INSECTS -PLANTS RELATIONSHIP AND SPECIES DIVERSITY OF DELTA STATE UNIVERSITY CAMPUS, ABRAKA, NIGERIA

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Abstract

Plant and insect shares strong mutual relationship in terms of pollination and nesting place. This study documented insect - plants relationship and diversities within Delta State University (DELSU) Campus, Abraka. Sampling for insect and their associated plant species were carried out within in two campus (Site II and II) of DELSU, Abraka. Sweep nets were used for the collection of insect and leaves of plant species were collected for identification. A total of 609 insects from 4 orders, 13 families, and 14 species were collected from the two sites. The insect Orders and distribution of different families encountered were Coleoptera (30.76%), Diptera (15.38%), Hymenoptera (30.76%) and Orthoptera (23.10%). Variation in the results using Duncan Multiple Range Test (DMRT) showed significant difference in species abundance and composition across the study Sites. Species diversity indices of 0.1043, 0.8957, 2.404, 0.8511, 2.203 and 0.9371 were recorded in Site II while diversity indices of 0.0868, 0.9132, 2.585, 0.8291, 2.529 and 0.9324 were recorded in Site III for Dominance_D, Simpson_1-D, Shannon_H, Evenness_e^H/S, Margalef and Equitability_J. 17 plant species in 15 families mostly dominated by Asteraceae and Rubiaceae were encountered as nesting and resting places for insect across the two campus. This study therefore suggest that species conservation and planned expansion should be carried out to reduce the ecological damage of plant diversity as insects make use of the plant species for nesting (habitat), obtaining food and resting.

Keywords: Abundance, DELSU, Diversity, dominance, insects, plants

Introduction

Plants and insects are a very different group due to their ability to occupy different niches, from deserts to the Arctic Circle, and to almost every plant species that grows on Earth (Paul-Andre *et al.,* 2018). Plants and insects together make up about half of all known species of multicellular organisms. However, plants play diverse roles in both flora and fauna ecosystems. The benefits of plants range from the utilization by man for the treatment of different ailments (Erhenhi *et al.*, 2017), as well as food and shelter for insects. Each plant interacts with insects in different ways. Insects can act as shelters, dispersants, or fertilizers for plants, but plants can be food / energy sources or nesting sites for insects (Leckey *et al.,* 2015). Beginning with herbivores, plant-insect interactions date back to the Devonian period, about 420 million years ago, when plants first began to conquer land (Currano *et al.*, 2008). However, in the late Carboniferous, about 320 million years ago, these interactions became more intense, with entomophiles (insect pollination) about 252 million years before the emergence of flowering plants (angiosperms). It is also a feature that it has appeared (Leckey *et al.,* 2015). It is important to understand the interaction between plants and insects, as insects play an important role in the reproduction of flowering plants.

Ornamental plants are highly dependent on insects for pollination, so the diversity and abundance of insects affects their reproduction. Factors such as nectar secretion, flower and insect morphology influence insect visits to plants (Dalhat *et al.,* 2018). There is clear evidence that domestic and wild pollen mating populations have declined recently, both of which can be affected by a variety of environmental changes, including

The loss of flowers and nesting resources (Potts *et al*., 2010). However, this decline can be the effect of fragmentation and can also be indirect through the disruption of plant-animal interactions, especially plant-pollen maters interactions (Biesmeijer *et al.,* 2006).

Given that the pollen population of many insects is declining and that pollination of crops is strongly dependent on a small number of pollen hybrids (Kleijn *et al.,* 2015). Deeper quantitative insights into insect flower visitors are essential. Studying the evolution of plant-insect interaction requires an interdisciplinary approach within a historical (i.e. phylogenetic) framework. Among the most important evolutionary trends in these insect-plant relationships described in the literature is taxonomic conservatism with the diversification of the insects behind the host plant. Little academic research has been done to link ornamental plants to insect pollinators. There is also a lack of long-term or definitive population studies that may serve as the basis for native pollen maters. The purpose of this study is to document the relationship and diversity of insects and plants on the Delta State University (DELSU) campus in Abraka.

Materials and Methods

Study Area

The study was conducted within Sites II and III campuses of the Delta State University located at Abraka, Ethiope East L.G.A. of Delta State. It lies between latitude 5^0 45′ and 5^0 50′ N and longitude 6^0 and 6^0 15′ E with a tropical

climate (23 to 37°C) and humid (relative humidity, 50 to 70%) (Lemy and Egwunyenga, 2017).

Insect Sampling and Collection

Different locations were mapped out within the study area for the collection of insects. Areas with ornamental and non-ornamental plants which are visited by insects were included in the mapped out locations. Insect sampling and collection was carried out randomly within the mapped areas with the aid of insect nets as described by Gibb and Oseto (2019). Insects trapped in the nets were retrieved and placed inside a prepared ethyl acetate killing jar. Solvents contained in the jar was absorbed by placing cotton wool. Preservation of insects was done using 70% ethanol and the insects were placed on plain-white papers and tightly covered in containers. Insects collected and preserved were transported to the research laboratory of the Department of Animal and Environmental Biology for identification based on their morphological features using standard entomological keys as described by Adelaja *et al.* (2021).

Plant Collection and Identification

Transect walk was made within the mapped out areas of the study for plants hosting insect and their details were entered into a field notebook. Samples of the plants encountered were collected, with the parts placed on a plant press and taken to the Herbarium of the Department of Botany, Delta State University, Abraka for proper identification. Accurate taxonomic references (Keay, 1989) were employed in the process of identification of the plants.

Data Analyses

The data obtained were subjected to analysis using descriptive statistics. PAST (Paleontological Statistics) Software, Version 4.03 was used for data analysis. Duncan Multiple Range Test (DMRT) was employed for comparing differences in insect species abundance in the study areas.

Results and Discussion

Insect species diversity and their abundance within Site II and III campuses, DELSU, Abraka showed a diverse insect species occurrence in the area (Table 1). 609 insects from 4 orders, 13 familie s, and 14 species dominated the two sites. Insect species in four (4) order, including Coleoptera, Diptera, Hymenoptera and Orthoptera were documented. The insect orders documented comprises of important insect species which has previously been documented by authors, including Aina-Oduntan *et al.* (2021) within forest research institute in Ibadan, Nigeria. Naman *et al.* (2019) reported similar insect order at the main campus of Kaduna State University, Nigeria. Adelaja *et al.* (2021) also recorded similar insect orders within telecommunication mast in Kwara State, Nigeria. Insect species documented include *Musca domestica*, *Dermestes* sp., *Zonocerus variegatus* among others. These species have also been recorded by several researcher including Yager *et al.* (2017) within the Federal University of Agriculture Forestry Nursery at Markudi, Nigeria. Also, Ajayi *et al.* (2018) recorded similar species within the premises of the Faculty of Agriculture at the Nasarawa State University, Nigeria. Previous study by Ojianwuna *et al.* (2019) within DELSU, Abraka comprising of similar insect order and species has also been reported

Table 1 Diversity and abundance of insect species within DELSU campus, Abraka

Order	Family	Species	Sites	
			Site II	Site III
Coleoptera	Scarabaeidae	*Anomala mixta*	0	29
	Dermestidae	*Dermestes sp*	21	32
	Scarabaeidae	*Heteronychus mossambicus*	15	9
	Coccinellidae	*Scymnus sp.*	8	16
Diptera	Muscidae	*Musca domestica*	55	73
	Calliphoridae	*Lucilia sericata*	39	67
Hymenoptera	Eumenidae	*Antodynerus bellatulus*	0	44
	Formicidae	*Camponotus acvapimensis*	27	11
	Pterimalidae	*Dinarmus sp*	5	8
	Braconidae	*Apanteles* sp.	9	5
Orthoptera	Acrididae	*Acrotylus insubricus*	23	12
		Schistocerca americana	11	18
	Pyrgomorphidae	*Zonocerus variegatus*	19	26
	Gryllidae	*Oecanthus longicauda*	0	27
Total			**232**	**377**

The species diversity based on insect order recorded in the study showed that the order Diptera was most dominant in terms of individual species; 238(38.43%). This was followed by Orthoptera; 136(22.34%) and closely followed by Coleoptera; 130(21.34%). The least individual species diversity was recorded in the order Hymenoptera; 109(17.89%). Duncan Multiple Range Test showed that there was no significant different (P>0.05) between the order Coleoptera and Orthoptera. However, significant difference (P<0.05) was recorded between the order Diptera in relation to other insect order within the study area (Table 2). Biodiversity indices for the study area are documented in Table 3. Species diversity indices showed that the study area recorded low species diversity and richness with Dominance_D (0.1043), Simpson_1-D (0.8957), Shannon_H (2.404), Evenness_e^H/S (0.8511), Margalef (2.203) and Equitability_J (0.9371) for Site II while diversity indices were recorded as Dominance_D (0.0868), Simpson_1-D (0.9132), Shannon_H (2.585), Evenness_e^H/S (0.8291), Margalef (2.529) and Equitability_J (0.9324) for Site III. The observations in this study in terms of diversity indices were low compared to the results obtained by Ajayi *et al.* (2018). The results corresponds with the study of Okrikata and Yusuf (2016).

Table 2: Percentage frequency distribution of insect species within DELSU campus, Abraka

Insect Order	Family (%)	Individual Species (%)
Coleoptera	4(30.76)	130(21.34)[b]
Diptera	2(15.38)	234(38.43)[a]
Hymenoptera	4(30.76)	109(17.89)[c]
Orthoptera	3(23.10)	136(22.34)[b]
Total	**13(100)**	**609(100)**

Values with different superscripts on the same column are significantly different ($P < 0.05$) while those with same superscript on the same column are not significantly different at $P>0.05$ using Duncan Multiple Range Test.

Table 3: Biodiversity indices of insect species in different campus of DELSU, Abraka

Variables	Site II	Site III
Species Number	12	15
Individuals	232	377
Dominance_D	0.1043	0.0868
Simpson_1-D	0.8957	0.9132
Shannon_H	2.404	2.585
Evenness_e^H/S	0.8511	0.8291
Brillouin	2.291	2.494
Menhinick	0.8535	0.824
Margalef	2.203	2.529
Equitability_J	0.9371	0.9324
Fischer_alpha	2.975	3.389
Berger-Parker	0.2026	0.1618
Chao-1	13	16

The diversity of plant species in relation to insects within the study area is shown in Table 4. 17 plant species in 15 families mostly dominated by Asteraceae and Rubiaceae were encountered as nesting and resting places for insect across the two campus. The species of plants include ornamental, non-ornamental and economic plants. Similar families have previously been reported by Ilondu and Lemy (2018) within DELSU and environs. Within the Bowen University Campus, Osun State, Nigeria, Soladoye *et al.* (2015) recorded similar families and species. Also, Nnadi *et al.* (2021) documented similar species and families within Rivers State University premises, Port Harcourt-Nigeria.

Table 4. Plants associated with insect species in Site II and III of DELSU, Abraka

S/N	Scientific Name	Common Name	Family
1	*Acalypha wilkesiana* Mull	Copperleaf	Euphorbiaceae
2	*Anacardium occidentalis* L	Cashew	Anacardiaceae
3	*Aspilia Americana* Pers	Sunflower	Asteraceae
4	*Cuphea hyssopifolia* Kunth	False heather	Lythraceae
5	*Duranta erecta* L	Pigeon berry	Verbenaceae
6	*Ficus benjamina* L	Weeping fig	Moraceae
7	*Hibiscus rosa-sinensis* L	Rose mallow	Malvaceae
8	*Indigofera spicata* Forssk	Creeping indigo	Fabaceae
9	*Ipomoea pupurea* (L.) Roth	Morning glory	Convolvulaceae
10	*Ixora chinensis* Lam	Chinese Ixora	Rubiaceae
11	*Ixora taiwanensis* L.	Ixora	Rubiaceae
12	*Lonicera japonica* Thunb	Honey suckle	Caprifoliaceae
13	*Luffa cylindrica* Mill	Sponge gourd	Cucurbitaceae
14	*Mentha suaveolens* Ehrh	Apple mint	Lamiaceae
15	*Tecoma stans* (L.) Juss	Yellow bells	Bignoniaceae
16	*Thuja occidentalis* L	White cedar	Cupressaceae
17	*Tridax procumbens* L	Coat buttons	Asteraceae

Conclusion

The study has established a relationship between insects and plant species within Campus II and III premises of Delta State University, Abraka. The result showed that insects belonging to different orders are dominant within the study area. It also provides an inventory of insect and plant species with possible relationship within the study area. The documentation of specific insects to specific plant is relevant for pollination studies. Hence, the study recommends a follow-up study relating specific insects to plant. Seasonal variation should be considered in a follow-up study as well as the possibilities of human activities

affecting the diversity and relationship between insects and plant species.

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