BETTLE FAUNA OF AGRO AND FOREST ECOSYSTEMS IN A TROPICAL RAINFOREST HABITAT, NIGERIA

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ABSTRACT

An investigation was carried out to study the beetle fauna of a cultivated farmland and tropical rainforest plot at the Permanent. Site of Nnamdi Azikiwe University, Awka for a twelve-month period using the pitfall technique. Eight pitfall traps made up of plastic containers with mouth diameters of 9.80 cm and 6.20 cm deep were set monthly at random in the two sampling sites. The traps, which were filled to one third with 5 % formalin, serving a preservative, were recovered after twenty-four hours and the insects caught sorted and counted under a dissecting microscope. Species of beetle obtained from the cultivated plot were Macrocheilus labrosus, Hyparpalus sp., Carpophilus fumatus, Podagrica uniforma, Tetragonothorax sp., Chlaenius sp., Pheropsophus parallus, Silidas apicalis, Tenebroides mauritanicus, Heteroderes sp., and Heterorynchus licas while only Hyparpalus sp., and Mylabris sp., were obtained from the fallow plot. The result of Fisher's Least Significance Difference (F-LSD) test shows that the pitfall catches of beetles from the two sampling sites were significantly different at p-value of 0.0002 and mean difference of 3.417. The heterogeneity of the beetle species at the cultivated plot was traced to nature of vegetation and mode of life of the beetle species. The role of certain beetle families as faunal indicators was highlighted. Other factors, which influenced the beetle species at the arable plot and their non-trapping at the forest ecosystem, were also discussed.

Keywords: Beetle fauna, Arable plot, Secondary regrowth forest, Pitfall traps

INTRODUCTION

The terrestrial habitats are rich in terms of their insect fauna and floristic composition. At present, our knowledge of the vast majority of the insects in the Nigerian terrestrial ecosystems is far from being complete (Ewuim, 2004). New areas of vegetation are being cleared for farming and urban development and therefore the environment is continuously changing (Youdeowei, 1980; Ewuim, 2004).

The insects are the most numerous of all terrestrial animals both in terms of species and total abundance. However, only a small fraction is pestiferous (Ewuim, 2004). These insects are therefore strategic in the welfare of man through their activities. The beetles which constitute about two-thirds of all known insects, and about one-third of all known animal species invariably, participate in various activities, resulting' in several changes in the ecosystems. The beetles like other insects, often evolve and exists as components of communities of plants and other animals. Most of the species are terrestrial even though some are aquatic. In terms of food and feeding habits, many beetles are plant eaters; some are predacious with others being scavengers, while some of them are wood-borers. In terrestrial ecosystems many of these herbivorous forms constitute serious pests of crops and causing significant damage either directly or even transmitting diseases, even though some are known to be beneficial herbivores.

With destruction of natural habitats by man and in particular destruction of vast areas of forests for industrial, agricultural and urbanization purposes (Boorman, 1981), these beetle therefore constitute an interesting group to study in natural ecosystems. The study of the beetle species in the arable plot and a secondary regrowth forest will no doubt provide useful information on their distribution and abundance.

MATERIALS AND METHODS

Study Area: The study was carried out in two rather contrasting study sites a cultivated farmland and a secondary regrowth forest, all of which are located at the Permanent Site of the Nnamdi Azikiwe University, Awka. Awka is the capital of Anambra State of Nigeria and located in the lowland rain forest zone of Southern Nigeria (Keay, 1965; Charter, 1970).

The cultivated plot which measures 800 cm^2 in area is located between latitude 6.23782°N and longitude 7.12884°E. At the time of investigation and apart from the cassava, *Manihot esculenta* Kranz, planted in mounds, the plot had a variety of weeds which include *Sida acuta* Burm, *Aspilia africana* (CD), *Euphobia hirta* (L.), *Chromolaena odorata* (L.), *Emilia sonchifolia* (L.), *Tridax procumbens* (L.), *Mariscus alternifolus* Vahl., *Commelina benghalensis* (L.), and *Axonopus compressus* (S.W.) Also present was a shrub *Phyuanthus amarus* Schum and Thom.

On the other hand, the forest investigated can be described as a secondary regrowth forest. The study area lies between latitude 6.25774°N and longitude 7.11275°E. Alternatively it is located south east to east of the School of Postgraduate Studies and general south-east of Rufai Garba Square with an approximate bearing of 125° and a distance of 200 m from the center point of the Square.

Table 1: Pitfall Catches of Beetles Obtained from the Arable Plot and the Forest at Awka, Nigeria

Beetle family	Genus and Species	*Beetle Population in Sampling Sites	
		Cultivated plot	Forest
Carabidae	*Macrocheilus labrosus*	1	-
	Pheropsophus parallus	1	-
	Chlaenius sp.	2	-
	Hyparpalus sp.	11	-
Nitudilidae	*Carpophilus fumatus*	1	-
Curculionidae	*Tetragonothorax* sp.	1	-
Cantharidae	*Silidius apicalis*	1	-
Ostomatidae	*Tenebroides mauritanicus*	2	-
Elatridae	*Heteroderes* sp.	1	-
Scarabaeidae	*Heterorynchus licas*	1	-
Staphylinidae	*Mylabris* sp.	-	-
Unidentified Beetles		7	-

** Significant at probability level α > 95%; t-table = 2.201*

The size of the sampling plot is about 200m^2 in area. The herbaceous plants found at the fringe of the forest included *Chromolaena odorata* R. M. Kings and Robinson, *Panicum maximum* Jacq. In addition to shrubs like *Mallotus oppositifolius* Giezel. The trees included *Newbouldia laevis* P. Beauv., *Alstolia boonei* de Wild, *Diallum guineensis* L., *Alchornea cordifolia* Schum and Thonn., *Alstonia bonei* de Wild, *Ceiba pentandra* Linn., Gaertn., *Chlorophora exelsa* Welw. Benth., *Harungana madagascariensis* Lam and Pols, *Newbouldia laevis* P. Beauv., *Morinda lucida* Benth., *Pterocarpus milbraedii* Harrns, *Ricinodendron heudelotti* Baill., *Rauvolfia vomitoria* Afyel and *Fagara macrophylla* Engl.

Sampling Method: Eight pitfall traps made of plastic containers, with mouth diameters of 9.80 and 6.2 cm deep were set monthly in the two study sites for a twelve month period. The traps were filled to one-third with 5 % formalin. The traps were recovered after twenty-four hours, and the insects caught were sorted identified and counted under a dissecting microscope. Rainfall data was collected during the sampling period using the rain-gauge, while bulb -thermometer was used to measure aerial and soil temperature on each sampling occasion.

The insects and their larvae were identified using Insects of Nigeria - Check List and Bibliography (Medler, 1980). The identification of the specimens was verified in the Department of Crop Protection, Institute of Agricultural Research, Ahmadu Bello University, Zaria, Nigeria. The voucher specimens were also kept as reference point for further studies. The data was analysed using Fisher's Least Significant Difference (F-LSD) to ascertain whether or not statistical difference existed between the pitfall catches of beetle species, obtained from the cultivated and forest plots.

RESULTS

A total of 26 beetles were trapped using the pitfall technique during the twelve-month sampling, from the cultivated plot, with none obtained from the forest. The cultivated farmland had beetle species which included *Macrocheilus labrosus, Pheropsophus parallus, Chlaenius* sp., and *Hypapalus* sp., which belong to the carabid family. Single species collected from the cultivated farmland include *Carpophilus fumatus* (Nitudilidae), *Tetragonothorax* sp. (Curculionidae), *Silidius apicalis* (Cantharidae), *Tenebroides mauritanicus* (Ostomatidae) *Heteroderes* sp. (Elatridae), *Heterorynchus licas* (Scarabaeidae) and *Mylabris* sp. (Staphylinidae).

The result of t-test also showed that the pitfall catches of the beetles from the cultivated plot and the forest were significantly different ($p < 0.05$) with all catches obtained from the cultivated plot. The increased pitfall catches of beetles at the cultivated plot is an indication of higher activity-density of the beetle populations at this sampling site.

DISCUSSION

The heterogeneity in the distribution of the beetle species at the cultivated site is related to the efficiency and capture rate of the wandering species. Out of eight families of beetle trapped, Carabidae, Nitudilidae, Curculionidae, Cantharidae, Ostomatidae, Elatridae, Scarabaeidae and Staphylinidae were recorded in the cultivated plot only. In an earlier study, Ewuim (2004) associated members of Carabidae family with cultivation and complex relationship between wandering beetle, abundance and the frequency of vegetation cover (weed) have been established (Spreight and Lawton, 1976; Ewuim, 2004). The preponderance of beetles especially at the cultivated plot may be associated with the nature of the vegetation.

In earlier studies the relative abundance of the ground beetles was associated with nature of vegetation (Ewuim, 2004), while the curculionids have been associated with flower visiting and pollination (Sakai et *al.,* 1998; Ewuim, 2004). Weevils are plant eaters and thus are serious agricultural pests. The non-trapping of beetles at the forest plot might also be associated with dense litter cover and nature of environment which markedly impeded the locomotor activity of the beetles and thus their non-trapping. These observations are similar to those of Adis (1979) and Ewuim (2004) who observed that in the forest the depth of ground litter influenced pitfall sampling results. There is also evidence to suggest that the nature of the forest habitat might have also

influenced the trapping of these beetle species including the position of installment of these traps in a given habitat.

Apart from the possibility of evasion of traps by species depending on the nature of a habitat, Ewuim (2004) in an earlier study emphasized that the vegetation structure can also greatly influence pitfall captures. Vegetation structure can also, in turn affect the locomotory ability of the species in the habitat. Species also respond differently to continuous variation in environmental quality (Bell et *al.,* 2000; Ewuim 2004) hence the differences observed in the trapping the species at these sites. The zero counts observed for the beetle species at the forest may not necessarily reflect absence at the plot but in line with the observation of Schowalter and Ganio (1998) that large number of zero obtained for many taxa complicate statistical analysis of arthropod abundances which defy normalization using any transformation.

It has been observed that adult beetles are herbivorous during their surface life and constitute the most influential grazers hence their increased number in the cultivated farmland. This also explains the trend in the result of the F-LSD carried out in which there was significant difference in the trapped beetles with all trapped in the cultivated plot when compared with the forest plots (Ewuim, 2004). The alteration of vegetation structure in the non-forested plots studied therefore possibly influenced the spatial and temporal (spatiotemporal) variations in these species studied since in general; temporal dynamics of insect populations invariably take place within a spatial context. In the long run evidence abound from this study that the least stable and perhaps the least efficient community is the highly diverse one as observed for the cultivated plot. In fact, Ewuim (2004) have questioned the whole concept of increased diversity bestowing increasing stability and has demonstrated that the diverse community in more fragile. Disturbed systems like those of the cultivated farmland may be inherently more resilient (Ewuim, 2004) even in terms of the insect species as observed for agro-ecosystem.

In the final analysis, the significant difference observation in the trapping of the beetle species with a high population density for the cultivated plot is also a strong indication that the beetle families were particularly sensitive indicator taxa of land use (Ewuim, 2004) as confirmed by the increased density of the coleopteran species in the cultivated agro-ecosystem.

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