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COMPARATIVE STUDY OF ECOLOGICAL SURVEY TECHNIQUES ON INVERTEBRATE

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ABSTRACT
The objective of this study was to determine appropriate methodologies in different habitats in order to identify invertebrates using identification keys. The study was carried out in the Close House in the University of Newcastle Experimental Farm. The methods employed during the study were Pitfall trapping, Sweep netting, Blo-Vac and Beating trays. The skills of using the identification keys were developed in order to identify the groups of insects present in different habitats at least to the level of their order. Major invertebrate orders such as Hemiptera, Diptera, Hymenoptera and Coleoptera were identified and assessed using appropriate methods of survey, having undertaken a quantitative comparison of the relative advantages and disadvantages of the various methods used. Sampling techniques were taken in open and dense vegetations, trees and shrubs and the data collected were analysed using bar charts, Simpson's biodiversity index and Shannon biodiversity index. The results showed that Blo- Vac method produced the highest number of species in both habitats followed by Sweep netting but beating tray method recorded the least number of species from trees and shrubs. There was a significant difference between Simpson biodiversity index and Shannon diversity but there was no significant difference between Simpson Evenness and Shannon Evenness.

KEYWORDS: Ecological Survey, Techniques, Invertebrate, Habitats.

INTRODUCTION

There are over 20,000 species of insects in Britain and all over the world. Some are found in many different habitats while others are restricted to particular habitats. As there are numerous number of invertebrates all over the country and they are important, it is necessary to develop adequate techniques in conservation and management of this species and their habitats. Rodwell (1991) stated that vegetation classification systems based on species assemblages such as the National Vegetation Classification has helped people to recognise and identify different kinds of plants communities and that an assemblage approach is appropriate for invertebrates because of comprehensive species by species approach to their conservation. For example, Ground beetle assemblages have been used to classify habitats at national and regional scales *(*Luff *et al* 1989).

Identification and classification of invertebrates may not be possible without employing some techniques. These sample techniques have pros and cons however the following advantages and disadvantages that are associated with the methods used in this study were examined. Greenslade (1964) observed that pitfall trap is the most commonly used trap method for studying invertebrates and it is a cheap and easy method of catching very large numbers of invertebrates with minimum effort but its disadvantages are that the catch rate varies and they are affected by invertebrate activity and the vegetation in the vicinity of the trap which impedes invertebrate movement. Sweep netting, is quick, low-cost and efficient way of collecting large numbers of invertebrates. However, sweep netting cannot be carried out if the vegetation is damp and it does not work well in vegetation which is less than 15cm high or in vegetation which has been flattened by wind, rain or trampled. Beating tray is a very quick and easy method to collect and gives relative estimates of invertebrate numbers. Sunderland (1996) stated that Blo-Vac is faster but it is costly and makes noise while beating tray method encountered some problems because the trays were flat so the insects that fell on the trays flew away.

Ecological studies are used to monitor environmental changes. Samways (2005) reported that the use of invertebrates by conservationist to assess conservation site quality and indicate taxa in terrestrial ecosystem started recently. Biederman *et al* (2005) noted that semi-natural grasslands supports dense

population and a wide range of species with diverse ecological adaptation. Knowledge about most species and modern identification keys provide a model for the composition and structure of populations. Assemblages respond to major environmental and anthropogenic areas which could help to predict the impact of likely future changes in land use and environment. This is to say that one of the advantages of invertebrates is that they respond rapidly to environmental change or disturbance and as such, they are often used as indicators of change. Morris (1981). Community parameters such as the number of species and individuals are useful parameters for biodiversity and conservation assessment and monitoring habitat changes (Bouchard *et al* 2001). The objective of this study was to determine appropriate methodologies in different habitats in order to identify invertebrates using identification keys.

MATERIALS AND METHODS.

This study took place in the Close House of Newcastle University experimental farm in 2007 cropping season. Different types of sampling methods were used in different habitats and the samples collected were identified under the microscope and also by the use of identification keys from the book provided. The experimental designs used were the application of the various types of technique of sampling in different habitats. The methods used were Pitfall Trapping, Sweep netting, Blo-Vac and Beating trays. These were applied directly in the habitats for sample collection.

Pitfall Trapping:

Pitfall traps were set out over ten days in wild flower plots below the glass houses in the Close House of the University to trap the insects. The traps were set out in both open vegetation and dense vegetation. This consisted of a plastic cup of about 7cm diameter; 6.5cm depth were sunk into the ground with the top level at the soil surface. Samples collected were transferred into a polythene bag with cotton wool soaked with alcohol solution and then tied up and allowed for about 15 minutes to die before sorting them into order such as Coleoptera (beetles), Hemiptera and Diptera. Sorting was done using the keys provided and an accurate drawing of two small numbers of the specimens were made and labelled. They were sorted into polythene bags labelled against each habitat.

Sweeping netting:

The sweep net was used to collect samples of insects from the rough vegetation near the road behind the field laboratory and also along grass vegetation in the wall garden. The sweep net was swigged 20 times with the tip touching the ground and the samples were tipped into the polythene bags labelled against each habitat with cotton wool soaked with alcohol solution and tied up and allowed for 15 minutes before sorting. The samples were sorted differently and records were kept according to their habitats. The precaution taken when carrying out this method was to ensure that the sites which others might have sampled were not sampled in order to get accurate results.

Blo-Vac

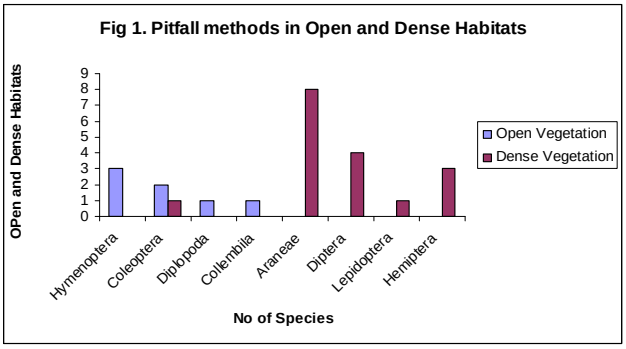
This is a modified leaf-blower machine which is hand –held two stroke petrol engine with a small diameter (15cm) with net placed at the end of rigid suction tube. This method was compared with sweep netting, so it was carried out in 60 seconds in the same sites that were already sampled with sweep net. The samples were tipped into polythene bags with a cotton wool soaked in alcohol solution and allowed for 15 minutes before sorting.

Beating Trays:

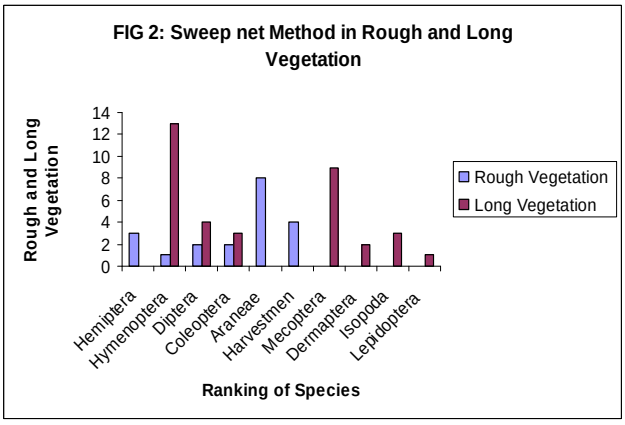
In this method, samples were collected from a deciduous (willow plants) and evergreen tree called coniferous species. A tray was placed under the trees and beaten on top of the trees so that the insects fall on the trays and was collected in polythene bag with cotton wool soaked in alcohol solution and allowed for 15 minutes before sorting. Non parametric test was the statistical analyses used in this study.

RESULTS

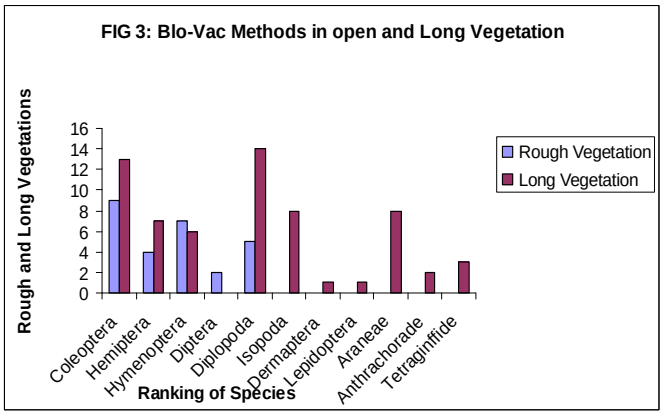
There were significant differences between the sampling techniques. The result produced significant differences in the habitats and even in the total abundance of the invertebrates. Some of the taxa were
biased in some habitats as illustrated in the charts (Fig 1 – 4).



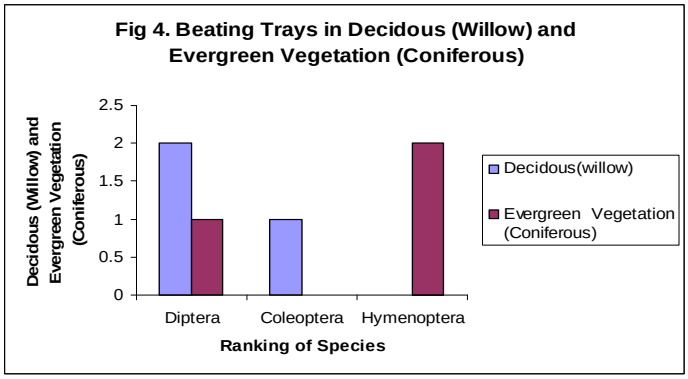
This chart (fig 1) showed the relationship between the total number of species and the number of individuals in the two habitats. The total abundance of species in open vegetation was 4 while the dense vegetation recorded five species using pitfall trapping methods.



This chart (Fig 2) revealed two assemblages of two vegetation, open and long using Sweep netting method. Open vegetation recorded total abundance of six species while dense vegetation recorded a total of seven species. The most dominant species occurred on the scale of 1-4.



The Y axis produced the relative abundance of species while X axis ranks each species in the order from the most to the least abundance species. This method (blo vac) (fig 3) recorded the best result above all other methods used in this study.



Beating tray method was applied in deciduous (Willow trees) and evergreen (coniferous species). This method and habitats recorded the least results in this study can seen from the fig 4 above.

Table 1: Simpson's Diversity Index

Methods	Pitfall Trapping		Sweep Netting		Blo- Vac	
Vegetations	Open Veg.	Dense Veg.	Rough Veg.	Long Veg.	Rough Veg.	Long Veg
Simpson's Diversity	3.267	3.176	4.082	4.239	4.166	7.737
Simpson's Evenness	0.817	0.635	0.68	0.606	0.833	0.703

Table 2: Shannon's Diversity Index

Methods	Pitfall Trapping		Sweep Netting		Blo- Vac	
Vegetations	Open Veg.	Dense Veg.	Rough Veg.	Long Veg.	Rough Veg.	Long Veg
Shannon's Diversity	1.277	1.335	1.583	1.651	1.499	1.995
Shannon's Evenness	0.921	0.829	0.884	0.849	0.931	0.832

There are significant differences between Simpson biodiversity index and Shannon diversity index but there is no significant difference between Simpson evenness and Shannon evenness as shown on the tables above.

DISCUSSION

Each sampling method has it own biases. Many invertebrates were found to be more abundant in one habitat than the other. This may be as a result of efficiency of the method or the skill of the researcher applying these techniques or even environmental factors which tend to favour them in those habitats. Southwood and Henderson (2000) reported that light traps are more attractive to the target species than others and that seasonality, weather conditions and that of the skills of the researcher contribute more to the variables. This may be true especially the weather condition which might have been responsible for few number of species in some habitats. Blo-vac method produced the highest result of the total abundance of species and richness in the both vegetations, this was followed by sweep netting and then pitfall while beating trays produced the least results among the methods used. Blo-vac also produced some different species composition from those produced by other methods.

There were differences between Simpson biodiversity and Shannon biodiversity but there were no significant differences between their evenness. This result did not agree with Boswell and Patil (1971) who stated that log series produced slightly more even distribution of species abundance than geometric series even though one less than the normal distribution. He stated further that the small of abundant species and the large proportion of rare species as predicted by the log series apply only with geometric series. The frequency of species is expressed in relation to its abundance. The charts showed the relationship between the number of species and the number of individuals in the habitats and methods. Magurran (1988) argued that plotting methods needed to be standardized to facilitate the comparison of different data sets. In this study, two diversity indices used were the Simpson diversity index and Shannon diversity index. Diversity between these indices was shown but there was no significant difference in their evenness.

According to Peet (1974) diversity measurement is based on three assumptions.
That all species of notable conservation value or species that makes a disproportionate contribution to community function do not receive special weighting because relative abundance of species in a habitats is the only factor that determines its importance in a diversity measure. The second assumption of biodiversity measure is that all individuals are equal and that there is no distinction between the world's largest species in California and a small one in China. Thirdly, that biodiversity measures assume that species abundance was recorded using appropriate and comparable units and that abundance must be in the form of numbers of the individuals when the log series model was used.

REFERENCES

Biedermann R; Actuger R; Nickel H. and Alan .A.S (2005) Conservation of Grassland Leafhopper. A brief review. *Journal of Insects Conservation*. 9: 229-243

Bouchard.P, Hamiton K.G. A. and Wheeler T.A (2001). Diversity and conservation Status of Prairie endemic Auchenorrhyncha (Homoptera) in alvars of the Great Lakes region. *Pro. Entomology. Soc.Ontario* 132:39- 56.

Boswell, M.T and Patil, G.P. (1971). Chance Mechanisms of Generating the Logarithmic series distribution used in analysis of number of species and Individuals: *In Statistical Ecology vol.3.*

Greenslade, P.J.M (1964). Pitfall trapping as a method for studying populations of Carabidae. *Journal of Animal Ecology* 33: 301-310.

Luff, M.L; Eyre M.D and Rushton S.P.(1989) Classification and ordination of habitats of Ground beetles. (Coleoptera Carabidae) in north-east of England. *Journal of Biogeography*. 16: 121-130

Magurran, A.E (1988) Ecological Diversity and its Measurement. Princeton University Press.

Morris, M.G (1981) Response of grassland invertebrates to management by cutting. Adverse effects on Auchenorrhyncha. *J. Applied Ecology* 18: 763-771

Peet, R.K. (1974) The Measurement of species diversity. *Ann. Rev. Ecol. Syst.* 5: 285-307.

Rodwell, J. S. (1991) British Plant Communities, Woodland and Shrubs .The Development of Isles: A habitats based invertebrate's assemblage Classification System for assessing Conservation interest in England. Jonathan R.W and Derek.A.L. English Nature. . Cambridge University in *Journal of Insects Conservation* 2006 10: 179-188

Samways, M. (2005) .Insect Diversity Conservation. Cambridge University Press.

Southwood, T.R. and Henderson, P.A. (2000). Ecological Methods.Oxford: Blackwell Science.
Sunderland, W.S (1996). Ecological Census Techniques. Bath Press UK .PP 164-165.

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