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ASSESSMENT OF BUTTERFLY DIVERSITY IN EAGLE OWL GULLY OF AMURUM FOREST RESERVE, JOS EAST LOCAL GOVERNMENT AREA, PLATEAU STATE, NIGERIA.

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Abstract

Butterfly diversity at the Eagle Owl Gully, Amurum Forest Reserve, Jos East, Plateau State was investigated by the use of sweep nets along transects in two types of habitats namely protected and unprotected. A total of three hundred and ninety-four butterflies belonging to thirty-three genera and seven families were identified in this study. Members of the families Lycaenidae 164 (41.6%); Pieridae 116 (29.4%) and Satyridae 73 (18.6%) were more dominant than Acraenidae 1 (0.3%); Danaidae 4 (1.0%) and Papiliolnidae 5 (1.3%); which were scarce in the study area. Abundant species of butterfly recorded in this study include *Ypthima* 62 (15.7%); *Hypokopelates* 45 (11.4%) and *Eurema* 45 (11.4%). The number of butterflies in the protected habitat 230 (58.4%) were more than those in the unprotected habitat 164 (41.6%), though not statistically significant (K-S = 0.139; P> 0.05). The distribution of butterfly genera in the two habitats showed a significant difference (K-S = 0.000; P< 0.05). This suggests the effect of grazing and agriculture activities on the ecosystem.

Key words: Butterfly, Diversity, Protected habitats, transects, Amurum forest.

Introduction

Butterflies (Phylum: Arthropoda; Class: Insecta; and Order: Lepidoptera), comprise three groups of families commonly called skippers, moths and butterflies (James, 2002). Bernard (1982) described seventeen families in the Order Lepidoptera with only eight making the butterfly group. The butterflies abound almost everywhere, and feed as a group, on an enormous variety of plants, having the greatest ecological and economic importance (Southwood, 1973).

Viejo *et al* (2000) ascertained that about two thousand species of butterfly are found in West Africa, with Nigeria alone having over one thousand species and an estimated two to three hundred species in Amurum Forest Reserve, Jos East of Plateau State.

The beneficial impact of butter flies has been reported in Agriculture – as pollinators (Vane-Wright *et al*, 1991); Industries – as silk producers for textile products (Erhardt, 1985); Indicators of environmental quality (Devries, 1988); and they are appreciated for their aesthetic values in ecotourism (Thomas *et al*, 1992).

The holometabolous life history of butterflies reveals that Lepidoptera are exposed to a wide range of environmental influences, and they are highly sensitive to changes in weather factors such as temperatures, humidity, wind, rainfall and altitudes (Pollard, 1988). The estimation of numbers and kinds of organisms within a given area, habitat, or community (taxonomic diversity or species richness) is important in biological assessment of the environment. Vane-Wright *et al.*, (1991) observed that the knowledge of biodiversity is required to understand the natural world as well as the natural and artificial changes it may undergo. Krebs and Davies (2001) emphasized that species diversity occurs in time and space

within and between species, within and between habitats on vegetations and on a range of scale from hours to extremely long period of time and centimeters to continents.

Many studies have attempted to identify a single factor as being responsible for the distribution pattern of butterflies but recent work (Charles, 2001) suggested that there may be a series of factors that play different roles within a broad geographical region. Among the factors listed are competition, predation, food web structure, numerical abundance of species, short and long-term aspects of evolutionary rates and genetic factors. The work further added that small size coupled with their dispersal ability enable them to carve out and occupy dimensions. These factors have been postulated as the main reason for diversity of butterflies, with emphasis on size (Thomas *et al*, 1992). According to Brown (1997), plants play important role in, contributing to butterflies diversity. The diversity value of any ecosystem is viewed in terms of the number of species interacting among themselves and with their physical environment. Holling *et al.*, (1995) provided empirical evidence to show that the deletion of some species appears to have minimal effects on the functioning of the ecosystem. Whilst the deletion of others triggers a fundamental transformation from one ecosystem type to another. The implication of this as observed by Heywood *et al* (1995) is that the residents of the ecosystem depend on the range of species capable of supporting the critical structuring processes of those ecosystems under different environmental conditions that subject the system to different degrees of stress and different magnitudes of shocks. Schindler (1990) observed that a change in the composition of species that affects anyone of the key structuring processes may have profound consequences on the ability of an ecosystem to provide economically valued ecological services.

Increase in human population combined with advances in technology have directly subjected the ecosystem to changes, which many organisms (including Lepidopterans) cannot adapt to. This therefore suggests the need to develop long-term resources management policies for these ecosystems, based on an understanding of the ecological processes involved. This will assist in ensuring a sustained yield of Agriculture and Forest products for human benefits. Nylin (1995) suggested the need for techniques to monitor changes in populations caused by ecosystem degradation and regene-ration.

It has been speculated that habitat type determines richness and kinds of butterflies (Bernard, 1982; Ehrlich, 1984 and Brown 1997). This study therefore sought to determine and compare the diversity of species of butterflies between the protected and unprotected habitats of the Eagle Owl Gully of Amurum Forest Reserve in Jos East, Plateau State, Nigeria. The study area is a forest reserve conservatory for birds; therefore an inventory of the butterfly species will be important in the study of insectivorous birds in this ecosystem.

Materials and Methods

The Study Area

The study was carried out at the Eagle Owl Gully of Amurum Forest Reserve, Jos East, Plateau State, Nigeria. Plateau State is located in the Guinea Savanna region of Nigeria on latitude 9^0 53'N and longitude 8^0 39'E. Viejo *et al* (2000) described its unique distinct cold weather condition with annual temperatures of 10 - 32^0C and annual rainfall of 1375mm 11750mm. The Eagle Owl Forest is about 400 hectares and is characterized by three different habitat types – the gallery forest, the scrubby forest and the grassland savanna. The Gully forest is one of the eroded sides of the Amurum Forest

Reserve, which lies between the protected and unprotected habitats.

Site Selection

Two sites were selected in the Eagle Owl Gully Forest Reserve for this study as follows:

1. The protected area: This is an area inside the Forest Reserve that is not open for animal grazing or cultivation
2. The unprotected area: This is an area outside the Forest Reserve that is open to grazers and is cultivated for different crops.

Both sites have no clear differences in terms of plant species, but they differ in vegetation density.

Sampling Method

A total number of six line transects of 10x 10m each, were marked in both sites using a Global Positioning System (GPS) – etrax GARMIN 12 channel device. Three coloured stripped cloths were tied to defined positions on each line transect for convenience and easy walk along the transects. The transects were surveyed twenty-eight times in fourteen rounds (each for protected and unprotected sites) of sampling butterflies. Three line transects were walked on the protected and unprotected habitats once in every sampling day. Pollard's Transect Walking Technique (PTWT) was modified to include captures with a sweep net. Butterfly species seen on each transect were trapped, counted, described and recorded. Perched butterflies at a distance difficult to be reached were observed using binoculars (Supreme 10 x 50) and recorded. Vegetation measurements in terms of plant phaenology were randomly taken from both sampling sites on each line transect by the method of Sutherland (2001).

Mounting of Butterfly Specimens

All the trapped butterflies were collected in specimen bottles containing ethyl acetate soaked in cotton wool and were separated for protected and unprotected habitats. The butterflies were mounted by the method of CGNEE (2004) and displayed by the method of Bernard (1982).

Identification of Butterflies

The identification guides of Bernard (1982), James (2002) and Hogue and Gray (2004) were used for the identification of butterfly species trapped, spotted and described. Butterfly species diversity was calculated and an analysis of vegetation factors associated with the total number of butterflies in each family was performed for both protected and unprotected habitats. Statistical analysis was carried out using Version 11.0 SPSS software package.

Results

A total number of three hundred and ninety-four butterflies belonging to thirty-three genera and seven families were collected from both the protected and unprotected habitats at the Eagle Owl Gully of Amurum Forest Reserve (Table 1). The highest number of species were recorded in the families Lycaenidae 164 (41.6%); Pieridae 116 (29.4%) and Satyridae 73 (18.6%). Families with less number of species include Nymphalidae 31 (7.9%); Papilionidae 5 (1.3%); Danaidae 4 (1.0%) and Acraenidae 1 (0.3%).

Five genera from three families were found to be more abundant in this study as follows: *Ypthima* (Satyridae) 62 (15.7%); Hypokopelates (Lyceanidae) 45 (11.4%); *Eurema* (Pieridae) 45 (11.4%); *Catopsilia* (Pieridae) 36 (9.1%) and *Azanus* (Lycaenidae) 34 (8.6%). Seven other genera occurred minimally ranging from 12 – 17 numbers of species. The remaining twenty-one genera from the

total recorded in this study had low occurrence with less than ten species.

The distribution of butterflies between protected and unprotected habitats per family (Table 2) shows that there were more butterflies in the protected habitat 230 (58.4%) than the unprotected habitat 164 (41.6%). A survey of the protected habitat further shows that higher numbers of species were found in the families – Lycaenidae 100 (25.4%); Pieridae 62 (15.7%) and Satyridae 43 (10.9%). Acraenidae was not found in this habitat. In the unprotected habitat, higher numbers of butterfly species were found in the families – Lycaenidae 64 (16.2%); Pieridae 54 (13.7%) and Satyridae 30 (7.6%). The remaining four families were represented by less than twenty species in this habitat.

Table 1: Number of butterfly families and genera sampled at the Eagle Owl Gully of Amurum Forest Reserve.

Family	Genus	Number (%)
Acraenidae	*Acraea*	1 (0.3)
Danaidae	*Danaus*	4 (1.0)
Lycaenidae	*Anthene*	12 (3.1)
	Axiocerses	2 (0.5)
	Azanus	34 (8.6)
	Critinophila	1 (0.3)
	Cupidopsis	12 (3.1)
	Hypokopelates	45 (11.4)
	Iolaus	17 (4.3)
	Lepidochrysops	16 (4.1)
	Liptena	2 (0.5)
	Omipholidotes	1 (0.3)
	Spindasis	3 (0.8)
	Triclema	2 (0.5)
	Virachola	17 (4.3)
		164 (41.6)
Nymphalidae	*Byblia*	1 (0.3)
	Chraxes	4 (1.0)
	Euriphene	7 (1.8)
	Junonia	16 (4.1)
	Neptis	3 (0.8)
		31 (7.9)
Papilionidae	*Graphium*	5 (1.3)
Pieridae	*Belenois*	15 (3.8)
	Catopsilia	36 (9.1)
	Dixeia	9 (2.3)
	Eurema	45 (11.4)
	Leptosia	8 (2.0)
	Mylothris	3 (0.8)
		116 (29.4)
Satyridae	*Bicyclus*	1 (0.3)
	Juninia	7 (1.8)
	Ypthima	62 (15.7)
	Appias	1 (0.3)
	Colotis	1 (0.3)
	Trucus	1 (0.3)
		73 (18.6)
	TOTAL	**394 (100)**

Table 2: Distribution of Butterfly Families in Protected and Unprotected Habitats.

Family	Type of Habitat Protected [n (%)	Unprotected [n (%)]	Total [n (%)]
Acraenidae	0 (0.0)	1 (0.3)	1 (0.3)
Danaidae	1 (0.3)	3 (0.8)	4 (1.0)
Lycaenidae	100 (25.4)	64 (16.2)	164 (41.6)
Nymphalidae	20 (5.1)	11 (2.8)	31 (7.9)
Papilionidae	4 (1.0)	1 (0.3)	5 (1.3)
Pieridae	62 (15.7)	54 (13.7)	116 (29.4)
Satyridae	43 (10.9)	30 (7.6)	73 (18.6)
TOTAL	**230 (58.4)**	**164 (41.6)**	**394 (100)**

The results showed that the number of butterflies did not differ significantly between the protected and unprotected habitats of Amurum Forest (K-S =0.139; P> 0.05). The distribution of butterflies genera however, showed a significant difference between the two habitats (K-S = 0.000; P< 0.05).

Discussion

The analysis of the result showed diversity of butterflies at the Eagle Owl Gully of Amurum Forest Reserve, Plateau State. The observations and assessment were corroborated by Thomas *et al,* (1992), Hill *et al*, (1995), and Brown (1997) that reported great abundance of butterfly species in forest canopies. The high number of species recorded in the families – Lycaenidae and Pieridae is supported by the studies of Bernard (1982) who reported the two families as the largest of the order – Lepidoptera, that can be seen almost everywhere. The genera *Yypthima* (Satyridae), *Hypokopelates* (Lycaenidae) and *Eurema* (Pieridae) are the most abundant butterfly species in both the protected and unprotected habitats of Amurum Forest Reserve. Pierce *et al,* (2002) reported *H. kafuuensis* as being polyphagous and can therefore adapt to a wide range of habitats. Butterfly species of the families – Nymphalidae, Papilionidae and Danaidae were common but not abundant while the family – Acraenidae was rare. The occurrence of these species could probably provide useful information on conservation. Their occurrence in low number could also be associated with some seasonal factors (Pierce *et al*, 2002). More butterfly species at the protected habitat than the unprotected suggests the effect of disturbances in the ecosystem.

Conclusion

The results from this study showed a high diversity of butterfly species at the Eagle Owl Gully Forest Reserve of Amurum, Jos East, Plateau State. The difference in species diversity between the protected and unprotected habitats, though not statistically significant, is an index of disturbance in terms of grazing and cultivation. The most commonly found species and families of butterflies in this forest reserve include: *Ypthima* (Satyridae), *Hypokopelates* (Lycaenidae) and *Eurema* (Pieridae).

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