differ in vegetation density but have no obvious differences in terms of plant species.

Walk-and-capture transects routes of 1000m each were surveyed for butterfly during the study. Three line transects were situated in each of the unprotected and protected habitats and were worked on, once in every sampling day. These transects were surveyed 28 times in 14 rounds of sampling butterflies for each category of site. Butterfly species seen on each transect were trapped, counted, described and recorded. All butterflies seen 2.5m either side of the transect route and up to 5m in front were trapped using a sweep net or released after marking, when positive identification was possible (Hill, Kramer, Lace and Banham, 1995 and Pollard, 1977). Vegetation measurements in terms of plant phaenology were taken randomly from both categories of sites on each line transects using the method of Sutherland (2001).

All the captured butterflies put in specimen bottles containing ethyl acetate soaked in cotton wool, were pooled from unprotected and protected habitats. The butterflies were mounted by the method of Cyber Gallery of Natural Ecology Experience (2004) and displayed by the method of Bernard (1982). Butterflies collected were identified using Butterflies of West Africa (Larsen, 2005) and identification guides of Bernard (1982), James (2002) and Hogue and Gray (2004). Following the calculation of butterfly species diversity, analysis of vegetation factors associated with the total number of butterflies in each family was done for both unprotected and protected habitats.

In the year 2000, Viejo, Paul and Curie, (2000) documented that there were about 2000 species of butterflies in West Africa. In the year 2007, Akwashiki, Amuga, Nwansat and Ombugadu (2007) recorded a decreased number to about 1000 species of butterfly in West Africa probably because of climate change effects and Sundufu and Dumbuya (2008) recorded same in 2008. Therefore, in this study, the ecological composition of butterflies of the study area, in relation to current amount of butterflies of West Africa, was determined by dividing the number of species of butterfly collected in this study, by 1000 species recorded by Akwashiki, Amuga, Nwansat and Ombugadu (2007) and Sundufu and Dumbuya (2008) and multiplied by 100%. That is:

$$\frac{y}{1000\,species} \times 100\%$$

where y is number of species of butterflies collected in this study (Table 1).

Kolmogorov - Smirnov two-sample test was employed in the analysis of data on butterfly diversity and distribution. The analysis was carried out using version 11.0 Statistical Package of Social Science (SPSS) software.

RESULTS AND DISCUSSION

A total number of 201 butterflies belonging to 28 genera and 5 families were collected from both the unprotected and protected habitats of Okwu Ogbaku Forest Reserve, Mbaitoli, Imo State (Table1). That this result marked relatively high diversity of butterfly species seems supported by Akwashiki, Amuga, Nwansat and Ombugadu (2007) and Sundufu and Dumbuya (2008). However, the result is further corroborated by Thomas, James and Warren, (1992), Hill, Kramer, Lace and Banham (1995), and Brown (1997) who reported rich butterfly fauna in forest canopies. The highest number of species were recorded in the families Lycaenidae, Pieridae and Satyridae. That the families Lycaenidae and Pieridae were recorded in high numbers in this study is supported by the works of Akwashiki, Amuga, Nwansat and Ombugadu (2007) and Brown (1997) who reported the two families as the largest of the Lepidopteran order, that also appear ubiquitous. In contrast, the families Nymphalidae and Papilionidae occurred in lesser number of species. The presence of the Nymphalidae in low number has implications for pollination in the area, since they are among the exceptionally fruit-feeding butterfly community. The fruit-feeding habitat of the Nymphalidae is documented by Sundufu and Dumbuya (2008). Generally, 3 genera from 3 families showed greater abundance in this study than the others. They are: Ypthima (Satiridae), Hypokopelates (Lycaenidae) and Eurema (Pieridae). It is not uncommon that these 3 genera were the most abundant butterfly species in both the unprotected and protected habitats of the study area since Pierce, Michael and Health (2002) already reported species of Hypokopelates as polyphagous creatures who have the capacity to adapt to a wide range of habitats.

However, 8 other genera occurred in lesser numbers of species from 7 to 16, leaving the remaining 17 genera in lowest occurrence with less than 7 species. Analysis of results associated with habitat types showed that higher numbers of species occurred in the families Lycaenidae, Pieridae and Satyridae than Nymphalidae, and Papilionidae in the protected habitat (Table 1). Similarly, in the unprotected habitat, higher numbers of butterfly species were found in the same families but as follows: Lycaenidae, Pieridae and Satyridae than Nymphalidae and Papilionidae (Table 2). The common occurrence of the Nymphalidae and Papilionidae in low numbers in both habitats could be attributed to some seasonal factors. This observation and assessment seem also supported by Pierce, Michael and Health (2002). Moreover, the occurrence of these species in the first place could supply useful information on conservation of biodiversity.

CONCLUSION

The distribution of butterflies genera showed a significant difference between the two habitats.This suggests the effect of grazing and agricultural activities on the ecosystem. However, number of butterflies in the protected habitat differed (though not significantly) from those of the unprotected habitat. This difference is simply an index of disturbance in terms of grazing and cultivation. Since the butterfly fauna of

West Africa currently consist of approximately 1000 species (Akwashiki Amuga, Nwansat and Ombugadu, 2007 and Sundufu and Dumbuya, 2008), the species recorded in Okwu Ogbaku Forest Reserve thus amount to approximately 3.0% of all butterflies recorded in West Africa (Table 1).

Table 1: Number of Butterfly Families and Genera Sampled at Okwu Ogbaku Forest Reserve, Mbaitoli, Imo State, Nigeria.

Family	Genus	Number	(%)
Lycaenidae	Hypokopelates	25	(12.4)
	Azanus	16	(8.0)
	Iolaus	9	(4.5)
	Lepidochrysops	8	(4.0)
	Virachola	8	(4.0)
	Anthene	7	(3.5)
	Cupidopsis	6	(3.0)
	Liptena	2	(1.0)
	Spindasis	2	(1.0)
	Omipholidotes	1	(0.5)
	Total	84	(41.8)
Pieridae	Eurema	23	(11.4)
	Catopsilia	15	(7.5)
	Belenois	9	(4.5)
	Dixeia	5	(2.5)
	Leptosia	4	(2.0)
	Mylothris	1	(0.5)
	Total	57	(28.4)
Satyridae	Ypthima	29	(14.4)
	Juninia	4	(2.0)
	Appias	2	(1.0)
	Colotis	2	(1.0)
	Bicycus	1	(0.5)
	Trucus	1	(0.5)
	Total	39	(19.4)
Nymphalidae	Junonia	8	(4.0)
	Euriphene	4	(2.0)
	Chraxes	2	(1.0)
	Neptis	2	1.0
	Byblia	1	(0.5)
	Total	17	(8.5)
Papilionidae	Graphium	4	(2.0)
Total: 5	28	201	(100)

Source: Fieldwork, 2010

Table 2: Distribution of Butterfly Families in Unprotected and Protected Habitats of Okwu Ogbaku Forest Reserve, Mbaitoli, Imo State, Nigeria.

Family	Unprotected Habitat[nC%]	Protected Habitat[nC%]	Total [nC%]
Lycaenidae	33 (16.4)	51 (25.4)	84 (41.8)
Pieridae	26 (12.9)	31 (15.4)	57 (28.4)
Satyridae	16 (8.0)	23 (11.4)	39 (19.4)
Nymphalidae	6 (3.0)	11 (5.5)	17 (8.5)
Papilionidae	2 (1.0)	2 (1.0)	4 (2.0)
Total	83 (41.3)	118 (58.7)	201 (100)

Source: Fieldwork, 2010

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