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RESEARCH ARTICLE

Seasonal Distribution, Abundance and Diversity of Soil Arthropods in Farmlands around Workshops in Calabar Metropolis, Southern Nigeria

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Abstract

This study was carried out in four different farmlands, each around mechanic workshop in Calabar Municipality and Calabar South Local Government Areas (Metropolis) in Cross River State. The study stations chosen were purely subsistence farming based. At each study station, a total of 15 samples were collected between the hours of 6 am to 7.30 am, once a week and four times a month for rainy season (June 2012-July 2012) and dry season (November 2012-December 2012) respectively. Three (3) replicate samples were collected along the row at the edge of each farmland and mechanic workshop at 25 m apart using a ruler to measure a diameter of 1.5 m to a depth of 10 cm. Results of the distribution of soil arthropods in the various sampling stations in Calabar metropolis showed that a total of 2486 soil arthropods classified into four (4) classes, five (5) Order and Nine (9) genera. These include; Chilopoda, Diplopoda, Arachnida and Insecta such as Hymenoptera, Coleoptera, Collembola, Isoptera and Orthoptera were recovered during the course of this study. Out of the Nine (9) genera of soil arthropods obtained, Collembola (*Dicyrtomina* sp.) was the most abundance, recording a total of 678(27.3%) followed by Hymenoptera (*Dorylus helvolus*) with 657(26.4%), Chilopoda (*Scolopendra* sp.) with 362(14.6%), Coleoptera (*Colosoma* sp.) with 306(12.3%), Isoptera (*Macrotermes nigeriense*) with 157(6.32%), Orthoptera (*Gryllotalpa* sp.) with 128(5.15%), Arachnida (*Liponyssus bursa* and *Sceliphron* sp.) with 131(5.31%) and Diplopoda (*Polydesmus* sp.) with 67(2.69%) was the least soil arthropods recorded. Therefore, Collembolla and Hymenoptera recorded significantly higher ($P<0.05$) percentage abundance than all other soil arthropods. The number of soil arthropods recovered during the study was obviously lower in the wet season (June-July 2012) than in the dry season (November-December, 2012) all through the sampling period. The five stations had more or less equal diversity levels with insignificantly different indices values. The study also showed that most soil arthropod groups recorded the highest abundance in dry seasons when a favourable ecological conditions for survival prevailed. This is because there was huge accumulation of food materials as well as good aeration for gaseous exchange; these life requirements diminish as the soil profile extends further.

Keywords: Seasonal distribution, soil arthropods, farmland, workshops, Calabar metropolis.

Introduction

The phylum arthropoda is by far the largest phylum in the animal kingdom. Moldenke and Lattin (1990) reported that there are approx. 713,500 species or that about 80% of all the species in the animal kingdom are arthropods. Animals of this phylum arthropoda are commonly called “Arthropods”; this name is derived from two Greek words “Arthrous” (meaning jointed and “Pous” (meaning foot), (Leftwich, 1976). All arthropods have segmented bodies, thick exoskeleton and jointed appendages modified in various ways to form legs, mouth parts, antennae, cerci, etc. The arthropod body plan consists of repeated segments each with a pair of appendages and it has enabled them to become the most specie rich members of all ecological guilds (ways of making a living) in land and fresh water environments. Arthropods exhibit a great variety of structures and mode of life. They are bilaterally symmetrical, triploblastic and show high degree of metameric segmentation and have blood system. The central nervous system is made of a double ventral nerve cord situated ventral to the gut and connected to the central ganglia (Usua, 2002). The soil is an extremely dynamic, complex and highly heterogeneous system that allows the development of an extremely large number of ecological habitats. It is the home of an array of live organisms and performs important functions for the ecosystem (Gardi and Jeffery, 2009). The most dominant groups of soil organisms are microorganisms, such as bacteria and fungi, followed by a huge variety of animals such as nematodes, arthropods, enchytraeids and earthworms (Jeffery *et al*., 2010). They are known to improve soil structure by decreasing bulk density, increasing soil pore space, soil horizon mixing, increase aeration and drainage, increase water holding capacity, litter decomposition and soil aggregate structure (Abbott, 1989). Soil organisms range from macroscopic forms to the microscopic forms (Franke, 2003).

The purpose of this study is to assess the prevalence and distribution of soil arthropods and also to evaluate the effects of human activities on the distribution of soil arthropods in Farmlands around Calabar Metropolis, Cross River State, Nigeria.

Materials and methods

Study area: This study was carried out in four different farmlands, each around mechanic workshop in Calabar Municipality and Calabar South Local Government Areas (Metropolis) in Cross River State. They include Atimbo Farm, Ikot Ansa Farm, New Airport Farm and Anantigha Farm in Calabar Municipality and Calabar South Local Government Areas respectively. Atimbo Farm is Located at about 100 m from Arab construction Company. Atimbo Farm is a relatively small farmland. In front of the farmland is a local bar made of bamboo. In the course of sample collection, it was observed that the bar owner regularly poured waste water into the farm. Ikot Ansa Farm is situated at Old Odukpani road. Ikot Ansa Farm shares boundary with a building under construction. New Airport Farm is situated in a plain field. Anantigha Farm was much smaller than all other farmlands investigated. The control site was a farmland in the University of Calabar Farm (UNICAL) which was free of any mechanic workshop and is located at the boundary between the two Local Government Areas (Metropolis). The study stations chosen were purely subsistence farming based. The major crops cultivated include: *Manihot esculenta* (cassava), *Talinum triangulare* (waterleaf), *Telfairia occidentalis* (fluted pumpkin), *Zea mays* (maize) and *Abelmoschus esculentus* (okra).

Sample collection: Three (3) replicate samples was collected along the row at the edge of each farmland and mechanic workshop at 25 m apart using a ruler to measure a diameter of 1.5 m to a depth of 10 cm. Growing vegetation was gently removed using cutlass, root and leaf debris was also removed. This procedure was repeated at each study station for sample collection at 50 m, 75 m, 100 m and 125 m from the first point of collection (edge of mechanic workshop). At each study station, a total of 15 samples were collected between 6 am to 7.30 am, once a week and four times a month for rainy season (Jun 2012-Jul 2012) and dry season (Nov 2012-Dec 2012), respectively. A grand total of 900 samples was collected and labeled at the field for each replicate and sample site accordingly and put in a polythene bag and transferred to zoology and environmental biology laboratory for analysis. In the laboratory, soil samples was individually emptied into a tray measuring 40 cm X 20 cm and soil fauna sorted for larger arthropods using a pair of forceps and magnifying glass.

Sample preservation, identification and analysis: The soil was put in a petri dish and observed under a light microscope. Soil arthropods seen were picked using forceps into specimen bottles containing 70% ethanol to ensure preservation. For smaller arthropods, the soil was passed through Berlese extraction funnel; heat was applied to lamp holder and held by a metal cylinder. This heat source was placed a few inches above the soil. For maximum result, 60 w bulb generating temperature of about 30-40°C was allowed to heat for 2-3 h. Arthropods present was driven down through the sieve and funnel into a collecting beaker. Arthropods were identified using Identification guides (Krantz, 1978; Norton, 1990; Woolley, 1990).

Determination of biological parameters

Diversity index: The percentage occurrence and relative abundance of soil arthropods were calculated using biotic indices such as Margalef's index and Shannon and Weaver's index to estimate abundance and diversity of species. Margalef's index (d) is a measure of species richness (Margalef's, 1949) and is expressed as:

$$d = \frac{S-1}{N} \qquad (1)$$

Where, S is the number of species in samples. N is the number of individuals in the samples.

Shannon and Weaver's index (H) is a measure of species abundance and evenness (Shannon and Weaver, 1949) and is expressed as:

$$H = \sum \frac{Ni}{N} \log_2 \frac{Ni}{N} \qquad (2)$$

Where, N is the total number of individual in the sample. Ni is the total number of individuals of species *ith* in the sample.

Species equitability or evenness (E) (Pielou, 1966) is determined by the equation:

$$E = \frac{H}{\ln S} \qquad (3)$$

Where, H is the Shannon and Weavers index. S is the number of species in samples.

Statistical analysis: The data obtained were subjected to descriptive statistics to calculate the mean values and standard error in all the sampling stations. Analysis of variance (ANOVA) was also used to check the significant difference between mean values of the sampling stations (Andem *et al.*, 2012) cited by (Ogbeibu, 2005). Microsoft Excel, version 2010 was used for graphical illustration.

Table 1. Composition and relative abundance of soil arthropods in farmlands around Calabar Metropolis, Nigeria.

Taxonomic	S1 (Atimbo farm)		S2 (Ikot Ansa farm)		S3 (New Airport farm)		S4 (Unical farm)		S5 (Anantigha farm)		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Insecta												
Hymenoptera												
Dorylus helvolus	117	26.2	101	20.1	151	40.6	183	24.7	105	24.9	657	26.4
Coleoptera												
Colosoma sp.	62	13.9	90	17.9	23	6.18	85	11.5	46	10.9	306	12.3
Collembola												
Dicyrtomina sp.	109	24.4	128	25.4	114	30.6	171	23.0	156	36.9	678	27.3
Isoptera												
Macrotermes nigeriense	25	5.59	37	7.4	20	5.40	52	7.0	23	5.45	157	6.32
Orthoptera												
Gryllotalpa sp.	16	3.58	8	1.59	0	0	77	10.3	27	6.39	128	5.15
Chilopoda												
Scolopendra sp.	82	18.3	68	13.5	43	11.6	132	17.8	37	8.77	362	14.6
Diplopoda												
Polydesmus sp.	3	0.67	11	2.19	7	1.88	42	5.7	4	0.95	67	2.69
Arachnida												
Liponyssus bursa	15	3.36	29	5.76	14	3.76	0	0	0	0	58	2.33
Sceliphron sp.	18	4.03	31	6.2	0	0	0	0	24	5.67	73	2.94
Total number of Taxa	9	100	9	100	7	100	8	100	8	100	9	100
Total number of Individual	447		503		372		742		422		2486	

Results

Composition, abundance and distribution of soil arthropods on various sampling stations in Calabar Metropolis: Results of the distribution of soil arthropods in the various sampling stations in Calabar metropolis showed that a total of 2486 soil arthropods classified into four (4) classes, five (5) Order and nine (9) genera. These include; Chilopoda, Diplopoda, Arachnida and Insecta such as Hymenoptera, Coleoptera, Collembola, Isoptera and Orthoptera were recovered during the course of this study (Table 1). Out of the nine (9) genera of soil arthropods obtained, Collembola (*Dicyrtomina* sp.) was the most abundance, recording a total of 678(27.3%) followed by Hymenoptera (*Dorylus helvolus*) with 657(26.4%), Chilopoda (*Scolopendra* sp.) with 362(14.6%), Coleoptera (*Colosoma* sp.) with 306(12.3%), Isoptera (*Macrotermes nigeriense*) with 157(6.32%), Orthoptera (*Gryllotalpa* sp.) with 128(5.15%), Arachnida (*Liponyssus bursa* and *Sceliphron* sp.) with 131(5.31%) and Diplopoda (*Polydesmus* sp.) with 67(2.69%) was the least soil arthropods recorded. Therefore, Collembolla and Hymenoptera recorded significantly higher (P<0.05) percentage abundance than all other soil arthropods (Table 1). In terms of sampling stations, Hymenoptera with 657 representing 26.4% was the most abundant soil arthropods, recording the highest population in University of Calabar farm 183(7.36%), New Airport farm with 151(6.07%), Atimbo farm with 117(4.71%), when compared with Arachnida which recorded zero abundance in Anantigha, New Airport and University of Calabar farm respectively (Table 1).

The results also show a variation in the composition and relative abundance of soil arthropods in the various study locations. However, Hymenoptera recorded 183(7.36%), Collembolla 171(6.88%), Chilopoda 132(5.31%), Orthoptera 77(3.097%), Isoptera 52(2.09%) and Diplopoda 42(1.69%) recorded the highest population in Unical farm with the exception of Coleoptera 90(3.62%), Arachnida, that is *Liponyssus bursa* 29(1.17%) and *Sceliphron* sp. 24(0.97%) in Ikot Ansa and Anantigha respectively (Table 1). Also, this is shown in the Pie chart reflecting the mean relative abundance of soil arthropods recovered during the study (Fig. 1).

Fig. 1. Percentage composition of soil arthropods phyla in farmlands around Calabar Metropolis, Nigeria.

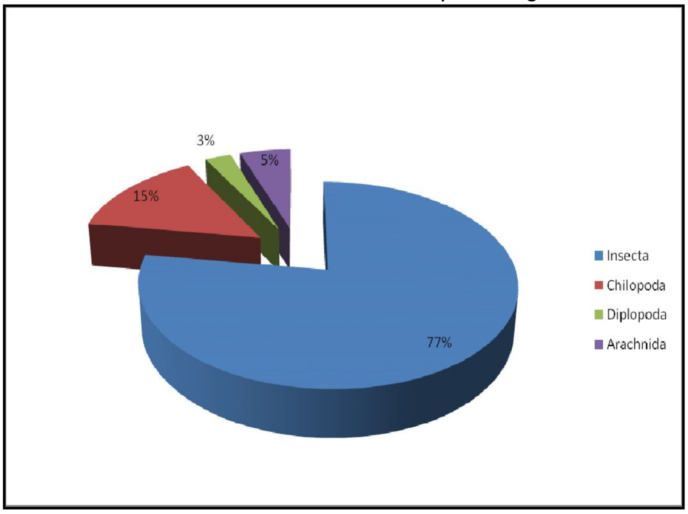


Table 2. Diversity indices of soil Arthropods in Farmlands around Calabar Metropolis, Cross River State, Nigeria.

Stations	S1 (Atimbo farm)	S2 (Ikot Ansa farm)	S3 (New Airport farm)	S4 (Unical farm)	S5 (Anantigha farm)	Total
Margalef's Index (d)	1.311[a]	1.286[a]	1.013[a]	1.059[a]	1.157[a]	1.023[a]
Shannon-Wiener Index (H)	0.798[a]	0.837[a]	0.654[a]	0.792[a]	0.743[a]	0.852[a]
Equitability Index (E)	0.362[a]	0.381[a]	0.336[a]	0.381[a]	0.357[a]	0.388[a]

Similar superscript letters in a row indicates insignificant differences in the indices values (P<0.05).

Table 3. Mean distribution of soil arthropods in farmlands around Calabar Metropolis, Cross River State, Nigeria.

Taxonomic	Sampling stations					
	S1 (Atimbo farm)	S2 (Ikot Ansa farm)	S3 (New Airport farm)	S4 (Unical farm)	S5 (Anantigha farm)	Mean ± S.E
Insecta						
Hymenoptera						
Dorylus helvolus	117	101	151	183	105	131.4[a] ± 15.61
Coleoptera						
Colosoma sp.	62	90	23	85	46	61.2[b] ± 12.42
Collembola						
Dicyrtomina sp.	109	128	114	171	156	135.6[a] ± 12.04
Isoptera						
Macrotermes nigeriense	25	37	20	52	23	31.4[c] ± 5.90
Orthoptera						
Gryllotalpa sp.	16	8	0	77	27	25.6[c] ± 6.08
Chilopoda						
Scolopendra sp.	82	68	43	132	37	72.4[b] ± 17.00
Diplopoda						
Polydesmus sp.	3	11	7	42	4	13.4[c] ± 7.28
Arachnida						
Liponyssus bursa	15	29	14	0	0	11.6[c] ± 5.43
Sceliphron sp.	18	31	0	0	24	14.6[c] ± 6.31

Mean values with different superscript differ significantly (p<0.05) from each other.

Diversity indices of soil arthropods in farmlands around Calabar Metropolis, Cross River State, Nigeria: A summary of the diversity indices calculated for the five stations is shown in Table 2. Taxa richness calculated as Margalef index (d) was least in New Air-port farm (1.013) while Atimbo farm accounted for the highest diversity (1.311). Shannon diversity index (H) was also least in New Airport farm (0.654) while Ikot Ansa farm accounted for highest diversity (0.837). Equitability was also least in New Airpot farm (0.336) and highest in both Ikot Ansa farm and Unical farm (0.381). The five stations had more or less equal diversity levels with insignificantly different indices values. Mean distribution of soil arthropods in farmlands around Calabar Metropolis, Cross River State, Nigeria is shown in Table 3. Hymenoptera (*Dorylus helvolus*) have mean and standard error values of 131.4[a] ± 15.61 across all stations throughout the study, Coleoptera (*Colosoma* sp.) have mean and standard error values of 61[b] ± 12.42 across all stations throughout the study, Collembola (*Dicyrtomina* sp.) have mean and standard error values of 135.6[a] ± 12.04 across all stations throughout the study, Isoptera (*Microtermes nigeriense*) have mean and standard error values of 31[c] ± 5.90 across all stations throughout the study, Orthoptera (*Gryllotalpa* sp.) have mean and standard error values of 25.6[c] ± 6.08 across all stations throughout the study. Chilopoda (*Scolopendra* sp.) have mean and standard error values of 72.4[b] ± 17.00 across all stations throughout the study, Diplopoda (*Polydesmus* sp.) have mean and standard error values of 13.4[c] ± 7.28 across all stations throughout the study, Arachnida (*Liponyssus bursa* and *Sceliphron* sp.) have mean and standard error values of 11.6[c] ± 5.43 and 14.6[c] ± 6.31 respectively, across all stations throughout the study. Analysis of variance (ANOVA) test for this result indicates that there was a significant difference ($p<0.05$) in the mean distribution of various identified soil arthropods among themselves and among the study stations, with Hymenoptera and Collembolla significantly higher than other soil arthropods.

Seasonal variation on the distribution of soil arthropods on various sampling stations in Calabar Metropolis: Generally, the number of soil arthropods species recovered during the study was obviously lower in the wet season (Jun-Jul) than in the dry season (Nov-Dec) all through the sampling period (Table 4 and Fig. 2). Hence, a total of 2486 soil arthropods were collected during the wet and dry season's surveys in five different sampling stations, which is Atimbo farm, Ikot Ansa farm, New Airport farm, Anantigha farm, and Unical farm (control) respectively.

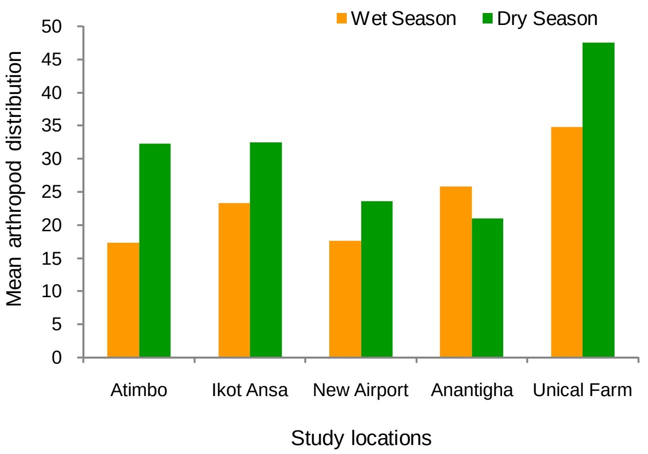
Table 4. Mean seasonal distribution of soil arthropods in farmlands around Calabar Metropolis, Nigeria.

Taxonomic	S1 (Atimbo farm)		S2 (Ikot Ansa farm)		S3 (New Airport farm)		S4 (Unical farm)		S5 (Anantigha farm)		Total	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Insecta												
Hymenoptera												
Dorylus helvolus	17	100	48	53	68	83	70	35	83	100	57.2	74.2
Coleoptera												
Colosoma sp.	23	39	37	53	8	15	31	15	37	48	27.2	34.0
Collembola												
Dicyrtomina sp.	44	65	59	69	53	61	72	84	69	102	59.4	76.2
Isoptera												
Macrotermes nigeriense	7	18	9	28	5	15	13	10	24	28	11.6	19.8
Orthoptera												
Gryllotalpa sp.	9	8	2	6	0	0	14	13	28	49	10.6	15.0
Chilopoda												
Scolopendra sp.	34	48	27	41	18	25	19	18	59	73	31.4	41.0
Diplopoda												
Polydesmus sp.	1	2	4	7	2	5	3	1	14	28	4.8	8.6
Arachnida												
Liponyssus bursa	11	4	11	18	5	9	0	0	0	0	5.4	6.2
Sceliphron sp.	10	7	13	18	0	0	11	13	0	0	6.8	7.8

Out of these numbers, about 1072(43.12%) was recorded during the wet season while 1414(56.88%) was recorded during the dry season (Table 4). Therefore, the number of soil arthropods obtained during the dry season was significantly (P<0.05) higher when compared with the wet season. Furthermore, out of the 1072 soil arthropods obtained during the wet season, a total of 314(12.63%) was recorded in Unical farm (control), 233(9.37%) in Anantigha farm, 210(8.45%) in Ikot Ansa farm, 159(6.39%) in New Airport farm and 156(6.28%) was the least number of soil arthropods recovered in Atimbo farm during the wet season (Table 4 and Fig. 2).

Considering soil arthropods collected during the dry season, 428(17.22%) was found in Unical farm (Control), 293(11.79%) in Ikot Ansa farm, 291(11.71%) in Atimbo farm, 213(8.57%) in New Airport farm, and 189(7.60%) was the least number of soil arthropods recorded in Anantigha farm during the dry season. More so, the result showed a higher population of soil arthropods in terms of relative abundance during the dry season than in the wet season. However, a total of 205 Chilopoda were sampled in the dry season while 157 Chilopoda were recorded in the wet season, 371 Hymenoptera were sampled in the dry season while 286 Hymenoptera were recorded in the wet season and 381 Collembolla were sampled in the dry season while 297 Collembolla were recorded during the wet season. It is therefore, not surprising that during the dry season, soil arthropods recorded a significantly higher abundance when compared to the wet season. From the result above, it can be stated that the number of soil arthropods recorded in the dry season differed significantly (P<0.05) from that of wet season (Table 4 and Fig. 2).

Fig. 2. Seasonal distribution of soil arthropods in farmlands around Calabar metropolis, Cross River State, Nigeria.



Discussion

Results from this study showed that the highest population of soil arthropods was found in Unical farm (control) when compared with Atimbo farm, Ikot ansa farm, New Airport farm, and Anantigha farm respectively. It is presumed that the low population of soil arthropods in Atimbo farm, Ikot ansa farm, New Airport farm, and Anantigha farm is due to various agronomic practices carried out annually by the subsistence farmers. Example of such practices include soil tillage and continuous cultivation as well as effect of sunlight and impact of rainfall, leading to soil erosion and leaching, reduced soil fertility and eventually low soil arthropods population (Per. Com).

These findings are supported by the works of Badejo and Lasebikan (1988) and Badejo (1990). In these works, the authors stated that soil disturbance during cultivation reduces soil arthropods densities and that recovery to pre-cultivation levels occurs during long fallow period. It is important to note that farming activities such as soil tillage, application of herbicide and pesticides, reduction of vegetation cover and the consequent changes in microclimate have negative effects on survival and reproduction of soil arthropods in arable fields. When cultivation is done on continuous basis, the period available for soil arthropods to grow becomes shortened (Badejo and Stralen, 1993; Badejo and Olaifa, 1997). A great number of specimens belonging to different taxa were recovered in all farmlands, though captures were numerically dominated by Collembola. Collembola are among the most abundant soil arthropods on earth with a long evolutionary history (Engel and Grimaldi, 2004). They have radiated into many niches, from the littoral zone to mountain tops and are particularly abundant in epiphytes of tropical rainforests (Hopkin, 1997). Furthermore, Collembolla are considered biological regulators and have important functions in ecosystems. They are known to feed on bacteria, fungi, mineral soil particles, organic matter, protozoa and nematodes and increase soil respiration and accelerate nitrogen mineralization (Kaneda and Kaneko, 2008). Collembola are also an alternative prey to generalist predators (Bilde *et al*., 2000; McNabb *et al*., 2001; Agusti *et al*., 2003; Oelbermann *et al*., 2008) that could enhance predator densities and their impact in biological control (Wise *et al*., 1999). The abundance and diversity of Collembolla have been widely used to assess the environmental impact of a range of pollutants on soils (Van Straalen and Lokke, 1997; Van Straalen and Van Leeuwen, 2002; Van Straalen, 2003; 2004). The greatest number of Hymenoptera occurred in the second week of July in agreement with other studies (Redolfi *et al*., 1999; Morris *et al*., 2002). Hymenoptera represents 657(26.4%) of the total soil arthropods distribution. According to Neuenschwander *et al*. (1986) many species of Hymenoptera could attack *B*actrocera *oleae* larvae as well as pupae inside the fruit and in the soil. Orsini *et al*. (2007) found that in California, Hymenoptera were the only predator observed antennating, carrying or trying to carry olive fruit fly pupae. The important role of Hymenoptera is well known in agricultural ecosystems. They participate actively in natural control, pollination, soil improvement and nutrient cycling. However, the detrimental effect of protecting scales and aphids from their natural enemies is also known (Way and Khoo, 1992). In addition, some species also can be considered as ecosystem engineers, since they are responsible for the structure of the soil. Also, in Atimbo farm, Ikot Ansa farm, New Airport and Anantigha farm, the significantly lower densities of Arachnida and Diplopoda at their sampling stations was caused by direct lethal effects on soil arthropods, negative impact on their reproductive rates or indirectly on their food sources.

The soil pollution might have posed a risk to soil processes and soil-based trophic networks (Arroyo and Iturrondobeitia, 2006). According to Seniczak *et al*. (1995), pollution primarily caused decrease in density; however, Siepel (1995) cited by Skubala and Kafel (2004) stated that species richness and density were also affected, while Migliorini *et al*. (2005) observed qualitative changes. Qualitative (species richness) and quantitative (density) indices were adversely affected by the soil pollution. This study revealed the absence of Arachnida and Orthroptera in Anantigha, New Airport and Unical farm respectively. Diplopoda was also observed to be relatively low. This absence is attributed to the high soil temperature of the over cropped soils, frequent and uncontrolled bush burning by farmers and ultimately leachates containing heavy metals and unfriendly fluids from the mechanic workshop that flow into the farmlands and eventually mastermind the reduction in population of some soil arthropods in some of the study locations (Per. Com). The study also showed that most soil arthropods groups recorded the highest abundance in dry seasons when favourable ecological conditions for survival prevailed. However, Chilopoda was 205 in the dry season and 157 in the wet season, Hymenoptera was 371 in the dry season and 286 in the wet season, and Coleoptera was 170 in the dry season and 136 in the wet season. It was also observed that the upper few centimeters supported more soil arthropod populations than the lower depth. This is because they were huge accumulation of food materials as well as good aeration for gaseous exchange; these life requirements diminish as the soil profile extends further (Per. Com).

Conclusion

The staggering abundance of soil arthropods in Unical farm is obviously due to the absence of mechanic workshop and therefore may be the reason for the richness of the soil which accounted for the enormous flourishing of the soil arthropods when compared with other farms which was situated around mechanic workshop. This study will serve as a tool of information for researchers and pave way for other works that will precede this one.

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