COLEOPTERAN FAUNA OF AGROECOSYSTEMS IN AWKA, NIGERIA

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ABSTRACT

A study was carried out to investigate the coleopteran fauna of two agroecosystems (cultivated farmland and fallow 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 inspected every twenty-four hours and the insects caught sorted and counted under a dissecting microscope. Species of Coleoptera 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 Coleopterans from the two sampling sites were significantly different at p-value of 0.0053 and mean difference of 2.500. The heterogeneity of the coleopteran species at the cultivated plot was traced to cultivation. The role of certain coleopteran families as faunal indicators was highlighted. Other factors, which influenced the Coleopteran species at the farmlands were also discussed.

Keywords: Coleoptera, Fauna, Agroecosystems, Pitfall traps

INTRODUCTION

The insects are strategic in the welfare of man through their activities. The coleopterans (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 coleopterans 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 coleopterans 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 coleopterans therefore constitute an interesting group to study. The study of the coleopteran species in a cultivated and a fallow farmland will no doubt provide useful information on their distribution and abundance.

MATERIALS AND METHODS

Site Description: The investigation 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^O N and longitude 7.12884^O 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 *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 *Phyllanthus amarus* Schum and Thom. On the other hand, the fallow farmland lies between latitude 6.25054^ON and longitude 7.12078^OE. The plot has been left fallow for twelve years after the previous cultivation and therefore was overgrown with plants associated with fallows. Identified herbaceous plants included *Chromolaena odorata* (L.), *Aspilia africana* (C.D), T*ridax procumbens* (L.), *Axonopus compressus* (Sw.) Beauv., *Mariscus longibracteatus* Cherm., *Sida acuta* Burm. f., *Panicum maximum* Jacq. and *Veronia ambigua* Kotchsky and Peyr. Trees found at the plot included *Pentaclethra macrophyla* (Bentham), *Chlorophora excelsa* (Welw.) Benth., *Mangifera indica* L., *Combretum molle* R. Br., *Eleais guineensis* Jacq., *Newbouldia laevis* (P. Beauv.), *Terminalia ivorensis* A. Chev. and., *Anthonata macrophylla* (P. Beauv.). The fallow farmland which is sandy loam and over 1000

m^2 in area is separated from the cultivated farmland by a tarred road leading from the first gate of the Permanent Site of the Nnamdi Azikiwe University, Awka.

Sampling Method: Eight pitfall traps made of plastic containers, with mouth diameters of 9.80 cm and 6.2 cm deep were set in the two study sites, on each sampling occasion (i.e. every month). The traps were filled to one-third with 5 % formalin. The traps were inspected every 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 readings of those temperatures were taken twice in each case both at the time of setting the traps and during their collection.

The insects and their larvae were identified using Insects of Nigeria - Check List and Bibliography by 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) test, to ascertain whether or not statistical difference existed between the pitfall catches of coleopteran species, obtained from the fallow plot and the cultivated farmland.

RESULTS

A total of 46 beetles were trapped using the pitfall technique during the twelve-month sampling of both agroecosystems. The cultivated farmland had 17 coleopterans, 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 *Carpoplilus fumatus* (Nitulidae), *Tetragonothorax* sp. (Curculionidae), *Silidius appicalis* (Cantharidae), *Heteroderes* sp. (Elatridae), *Heterorynchus licas* (Scarabacidae) while a single species of *Hyparpalus* was collected from the fallow plot. Other seven species of Coleoptera were collected from the cultivated plot while other nine species were collected from the fallow plot. The result of Fischer's Least Significance Difference (F-LSD) also showed the pitfall catches of the coleopterans from the cultivated plot and the fallow farmland were significantly different ($p<0.05$), with more catches obtained from the cultivated plot.

DISCUSSION

Homogeneity in the distribution of the beetle species between the fallowed and cultivated sites is related to the efficiency and capture rate of the wandering species. Out of eight families of Coleoptera trapped, Carabidae, Nitudilidae, Curculionidae, Cantharidae, Ostomatidae, Elatridae, Scarabacidae and Staphylinidae were more abundant in the cultivated plot than in the fallow plot (Table 1).

Table 1: Pitfall catches of coleopterans obtained from the fallow plot and cultivated farmland at Awka, Nigeria

Beetle family	Genus and Species	Beetle Populations Sampling Sites *	
		A	B
Carabidae	*Macrocheilus labrosus*	1	-
	Pheropsophus parallus	1	-
	Chlaenius sp.	2	-
	Hyparpalus sp.	11	1
Nitudilidae	*Carpophilus fumatus*	1	-
Curculionidae	*Tetragonothorax* sp.	1	-
Cantharidae	*Silidius apicalis*	1	-
Ostomatidae	*Tenebroides mauritanicus*	2	-
Elatridae	*Heteroderes* sp.	1	-
Scarabacidae	*Heterorynchus licas*	1	-
Staphylinidae	*Mylabris* sp.	-	7
Unidentified Coleoptera		7	9
Mean Difference (Sites A and B)		**2.500**	
Critical Differences		**1.719**	
Probability (P) Value		**0.0053+**	

** Sampling sites: A – cultivated plot; B = Fallow plot; + P – value significant at 5% probability level*

In an earlier study, Ewuim (2004) associated members of Carabidae family with cultivation and the complex relationship between wandering beetle, abundance and the frequency of vegetation cover (weed) have been established (Spreight and Lawton, 1976, Ewuim 2004). The higher number of the 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 (Greenslade, 1964; Ewuim, 2004), while the curculionids have been associated with flower visiting and pollination (Gakai *et al*., 1998; Ewuim, 2004). Weevils are plant eaters and thus are serious agricultural pests. The lower catches of beetles at the fallow plot might also be associated with dense vegetation associated with the fallow plot which might have markedly impeded the locomotor activity of the beetles and thus their poor trapping. These observations are similar to those of Spreight and Lawton (1976), who observed that strip of vegetation offered resistance to movement of ground beetles.

It has been observed that adult beetles are herbivorous during their surface life and constitute the most influential grazers (Hinds and Rickard, 1973) hence their increased number in the cultivated farmland than the fallow plot. This also explains the trend in the result of the F-LSD carried out in which there was significant difference in the trapped coleopterans with more trapped in the cultivated plot when compared with the fallow plot (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 the final analysis, the significant difference observation in the trapping of the coleopteran species with a higher population density for the cultivated plot is also a strong indication that the beetle families were particularly sensitive indicator taxa of land use (Rivers-Moore and Samsway, 1996; Ewuim, 2004) as confirmed by the increased density of the coleopteran species in the cultivated agro-ecosystem.

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