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Insect Diversity of Two Medicinal Labiatae in Southwestern Nigeria

A.D. Banjo, O.A. Lawal and S.A. Aina
Department of Plant Science and Applied Zoology
Olabisi Onabanjo University, Ago Iwoye
P.M.B.2002, Ogun State, Nigeria

Abstract: The insects associated with each of *Ocimum gratissimum* and *Ocimum basilicum* were revised. Insects found on the plants parts, include Diptera, Hymenoptera, Coleoptera, Orthoptera, Lepidoptera, Dictyoptera, Homoptera and Isoptera. The species richness, diversity index and the similarly index between the paired plant species were also calculated. The results of similarity and diversity indexes were influenced by the weather that fluctuated during the period of study (July to November). The Hymenoptera was the most abundant order on *O. gratissimum* and *O. basilicum*, accounting for 43.2 and 50.7%,

Key words: Labiatae, medicinal plants, *Ocimum* sp., insects

Introduction

Medicinal plants are of great importance to man as alternative for medicinal purposes. They have been in use since ancient time when their leaves, roots, stems, fruits and even flowers are used either as grounded forms, concoction of the part(s) or in form of an infusion.

Medicinal plants made use of in this study are *Ocimum gratissimum*, Linn and *O. basilicum*, Linn both in family Labiatae commonly called teabush and sweet basil, also *Efinrin-nla* and *Efinrin-ata* respectively (Gbile and Soladoye, 2002).

Ocimum gratissimum Linn. Synonymous to *O. vivide* Willd. Is also called fever plant or teabush (Agoha, 1974).

O. gratissimum is a small, smooth shrub, with many branches, commonly found around village huts and gardens, planted for its medicinal use usually not more than a meter high. Leaf is simple, oval in shape, up to 9 cm long and 4.5 cm broad. The apex is short and tapering to a tip; the base is wedge shaped. They are sparsely hairy on the under-surface and pilted with glands. The veins are slightly hairy and have aromatic smell when crushed (Agoha, 1974).

A decoction of the leaves is taken in Nigeria as a febrifuge and diaphoretic and is also regarded as stomatic and laxative. In French West Africa, it is used in coughs, fever and conjunctivitis. An essential oil has been obtained in small quantities (0.35-1.2%) from the leaves. It contains eugenol and 32-65% of thymol which accounts for its antiseptic value. Thymol can be prepared synthetically from piperitone (Bep, 1960).

The leaves contain thymol oil which is regarded as highly antiseptic. Some use the oil to prevent mosquito bites. The use of it as a laxative is common, though it is believed to be astringent. The oil mixes with alcohol in all proportions. A hot infusion of tea from the leaves acts as a remedy for fever and stimulates the secretion of sweat (Agoha, 1974).

It is used to cure catarrh and bone fracture in Okwanguro Division of Cross River National Park in Nigeria. Leaves are boiled in palm oil to make liniment for bone setting and fragrance from leaf is inhaled to relief catarrh (Emmanuel and Gabriel, 1996).

Corresponding Author: A.D. Banjo, Department of Plant Science and Applied Zoology, Olabisi Onabanjo University, Ago Iwoye, P.M.B.2002, Ogun State, Nigeria

The leaves of *O. gratissimum* are crushed in water and solution drunk for relief of dysentery (Personal observations).

Ocimum basilicum, (formerly *O.* americanum) is also called *efinrin wewe* in Yoruba and commonly referred to as tea bush, hairy or American basil. It belongs to family Labiatae. It is erect much branched annual herb. It is more or less woody below. *O. basilicum* has whitish ovate leaves and whorls of white purple tinged flowers in terminal racemes and in the leaf axils (Bep, 1960).

An infusion of the leaves mainly of *O. basilicum* is used in baths for febrile patients, in local instillations in the treatment of otitis or sinusitis and in fumigations of coughs and headaches. The plants contains an essential methyl cinnamate and is reported to have bactericidal action against *Salmonella typhi*.

O. basilicum is used as spice in local dishes and even earned the name curry leaf. When added to boiling meat, it gives it a very nice smell and also adds flavour to the cooked meat (Sofowora, 1982). It can also be used to treat headache or migraine. The leaves are plucked, squeezed and extract is applied to the head with sponge.

Its extract is taken with little salt to combat tapeworm infection. It is also used to treat gonorrhea infection by squeezing and adding grinded potash (kaun). This solution is administered orally thrice daily.

Extract from this plant is useful as pesticides. This plant when planted around human habitation is used to drive snakes away from the neighborhood (Sofowora, 1982).

Diversities of organisms (both pests and non pests) are associated with most of these plants, According to earlier works, they could either be defoliators, visitors, predators of other species or they are pollinators.

Banjo and Ogunbowale (1999) revealed that insects associated with the Nigerians Velvet Tamarind (*Dialium guineense*, Wild) were 12 species in which the coleopterans, dipterans and hemipterans were foliovorous, the hymenopterans (*Apis* sp.) were pollinators, isopterans fed on the root and bark of the plant while the dyctyopterans were mainly predators on other insects.

Also from another work of Banjo *et al*. (2000), it was discovered that insects associated with the agroecosystems of the spindle and globuse forms of pepper plant (C*apsicum* sp.) were Orthopterans (most abundant order), Dictyoptera, Diptera and Coleoptera. Their similarity index signified that they were very similar in abundance and their diversity index showed that they had low diversity and that few species were abundant.

The aim of this study is to identify the insects that affect these plants due to their various usages in nutrition, ethnopharmacy, pest control and some other usages. It is also important in order to enhance the planting, breeding and cultivation and conservation of these valuable products.

Materials and Methods

The site selected for the study of the insects associated with *Ocimum gratissimum* was the Back of the Biology laboratory (Mini-Campus) while the site associated for the investigation of the insects associated with *Ocimum basilicum* was beside Victory hall, along Onabamiro Road, Ago-Iwoye (6°48′N, 3°50′E) and Oru-Ijebu (about 3 km E of Ago-Iwoye) both within the rainforest region of Western Nigeria.

The sample collection was carried out fortnightly, starting from the July 2004 to November 2004 which span the rainy season and early dry season. Determination of number of insects was done by direct counting (Banjo *et al*., 2000).

Ten plants of each species were observed with at most 10 plants per site for each of the plants species. Insects were picked off leaves, flowers, fruits and stem (branches) by means of hand picking or net. Those of the roots were collected by digging to top-soil up to 1 inch and then observe and count insects found there in.

The collected insect specimens were preserved in a solution made up of 70% ethanol and 30% distilled water (70% alcohol) in clean improvised specimen bottles (injection bottles). Although, some specimens exhibited change in colour but the preservative was however able to maintain the specimens in an expanded and flexible state for the examination of their external structures.

Each preserved specimen was then tagged with information such as; source' date, plant number and plant species.

Identification of the insect specimens collected from the plants were carried out at:

- The Entomology Department of the Cocoa Research Institute of Nigeria (CRIN), Idi Ayunre, Ibadan, Nigeria.
- Entomology Department of the Forestry Research Institute of Nigeria (FRIN), Jerico, Ibadan, Nigeria.

The diversity index was calculated using the formula (Beals *et al*., 1999).

$$D = \frac{\sum\left[n_i\left(n_i - 1\right)\right]}{N\left(N - 1\right)}$$

where:
ni = Individual of each species caught,
N = Total Individual of all species caught and
D = Diversity index.

This was used to know the level of dissimilarity of the plants used and this is to know the degree of similarity in taxonomic categories represented between the pair.

Morisita's index of similarity was used to calculate the similarity index between each paired group of the plants used (Krebs, 1989).

$$C\lambda = \frac{2\sum n_1 n_2}{\left(\lambda_1 + \lambda_2\right) N_1 N_2}$$

where, λ_1 and λ_2 = squares of total number of individuals in sample 1 and 2, respectively, n_1 = number of individuals of species in sample 1 and n_2 in sample 2.

N_1, N_2 = Total number of individuals in sample 1 and 2 respectively.

The graphs of population dynamics was also plotted for orders of insect using the mean number of insect collected in each month against the months of collection.

Results

Ocimum gratissimum

On *O. gratissimum*, Diptera population reduced between July and August, increased in September, reduced again in October and rise in November. Hymenopteran reduced from July to August, increased in September and reduced through November. Coleopteran on the other hand, increased from the scratch in September, reduced in October and increased a little in November (Fig. 1). Orthopteran were found to increase between July and August, reduced in September till it reached zero in November. Lepidopteran on the other hand, reduced from July to maintain zero level in September and October and then increased in November. Homopteran population reduced from July to August, increased in September and declined to zero in October and November (Fig. 1).

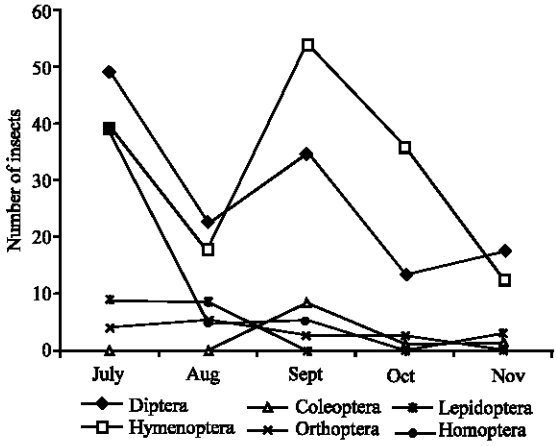

Fig. 1: Population fluctuation of insects on *Ocimum gratissimum*

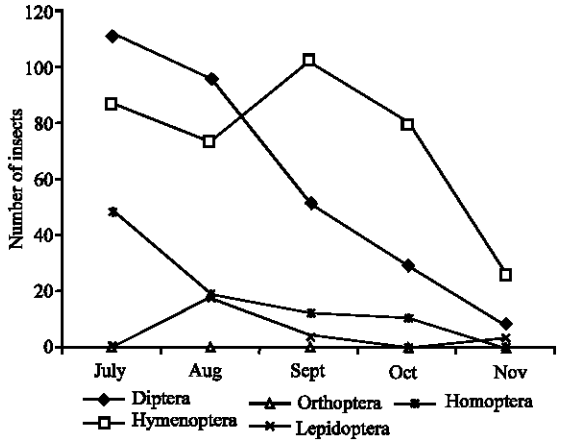

Fig. 2: Population fluctuation of insects on *Ocimum basilicum*

Ocimum basilicum

Dipteran population decreased steadily from July to November. Hymenoptera reduced from July to August, increased in September and decreased November. Orthopteran emerged from scratch and return to zero in October and November (Fig. 2). The Hymenoptera was also the most abundant on *O. gratissimum* followed by Diptera, Homoptera, Lepidoptera, Coleoptera and Orthoptera (Fig. 1). The hymenoptera was the most abundant on *O. basilicum* followed by Diptera, Homoptera, Lepidoptera and finally Orthoptera (Fig. 2).

Species Richness

Species richness of Diptera on *O. gratissimum* was 2, Hymenoptera was 2, Coleoptera was 1, Orthoptera was 2, Lepidoptera was 1 and Homopteras 2 is shown in Table 1 and relative abubdance of insects is shown in Fig. 3. On O. *basilicum*, species richness was; 2 for Diptera, 1 for Hymenoptera, 1 for Orthoptera, 1 for Lepidoptera and also 1 for Homoptera is shown in Table 2 and relative abundance of insects is shown in Fig. 4.

Table 1: Diversity of insect species caught on *Ocimum gratissimum*

Insects	Sum	Mean	SD	SE of mean	Diversity index	Species richness
Diptera					0.905	2
Musca sp.	13	1.3	2.7507	0.8699		
Diptera unidentified	247	24.7	14.8851	4.7071		
Hymenoptera					0.903	2
Formica sp.	315	31.5	22.4413	7.0966		
Dorylus nigricarp	17	1.7	5.0343	1.5920		
Coleoptera unidentified	30	3.0	5.8119	1.8379		1
Orthoptera					0.57	2
Coryphosena stenoptera	20	2.0	2.1603	0.6831		
Orthoptera unidentified	8	0.8	0.6325	0.2000		
Lepidoptera unidentified	34	3.4	4.3513	1.3760	1	
Homoptera					0.62	2
Aphis cracivora	49	4.9	12.3868	3.9171		
Homoptera unidentified	16	1.6	3.3731	1.0667		
N = 10	749	74.9				10

Table 2: Diversity of insect species on *Ocimum basilicum*

Insects	Sum	Mean	SD	SE of Mean	Diversity index	Species richness
Diptera					0.54	2
Musca sp.	190	19.0	15.2753	4.8305		
Diptera unidentified	341	34.1	33.6665	10.6463		
Hymenoptera						
Formica sp.	753	75.3	34.8905	11.0333		1
Orthoptera						
Coryphosena stenoptera	1	0.1	0.3162	0.1000		1
Lepidoptera unidentified	55	5.5	11.3847	3.6002		1
Homoptera						
Aphis cracivora	145	14.5	17.4244	5.5101		1
N = 10	1.485	148.5				6

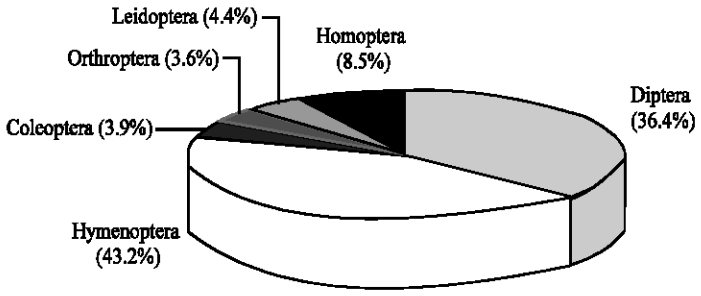

Fig. 3: Pie chart showing insects relative abundance on *Ocimum gratissimum*

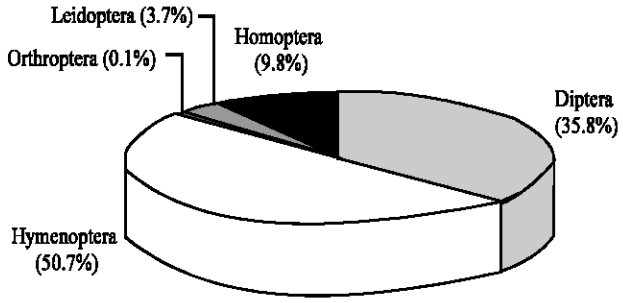

Fig. 4: Pie chart showing insects relative abundance on *Ocimum basilicum*

Diversity Index

On *O. gratissimum*, the diversity indices were; Dipterans was 0.905, Hymenopterans was 0.903, Orthopterans was 0.59 and Homopterans was 0.62. On *O. basilicum*, the diversity index for Dipterans was 0.54.

Banjo *et al*. (2000), also used the Simpson's diversity index to determine the species diversity within each order of insect found on two varieties of *Capsicum frutescens*. For Orthoptera, Sombo was 0.45 and Atawewe was 0.48; Heteroptera, Sombo was 0.3 and Atawewe was 0.6; Coleoptera, Sombo was 0.41 and Atawewe was 0.50 and Diptera, Sombo was 0.34 while Atawewe was 0.30. He also summarized that all the orders have low diversity and that few species were dominant.

Discussion

On *O. gratissimum*, 10 species of insects were found which are from 6 orders; Diptera, Hymenoptera, Coleoptera, Orthoptera, Lepidoptera and Homoptera which had percentage abundant of 36.4, 43.2, 3.9, 3.6, 4.4 and 8.5%, respectively. The most important insect found on this plant was the Diptera even though most of them were not identified to species level but they suck the nectars thereby pollinating the flowers. A major pest found were the Homopteran that lived underneath the leaves.

O. basilicum on the other hand haboured just 6 insect species which belonged to 5 orders; Dipltera (35.8%), Hymenoptera (50.7%), Orthoptera (0.1%), Lepidoptera (3.7%) and Homoptera (9.8%). Even though the Hymenopterans occurred most but the Dipterans were still the most important because the acted as a form of symbiont as found on *O. gratissimum*. Okin (2001), revealed that the insects associated with *O. gratissimum* include *Aspavia armigera*, *Coryphosena stenoptera producta*, *Catantops spissus spissus*, *Mantis religiosa*, *Apis melifera*, *Enodera superstitiosa*, Vile spider, *Heteropterni thoracica* and *Zonocerus varagatus* while the most occurring were *Zonocerus variagatus*. These are in contrast with the present study.

Chapman (1972), opined insects develop only within a limited range of temperature, which is characteristic of the species and they are killed by temperature outside this range. This could be the case of this study because I noticed that the fluctuation of temperature owing to the rapid changing seasonal condition was responsible for the population reduction, wiping out and also increase of some species as specified by the graphs.

Conclusions

Medicinal plants have various usages which cannot be overemphasized. They serve as food materials, alternative medicine and can also be used to control pests of agriculture importance.

The insects that were associated with each of the ten plants found to more diversed and this was due to the mophology and the chemical constituent(s) of the plants and also the weather condition which rather underevent some fluctuation.

The insects were either defoliators, visitors, pollinator or predators other insects. This work is also done in order to aid ethnopharmacy use of these plant the use of appropriate pest (insect) control means.

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