

ODONATA FAUNA OF CONTRASTING SEMI-AQUATIC AND TERRESTRIAL ECOSYSTEMS IN AWKA, NIGERIA

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ABSTRACT

The sweep net was used to study the Odonata fauna of the Permanent Site of Nnamdi Azikiwe University, Awka for a twelve-month period. The Odonata species collected from the marshy plot included Orthetrum chrysostigma, Ceriagrion glabrum, Platycnemis subaequistyla Fraser and Nesciothemis nigeriensis while Hemistigma coronata and Palpopleura lucia were obtained from the fallow plot. Only two species - Palpopleura lucia and Hemistigma albipuncta were collected from the cultivated plot. A statistical analysis of the collections of these insect species using Analysis of Variance (ANOVA) failed to show any significant differences at F-ratio of 0.458 and p-value of 0.6339, even though higher numbers of species were obtained at the wetland. Similarly the sweep net catches failed to show any significant difference using the Fisher's Least Significance Difference (F-LSD) test at 5% probability level. The higher catches of the odonates at the marshy plot was traced to the nature of the habitat. The role of these sub aquatic species as indicators of ecosystem quality was highlighted.

Keywords: Odonata fauna, Semi-aquatic ecosystem, Awka,

INTRODUCTION

The insects are strategic in the welfare of man (Ewuim, 2004), and constitute a major component of the earth's biodiversity with their species richness or diversity exceeding that of any group of extant organisms. The majority of arthropods, and indeed the majority of animals, is insects. Except in the sea where crustaceans hold sway, insects dominate the earth in terms of numbers and kinds and of such importance ecologically and economically, that we literally would not have reached our own place in nature without understanding something about them (Wallace *et al.*, 1981). In insects alone account for 20,000 species (90.54%) with these group contributing significantly to the maintenance of life support systems, and 99.90% of the insect species being beneficial or neutral to man (Ivbijaro, 2003). These insects are abundant in a wide range of habitats including both terrestrial and aquatic ecosystems (especially fresh water), and including wetlands, either as aquatic or sub-aquatic species, even though they have never adapted to a typical marine environment.

The term wetlands have been described variously. The Ramsar Convention in Caspian in 1971 adapted the term wetland as "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters. The definition focuses essentially on a specific type of ecosystem - wetlands. There are good reasons why shallow aquatic and wet terrestrial ecosystems should be grouped under the generic title of wetlands. A wetland has also been defined as a shallow seasonally or permanently water logged or flooded area, which normally supports hydrophytic vegetation (Wheeler and Proctor, 2000).

This definition like most others have failed to include the variety of animal life which is important in maintaining ecosystem dynamics in the environment (Ewuim *et al.*, 2001), and the influence of such a wetland on the nature of soil, in the area. Wetlands vary widely because of regional local differences in soil topography, hydrology, water chemistry, climate, vegetation and other factors including human disturbances (Cowardin *et al.*, 1992).

Odonata is an order of aquatic palaeopteran insects with about 6500 extant species in just over 600 genera and are generally located at or near fresh water although some species roam widely and may be found far from their breeding sites. The odonates whose adults and nymphs are predatory spend majority of their life history in water, with the larvae or their nymphs taking one to five years to complete their development, while some species sometimes spend about one twelfth of a year as adults (Burton *et al.*, 1974). The odonates even though their nymphs are aquatic, have generally been described as sub-aquatic species (Ewuim *et al.*, 2001).

Varieties of techniques have been developed in studying organisms in the wetland habitat. However no single method would be ideal for all habitats because of their characteristic advantages and limitations (Lewis and Taylor, 1979; Ewuim *et al.*, 2001; Ewuim, 2004). The sweep net has been used in such studies and classified by Southwood (1996) as a relative method, which employs catch per unit effort. Majority of the relative methods require only comparatively simple equipment and serve to concentrate the animal and provide impressive collections of data from situations where few animals will be found by absolute methods. The size of relative population estimates is influenced by changes in population 'phase' of the animal, their activity and variation as well as the responsiveness of the

different sexes and species (Southwood, 1996). In this study the sweep net will be employed in studying a marshy habitat, a cultivated plot and a fallow farmland in Awka with a focus on the species of Odonata. It is envisaged that this study will help add to the paucity of information available on this fauna in Nigeria especially in the habitats under investigation.

MATERIALS AND METHODS

Study Sites: The investigation was carried out in three sampling sites viz. a cultivated farmland, fallow plot, and a marshy plot and a forest all of which are found at the Permanent Site of 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). Awka is located between latitude 5° and 6°25' and longitude 7°E and 8°E with the town stretching for 8km in an East - West direction along the Enugu-Onitsha expressway and about 5km in a North-South orientation. The town is about 12,007 hectares in dimension.

The marshy habitat is located between latitude 6.23782°N and longitude 7.12884°E. Alternatively the bearing of this study site from Enugu 59 km/Onitsha 48 km milestones is 25° NW (or 335° Azimot) with a distance of 120m from the milestone. The plot is over 600 m² in area, and subject to seasonal flooding annually with the soil being sandy. The dominant plant in the habitat was *Scirpus mucronatus* L. - a sedge (family Cyperaceae) characteristic of swamps and streamsides (Lowe and Stanfield, 1974). Other common plant species in the site include *Setaria pallidifusca* Stapf and Hubb, *Panicum ribens* L. and *Cynodon dactylon*, Pegs and *Petotis* sp., which are all grasses. The other herbaceous plants included *Chromolaena odorata* (L.) R.M. King and Robinson; *Imperata cylindrica* (L.), *Mariscus longibracteatus* Cherm., *Axonopus compressus* (Sw.) Beauv., *Mimosa pudica* L., *Waltheria indica* (L.) in addition to the shrub *Mallotus oppositifolius* (Geisel). The trees included *Bauhinia rufescence* Lam. *Combretum molle* R. Br. *Eleais guineensis* Jacq., *Daniela oliveri* (Benn.), *Pentaclethra macrophylla* (Bentham), *Acacia nilotica* Mill., and *Vitex doniana* Sweet.

The cultivated plot was a cassava farmland. The farm had a previous history of five-year fallow before being cleared, and planted with cassava in the year of investigation. The plot is 800m² in area. The cultivated plot is located between latitude 6.25054°N and longitude 7.12141°E. At the time of sampling, and apart from the cassava, *Manihot esculenta* Kranz, planted in mounds, this farm had a variety of weeds. The weeds included *Sida acuta* Burm., *Aspilia africana* (Pers.) C.D. Adams, *Euphobia hirta* L. *Chromolaena odorata* (L.) R. M. King and Robinson, *Emilia sonchifolia* (L.) D.C., *Tridax procumbens* L., *Mariscus alternifolius* Vahl., *Commelina benghalensis* L., and *Axonopus eompressus* (Sw.) Beauv., and a shrub *Phyllanthus amarus* Schum and Thorn.

The fallow farmland lies between latitude 6.25054°N and longitude 7.12078°E. The plots have been left fallow for twelve years after the previous cultivation, and overgrown with plants and common weeds of fallows. Identified herbaceous plants included *Chromolaena odorata* (L.) R.M. Kings and Robinson, *Aspilia africana* (Pers.) C.D. Adams, *Tridax procumbens* L., *Axonopus compressus* (Sw.) Bc::aav., *Mariscus longibracteatus* Cherm., *Sida acuta* Burm. F., *Panicum maximum* Jacq. And *Vernonia ambigua* Kotchsky and Peyr. Trees found at the plot included *Pentaclethra macrophylla* (Bentham), *Chlorophora excelsa* (Welw.) Benth., *Mangifera indica* L., *Prosopis africana* L., *Combratum ghasalense* Engl. And Diels., *Combretum molle* R. Br., *Eleais guineensis* Jacq., *Newbouldia laevis* (P. Beauv.), *Terminalia ivorensis* A. Chev., *Anthonata macrophylla* (P. Beauv.) The fallow farmland is sandy loam and over 1000m² in area. It 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: Monthly sampling was carried out using the sweep net. One each sampling occasion, twenty-five sweeps were made across the vegetation with the bag carefully examined for insects after each sweep. The caught insects were deposited temporarily in a bottle which contained cotton and filter paper soaked in chloroform. The species of Odonata were identified using insect 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.

RESULTS

Table 1 shows the species of Odonata obtained from the three study sites during the twelve-month sampling period from January to December 1998. Three families of Odonata were obtained including Libellulidae, Coenagriidae, and Platycnemididae and represented by seven species. *Orthethrum chryso stigma* Burm. and *Nesciothemis nigeriensis* Gambles were the only libellulids collected from the marshy plot with the two families of Coenagriidae and Platycnemididae represented by *Ceriagrion glabrum* Burm and *Platycnemis subaequistyla* Fraser respectively. The other libellulid species collected from the cultivated (cassava) plot were *Palpopleura lucia* Dry. and *Hemistigma albipuncta* Ramb. while *Palpopleura lucia* and *Hemistigma coronata* were collected from the fallow plot.

The ANOV A test for significant differences in the species of Odonata collected failed to show any significance at F-ratio of 0.458 and probability level (p) of 0.6334 even though relatively higher collection of the species was made at the fallow plot (Table 1). Similarly, in the use of the Fisher's Probability Least Significant Difference, mean differences of 0.146, 0.083 and 0.063 at p levels of 0.304, 0.351 and 0.304 respectively were obtained (Table 2).

Evidently, relatively higher catch was recorded for species of Odonata at the marshy plot than in other plots.

Table 1: Odonata Fauna of Contrasting Ecosystem in Awka Nigeria.

Odonata Family	Genus and Species	Populations of Odonata			
		Sampling Site *			Total
		A	B	C	
Libellulidae	<i>Orthethrum chrysostigma</i>	3	-	-	3
	<i>Nesciothemis nigeriensis</i>	1	-	-	1
	<i>Hemistigma coronata</i>	-	-	2	2
	<i>Hemistigma albipuncta</i>	-	1	-	1
Platycnemididae	<i>Ceragrion glabrum</i>	2	-	-	2
	<i>Platycnemis subaequistyla</i>	1	-	-	1
	Sum of Square	0.344			
ANOVA	Mean Square	0.172			
	F-value	0.458 (-)			
	Probability (p) value	0.6339 (-)			

* Sampling Sites: A - marshy plot; B - cultivated plot; C - fallow plot (-) F-value not significant at 5% probability level

Table 2: Fisher's Least Significance Difference (F-LSD) of Odonates among contrasting ecosystems in Awka, Nigeria.

Study Sites *	Mean (-) Difference	Critical Difference	Probability (p) value
A,B	0.146 (-)	0.304	0.3434
A,C	0.083 (-)	0.351	0.6386
B,C	0.063 (-)	0.304	0.6841

A - marshy plot; B - cultivated plot C - fallow plot (-) Mean differences not significant at 5% probability level.

DISCUSSION

Out of a total number of 13 families of Odonata reported by Medler (1980) in Nigeria, three families represented by seven species were collected in this study. There was a preponderance of libellulid species represented by *Orthethrum chrysostigma*, *Palpopleura lucia*, *Nesciothemis nigeriensis*, *Hemistigma coronata* and *Hemistigma albipuncta* with *Orthethrum nigeriensis* collected from the marshy plot. The preponderance of these libellulids (Darter dragonflies) might be associated with their habit of repeatedly darting out on a brief flight from a favourite perch and then returning to it again, as noted from earlier observations (Burton et al., 1974), which predispose them to capture. The only two species of Odonata - *Palpopleura lucia* and *Hemistigma*

albipuncta obtained from the cultivated farmland have been noted as species whose adults are strong fliers (Boorman, 1981), Ewum, 2004} and many have been collected in the course of their exploratory predatory activities (Ewuim, 2004). The trapping of *Palpopleura lucia* and *Hemistigma coronata* at the fallow plot might also be associated with their predatory activities.

Four species of Odonata - *Orthethrum chrysostigma* and *Nesciothemis nigeriensis* both of which are skimmers (libellulids), *Ceragrion glabrum* (the coenagriid) and *Platycnemis subaequistyla* (a platycnemid) were also collected from the marshy plot. It has been demonstrated by Ewuim et al. (2001) that this taxonomic group (Odonata) contains aquatic and sub-aquatic species, and serving as faunal indicator of this wetland represented by the marshy plot (Ewuim, 2004). The odonates are always noticed around water in West Africa (Boorman, 1981; Ewuim, 2004) and though predatory, their nymphs are aquatic (Ewuim 2004). Evidently from this study the wetland supported a higher population density of Odonata as a result of its aquatic status, but the paucity in the collection of the odonates from the three sampling sites is traceable to the strong flying capabilities of this group making them elusive to collection using sweep nets. In the [mal analysis and to a very large extent, the presence of species of Odonata may be regarded as an indicator of ecosystem quality and as aquatic predators beneficial to man in terms of their involvement in insect pest control.

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REFERENCES

BADEJO, M. A. (1998). *Introduction to general classification of crustaceans*. College Press Limited, Ibadan.

BOORMAN, J. (1981). *West African Insects*. Longman Group Ltd., Essex, United Kingdom. 88 pp.

BURTON, J., YARROW, H. H., ALLEN, A. A., PARMENTER, L. and LARSBURY, I. (1974). *The Oxford Book of Insects*. Oxford University Press, London, 208pp.

CHARTER, J. R. (1970) *Vegetation Ecological Zones*. Federal Department of Forest Research Ibadan, Nigeria.

COWARDIN, L. M., CARTER, V., GOLET, F. C. and LAROE, E. T. (1992). *Classification of Wetlands and Deepwater Habitats of the United States*. U. S. Department of the Interior, Fish and Wildlife Service.

EWUIM, S. C. (2004). *A study of the insect fauna of the Permanent Site of Nnamdi Azikiwe University, Awka*, Ph.D. Thesis. Nnamdi Azikiwe University Awka, 269 pp.

- EWUIM, S. C., EGWUATU, R. I. and NWANA, I. E. (2001). Insect faunal indicators of an aquatic habitat in Awka, Anambra State, Nigeria. *Journal of Multidisciplinary Studies*, 7(1): 81 – 88.
- IVBIJARO, M. F. A. (2003). Insect and the environment. *A key note address presented at the 34th Annual Conference of the Entomological Society of Nigeria (ESN)*. University of Lagos October 6, 2003. 27pp.
- KEAY, R. W. J. (1961). *An outline of Nigerian Vegetations*. Federal Ministry of Information, Lagos, Nigeria. 46 pp.
- LEWIS, T. and TAYLOR, L. R. (1979). *Introduction to Experimental Ecology: A Student Guide to Fieldwork and Analysis*. Academic Press, London, 401 pp.
- LOWE, J. and STANFIELD, D. P. (1974). *The flora of Nigeria Sedges (Family: Cyperaceae)*. Ibadan, University Press, Ibadan, Nigeria 144pp.
- MEDLER, J. T. (1980). *Insects of Nigeria - Check List and Bibliography*. Memoirs of the American Entomological Institute, No. 30. American Entomological Institute, Michigan 641 pp.
- SOUTHWOOD, T. R. E. (1996). *Ecological Methods with particular reference to the study of insect populations*, Methuen London. 524 pp.
- WALLACE, R. A., KING, J. L. and SANDERS, G. P. (1981). *Biology: The Science of life*. Goodyear Publishing Company Incorporated, Santa Monica, California 1140 pp.
- WHEELER, B. D. and PROCTOR, M. C. F. (2000). Ecological gradients, subdivisions and terminology of north-west European mires. *Journal of Ecology*, 88: 187 - 203.