ISSN 1819-1894

Asian Journal of Agricultural Research

Knowledgia SCIENTIFIC
A Place to Publish Outstanding Research

http://knowledgiascientific.com

OPEN ACCESS
Asian Journal of Agricultural Research
ISSN 1819-1894
DOI: 10.3923/ajar.2023.40.45

Research Article

Soil Arthropods Diversity in Three Land Types and Growth Parameters of Oil Palm Nursery Seedlings

[1]Ogbebor Omo Charlee, [2]Osayande Pullen Efosa, [1]Thomas Idemudia Aneni and [1]Victor Chucks Adaigbe

[1]Division of Entomology, Nigerian Institute for Oil Palm Research, Benin, Edo, Nigeria
[2]Division of Soils and Land Management, Nigerian Institute for Oil Palm Research, Benin, Edo, Nigeria

Abstract

Background and Objective: Arthropods are important members of the soil ecosystem and help in the pollination of crops thereby increasing yield. Consequently, soil arthropods' diversity was investigated to determine if arthropods' diversity was related to environmental factors such as soil temperature, soil moisture and land use. **Materials and Methods:** Soils from three different land use were sampled with a soil auger and sub-sampled for arthropods' extraction using the Berlese-Tullgren funnel extraction method for soil arthropods. After sorting, the different order of arthropods as well as soils physical and chemical properties including climatic variables were analysed for One-way Analysis of Variance (ANOVA) using Genstat statistical software. The soils were also used to raise oil palm seedlings. The correlation between soil arthropods and climatic variables was done using SPSS version 21. **Results:** The land use types influenced soil arthropods' diversity. Coleoptera and insect larva were the most abundant and were higher in POME-impacted soil than the other land use types. Mean Coleoptera and insect larva in POME-impacted soil were 30.67 ± 5.9^{a} and 76.33 ± 33.1^{b}, respectively. Many of the soil arthropods correlated positively and significantly with one another. The soil arthropods also correlated positively with soil moisture content. **Conclusion:** There was a relationship between the soil arthropods and environmental factors measured across the three land use and that it was land use rather than arthropods diversity that influenced the growth of oil palm nursery seedlings.

Key words: Soil arthropods, land use types, oil palm seedlings, palm oil mill effluent, Nigerian Institute for Oil Palm Research (NIFOR)

Citation: Charlee, O.O., O.P. Efosa, T.I. Aneni and V.C. Adaigbe, 2023. Soil arthropods diversity in three land types and growth parameters of oil palm nursery seedlings. Asian J. Agric. Res., 17: 40-45.

Corresponding Author: Osayande Pullen Efosa, Division of Soils and Land Management, Nigerian Institute for Oil Palm Research, Benin, Edo, Nigeria

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The oil palm is one of the most useful tree crops in the world today[1]. Its major product, palm oil has been a safe and nutritious healthy source of edible oil for humans for thousands of years. And like other common edible fats, it is easily digested, absorbed and utilized in normal metabolic processes[2]. The chief source of palm oil mill effluent (POME) is the sludge water used in clarifying the oil. Palm oil mill effluent (POME) if controlled from contaminating water ways has been a source of nutrient, especially nitrogen and potassium in fertilizing crops[3]. Untreated palm oil mill effluent (POME) if applied to undisturbed soil in relatively small amounts at a time, easily dries off, even in wet weather, leaving a parchment-like layer of humus, with excellent mulching effect and a source of nutrient on mineralization[4]. Consequently, many small processing mills leave out a portion of the land where POME conveniently discharges without contaminating water ways. The soils around this environment are seriously impacted by this discharge, resulting in soil properties that vary from areas that are far away from the discharge[5]. The soil represents a favourable habitat for both macro and microorganisms and is inhabited by a wide range of microorganisms including bacteria, fungi, algae, viruses and protozoa[6]. A change in the soil ecosystem due to land use can significantly alter the balance of these organisms[7]. It has been shown that land use types though location dependent along with climatic factors and vegetation can significantly influence the distribution of the soils macro and micro fauna. Depending on soil properties, land use types can influence nutrient distribution in soils[7,8]. Arthropods are some of the organisms that are easily influenced by land-use change[9,10]. The majority of them are found in the soil where they assist in the distribution of soil organic matter and obtain their energy source in the process[10]. Many orders of soil arthropods have been isolated and studied. At adult stages, many help in pollination and play other useful roles in the soils ecosystem[10].

The present study hypothesized that soil arthropods' distribution and proliferation may vary in POME impacted soils, soils under cassava cultivation and grassland. It was also hypothesized that soils under these three different land use might differ in their capacity to support oil palm nursery seedlings. The specific objectives were to determine:

- Soil arthropods distribution in the three land use types
- Relationship amongst soil arthropods, soil physical and chemical properties and relative humidity of soils under the three different land use
- Some growth parameters of nursery oil palm seedlings grown on soils from the three land uses

MATERIALS AND METHODS

Description of the study area: The study was carried out from May, 2010 to June, 2011. The soils used for the experiment were obtained from three land use types namely, soils under cassava cultivation, Soils under grassland and POME impacted soils at the Nigerian Institute for Oil Palm Research (NIFOR) main station. The soils of the Nigerian Institute for Oil Palm Research (NIFOR) were developed on coastal plain sand parent materials[11] and classified as Ultisols[12]. The area is located in the rain forest zone and has two rainfall patterns, rainy and dry seasons. The rainy season begins in March and ends in October, while the dry season begins in November and ends in February. Annual rainfall ranges from 1500 mm to 2135 mm while minimum and maximum temperature ranges between 21 and 31 °C.

Soil sampling and experimental design: Six soil sample units were randomly taken from each land use type using a soil auger measuring at a depth of 0-15 cm in May, 2010. Areas sampled were carefully approached so as to minimize disturbance especially of the surface dwelling soil insects. The soils were transferred into 500-gauge poly bags of 12×14 inches, mulched with shredded empty fruit bunches and laid out in Randomized Complete Block Design (RCBD) and consisted of three treatments replicated five times so that all experimental units received equal treatments without bias. The soils were sub sampled and taken to the laboratory for arthropods' extraction using the Berlese-Tullgren funnel extraction method for soil arthropods[13]. And some soil properties such as soil pH, soil temperature, soil moisture content and relative humidity of the environment. Soil pH (H_2O) was measured in 1:1 soil: Water suspension using a pH meter[14] while soil temperature was taken by inserting thermometers into the soil at 5 cm soil depth. Soil moisture content was by the gravimetric method while the dew point humidity slide rule was used to set the wet bulb to get the dew point. The dew point was used to get vapour pressure and from the dry bulb data, the relative humidity was obtained.

Sorting and preservation: After the extraction, sorting was done under a binocular dissecting microscope manufactured by Adarsh International Laboratory, Ambala Cantt, Haryana, India and individual insect were removed and placed in the various container with the help of a suction pipette and placed in the glass specimen bottle containing 70% alcohol for 24 hrs. The specimen bottles were labelled accordingly. Further sorting was done to separate the organisms from any debris as debris sometimes accompanies the soil organism into the preservative culture during positive response to dryer.

Preparation of slide: As a result of the microscopic nature of most of the arthropods they were not readily identified. Hence, they were mounted on a CB2000C Compound Microscope, manufactured in the USA by Celestron Laboratory in New York with 5.5×5.5 Mechanical stage slide and examined under high power with phase contrast illumination. They were dehydrated in 70-90% absolute alcohol and then mounted in Canada balsam in xylene.

Statistical analyses: All data were statistically analysed using Genstat Statistical Software version 12 for Analysis of Variance (ANOVA) at 5% level of probability and thereafter correlated with the soil and weather parameters using Statistical Package for Social Science (SPSS) at 1 and 5% levels of probabilities.

RESULTS

Population of insect order under the three land use types: The mean abundance of different species of arthropods found in the three land use types are shown in Table 1. The other Coleoptera was significantly more abundant in POME impacted soil (30.67±5.9[a]) followed by soils under cassava (15.17±2.9[b]) and soils under grassland (14.33±3.8[b]) at the NIFOR main station. The soil cultivated to cassava recorded the lowest population of Arachnidan (1.67±0.5[b]) while soils under grassland had the highest abundance of Arachnidan (3.83±0.6[a]). Insect larvae were significantly higher in palm oil mill effluent (POME) impacted soil with a population of 76.33±33.1[b] than the other land use types as shown in Table 1.

Some growth parameters of oil palm nursery seedlings recorded under the three land use types: The highest plant height (0.39 m) and stem girth (0.05 m) were observed in soils under grassland while the highest dry matter yield of 44.20% was obtained in soils under cassava cultivation as shown in Table 2. These were significantly ($p<0.05$) higher than values obtained from other land use types. The lowest plant height, stem girth and dry matter yield were obtained in POME impacted soil with values of 0.018 m, 0.03 m and 36.90%, respectively (Table 2).

Some soil physical and chemical properties and relative humidity of the experimental site: Soil moisture content and temperature were significantly ($p<0.05$) higher in POME impacted soil than the other land use types except for soil temperature values of both POME impacted soil and soils under cassava which were the same (Table 3). Soil pH and relative humidity were non-significantly different in the three land use types (Table 3).

Relationship amongst soil arthropods, soil physical and chemical properties and relative humidity of the environment of the three land use types: In soils under grassland (Table 4), there was a positively significant ($p<0.05$) correlation between Coleoptera and Collembola ($r = 0.828$), Coleoptera and Hymenoptera ($r = 0.889$), Coleoptera and Isoptera ($r = 0.951$), Coleoptera and Myriapoda ($r = 0.943$, $p<0.01$), Coleoptera and Acarina ($r = 0.919$, $p<0.01$), Coleoptera and soil moisture ($r = 0.966$, $p<0.01$). Coleoptera

Table 1: Population of insect order from soils of the three land use

Treatment	Coleoptera	Collembola	Hymenoptera	Isoptera	Myriapoda	Acarina	Crustacean	Arachnidan	Insect larva
Soils under grassland	14.33±3.8[b]	13.0+2.9[a]	8.17±1.8[a]	12.5±2.6[a]	4.00±0.8[a]	21.00±5.2[a]	7.33±0.5[a]	3.83±0.6[a]	6.00 ± 00[a]
POME impacted soil	30.6±5.9[a]	16.0±3.0[a]	7.17±2.0[a]	12.67±1.9[a]	6.00±1.9[a]	26.50±4.4[a]	2.67±0.9[a]	2.00±0.7[a]	76.33± 33.1[b]
Soils under cassava cultivation	15.17±2.9[b]	7.67±3.1[a]	4.33±1.7[a]	11.00±1.4[a]	2.67±0.8[a]	17.67±0.8[a]	2.50±0.7[a]	1.67±0.5[b]	0.00±0.00[b]
LSD (0.05)	13.325	NS	NS	NS	NS	NS	NS	1.857	57.544

Means with the same letters are not statistically different at 5% level of probability using Duncan's Multiple Range Test

Table 2: Some growth parameters of oil palm nursery seedlings

Treatment	Plant height (m)	Stem girth (m)	Dry matter yield (%)
Soils under grassland	0.39[a]	0.05[a]	43.06
POME impacted soil	0.18[b]	0.03[b]	36.90
Soils under cassava cultivation	0.19[b]	0.03[b]	44.20
SE	0.013	0.0029	3.27

Means with the same letters are not statistically different at 5% level of probability using Duncan's Multiple Range Test

Table 3: Some soil physical and chemical properties and relative humidity of the experimental site

Treatment	Soil moisture (%)	Soil temperature (°C)	Soil pH	Relative humidity (%)
Soils under grassland	7.320[a]	06.20[a]	6.18[a]	84.75
POME impacted soil	11.28[b]	23.85[b]	6.33[a]	86.07
Soils under cassava cultivation	6.190[a]	22.53[b]	6.20[a]	86.09
SE	1.20	01.50	NS	NS

Means with the same letters are not statistically different at 5% level of probability using Duncan's Multiple Range Test

Table 4: Matrix of correlation among soil arthropods, physical and chemical properties and relative humidity of soils under grassland

	Cole	Collem	Hymen	Isoptera	Myriapoda	Acarina	Crustacean	Arachnida	Insect larva	Soil moisture	Soil temperature	Soil pH	Relative h.
Cole	1												
Collem	0.828*	1											
Hymen	0.889*	0.897*	1										
Isoptera	0.951*	0.910*	0.973**	1									
Myriapoda	0.943**	0.812*	0.896*	0.947**	1								
Acarina	0.919**	0.784	0.721	0.801	0.836*	1							
Crustacean	-0.799	-0.523	-0.581	-0.718	-0.661	-0.651	1						
Arachnida	-0.729	-0.748	-0.588	-0.622	-0.543	-0.879*	0.486	1					
Insect larva	-	-	-	-	-	-	-	-	1				
Soil moisture	0.966**	0.856*	0.806	0.894*	0.900*	0.976**	-0.749	-0.826*	-	1			
Soil temp.	-0.892*	-0.741	-0.588	-0.758	-0.758	-0.967**	0.658	0.852*	-	-0.948**	1		
Soil pH	-0.816*	-0.619	-0.743	-0.677	-0.677	-0.814*	0.508	0.797	-	-0.765	0.652	1	
Relative h.	0.138	0.026	0.086	0.462	0.462	0.170	0.170	0.458	-	0.174	-0.277	0.217	1

*Correlation is significant at the 0.05 level, **Correlation is significant at the 0.01 level, Cole: Coleoptera, Collem: Collembola, Hymen: Hymenoptera, h.: Humidity and temp.: Temperature

Table 5: Matrix of correlation among soil arthropods, physical and chemical properties and relative humidity of POME impacted soil

	Cole	Collem	Hymen	Isoptera	Myriapoda	Acarina	Crustacean	Arachnida	Insect larva	Soil moisture	Soil temperature	Soil pH	Relative h.
Cole	1												
Collem	0.970**	1											
Hymen	0.955**	0.912*	1										
Isoptera	0.779	0.799	0.857*	1									
Myriapoda	0.859*	0.907*	0.896*	0.938**	1								
Acarina	0.959**	0.935**	0.995*	0.849*	0.910*	1							
Crustacean	0.630	0.649	0.799	0.769	0.739	0.812*	1						
Arachnida	0.237	0.258	0.492	0.689	0.596	0.483	0.785	1					
Insect larva	0.888*	0.913*	0.953**	0.901*	0.955**	0.970**	0.879*	0.617	1				
Soil moisture	0.845*	0.922**	0.869*	0.803	0.908*	0.909*	0.834*	0.498	0.963**	1			
Soil temp.	-0.113	-0.210	0.069	0.010	0.082	0.037	0.086	0.478	0.040	-0.110	1		
Soil pH	-0.095	0.046	-0.103	0.378	0.184	-0.095	0.057	0.233	0.057	0.082	-0.501	1	
Relative h.	0.501	0.398	0.584	0.160	0.236	0.587	0.613	0.189	0.486	0.460	0.146	-0.670	1

*Correlation is significant at the 0.05 level, **Correlation is significant at the 0.01 level, Cole: Coleoptera, Collem: Collembola, Hymen: Hymenoptera, h.: Humidity and temp.: Temperature

Table 6: Matrix of correlation among soil arthropods, physical and chemical properties and relative humidity of soil under cassava

	Cole	Collem	Hymen	Isoptera	Myriapoda	Acarina	Crustacean	Arachnida	Insect larva	Soil moisture	Soil temperature	Soil pH	Relative h.
Cole	1												
Collem	0.834*	1											
Hymen	0.791	0.862**	1										
Isoptera	-0.358	0.078	0.112	1									
Myriapoda	0.897*	0.840*	0.618	-0.284	1								
Acarina	0.933**	0.749	0.891*	0.278	0.726	1							
Crustacean	0.314	0.423	0.707	0.000	0.055	0.539	1						
Arachnida	0.687	0.885*	0.856*	0.000	0.586	0.689	0.750	1					
Insect larva	-	-	-	-	-	-	-	-	1				
Soil moisture	0.581	0.727	0.940**	0.400	0.406	0.746	0.667	0.707	-	1			
Soil temp.	-0.554	-0.419	-0.431	0.131	-0.264	-0.503	-0.191	-0.423	-	-0.319	1		
Soil pH	0.473	0.759	0.461	0.005	0.722	0.314	0.234	0.680	-	0.308	0.159	1	
Relative h.	0.192	0.555	0.249	0.354	0.212	-0.071	0.108	0.568	-	0.168	-0.910*	0.461	1

*Correlation is significant at the 0.05 level, **Correlation is significant at the 0.01 level, Cole: Coleoptera, Collem: Collembola, Hymen: Hymenoptera, h.: Humidity and temp.: Temperature correlated negatively but significantly with soil temperature (r = -0.892, p<0.05) and negatively with soil pH (r = -0.816, p<0.05) (Table 4). Collembola correlated positively and significantly (p<0.05) with Hymenoptera (r = 0.897), Isoptera (r = 0.910), Myriapoda (r = 0.812) and soil moisture (r = 0.856). Similarly, Hymenoptera correlated positively with Isoptera (r = 0.973, p<0.01), Hymenoptera with Myriapoda (r = 0.896, p<0.05). Isoptera correlated positively with Myriapoda (r = 0.947, p<0.01), Isoptera with soil moisture (r = 0.894, p<0.05) while Myriapoda correlated positively with Acarina (r = 0.836, p<0.05), Myriapoda with soil moisture (r = 0.900, p<0.05) Acarina correlated positively with soil moisture (r = 0.976, p<0.01) and negatively but significantly with Arachnida, soil temperature and soil pH. Arachnida correlated positively and significantly (p<0.05) with (r = 0.852) but negatively with soil moisture (r = -0.826, p<0.05) while soil moisture correlated negatively but significantly with soil temperature (r = -0.948, p<0.01) (Table 4). In POME-impacted soils and soils under cassava cultivation, the trend of correlations between Coleoptera and the other insect order continued except for Isoptera (Table 5 and 6).

DISCUSSION

Coleoptera and insect larva were the most abundant and were higher in POME-impacted soil than the other land use types. The values were $76.33+33.1^{b}$ and $30.6+5.9^{a}$ for insect larva and Coleoptera, respectively. This finding agrees with Aneni *et al.*[15]. Coleoptera consists of beetles and weevils, has the potential to dominate other insect order in a given environment[13]. In this study, it was observed that the abundance of Coleoptera (beetles) was because the POME impacted soil provided the substrate for breeding and carbon source for the newly hatched larvae. Coleoptera under grassland correlated positively and significantly with Collembola, Hymenoptera, Isoptera, Myriapoda and Acarina. It is therefore probable that Coleoptera utilized many of the other insect order for their source of food and energy. This is buttressed by the high population of Coleoptera especially in the POME impacted soils where it had abundance of various food sources to choose from. The population of insect larvae was however the highest in POME impacted soil. The larva is one of the developmental stages of insects and in this study, the insect larva recorded might belong to any of the other insect orders, especially Hymenoptera and Coleoptera. Collembola are wingless and soft bodied[13]. Its correlation with Hymenoptera across the three land use types could only suggest that the soft bodied Collembola provided food and energy source to Hymenoptera which is one of the largest orders of insects that include bees, wasps, sawflies and ants[15]. Hymenoptera, Coleoptera, Collembola, Isoptera, Myriapoda and Acarina correlated positively and significantly with soil moisture content but negatively with soil temperature in soils under grassland and this could only indicate that moisture was required for their proliferation and abundance in soils irrespective of land use type[9,10]. When cultivated to oil palm sprouted seeds, soils under grassland had the highest plant height and stem girth while the POME-impacted soil produced the least plant height. This is probably due to the fact that many of the soil nutrients in POME-impacted soil were immobilized since the POME discharged at that point of sampling was not treated. With respect to soil properties, the POME-impacted soil had the highest soil moisture content though the other parameters such as soil temperature, soil pH and relative humidity were not significantly different across the three land use types. The implication of the findings from this study is was that arthropods proliferation is influenced by environmental factors such as soil moisture content, soil temperature and relative humidity. However, soil arthropods are poor decomposers of POME and do not contribute to the fertility status of soils used to raise oil palm nursery seedlings. Untreated POME should not be applied to soils cultivated to oil palm nursery seedlings due to the poor performance of oil palm seedlings cultivated to POME-impacted soils. Soils used for the cultivation of oil palm nursery seedlings should be sourced from under grassland cultivation as they gave the best performance of oil palm nursery seedlings.

CONCLUSION

The result from this experiment showed that land use types influenced the proliferation of the various insect order observed. Coleoptera and insect order were the most abundant and were higher in POME-impacted soil than the other land use types. Many of the soil arthropods correlated positively and significantly with one another indicating the likely hood of utilizing each other for food and energy source. Furthermore, the soil arthropods also correlated positively with soil moisture content. When cultivated to oil palm seedlings, soils under grassland produced the tallest palms with higher stem girth.

SIGNIFICANCE STATEMENT

This study has discovered that soil arthropods and insect larvae do not contribute to soil fertility status on a short term basis as earlier thought. The study has also uncovered that untreated POME should not be applied to soils for the cultivation of oil palm seedlings but soils used for the cultivation of oil palm seedlings should be sourced from soils under grassland which was hitherto ignored for raising oil palm seedlings.

ACKNOWLEDGMENT

The authors are grateful to the Executive Director of the Nigerian Institute for Oil Palm Research (NIFOR) for providing the enabling environment conducive for research.

REFERENCES

1. Behera, S.K., A.K. Shukla, K. Suresh, K. Manorama, R.K. Mathur and K. Majumdar, 2022. Yield variability in oil palm plantations in tropical India is influenced by surface and sub-surface soil fertility and leaf mineral nutrient contents. Sustainability, Vol. 14. 10.3390/su14052672.
2. Obahiagbon, F.I., 2012. A review: Aspects of the African oil palm (*Elaeis guineesis* Jacq.) and the implications of its bioactives in human health. Am. J. Biochem. Mol. Biol., 2: 106-119.
3. Nwoko, C.O. and S. Ogunyemi, 2010. Evaluation of palm oil mill effluent to maize (*Zea mays* L.) crop: Yields, tissue nutrient content and residual soil chemical properties. Aust. J. Crop Sci., 4: 16-22.
4. Onyia, C.O., A.M. Uyu, J.C. Akunna, N.A. Norulaini and A.K.M. Omar, 2001. Increasing the fertilizer value of palm oil mill sludge: Bioaugmentation in nitrification. Water Sci. Technol., 44: 157-162.
5. Benton, T.G., J.A. Vickery and J.D. Wilson, 2003. Farmland biodiversity: Is habitat heterogeneity the key. Trends Ecol. Evol., 18: 182-188.
6. Blair, J.M., P.J. Bohlen and D.W. Freckman, 1996. Soil Invertebrates as Indicators of Soil Quality. In: Methods for Assessing Soil Quality, Doran, J.W. and A.J. Jones (Eds.), Soil Science Society of America, Inc., Madison, Wisconsin, ISBN: 9780891188261, pp: 273-291.
7. Efosa, O.P., U.C. Stanley, E. Stanley and O.E. Robert, 2021. Relationship between soil organic matter and some physical properties in selected soils of the oil palm belt of Nigeria. J. Nat. Sci. Res., 12: 1-7.
8. Osayande, P.E., P.O. Oviasogie, A.A. Edokpayi and E.R. Orhue, 2019. Identification of soil fertility indices of inland valley soils of nifor using factor analysis. Afr. J. Basic Appl. Sci., 11: 45-51.
9. Pappoe, A.N.M., F.A. Armah and H.K. Akotoye, 2009. Diversity of soil surface invertebrates in cultivated and uncultivated fields in coastal Savanna Zone of Ghana. Res. J. Soil Biol., 1: 37-44.
10. Sileshi, G. and P.L. Mafongoya, 2006. Variation in macrofaunal communities under contrasting land use systems in Eastern Zambia. Appl. Soil Ecol., 33: 49-60.
11. Efosa, O.P., O.E. Robert and O.E. James, 2020. Relationship between some thermodynamic properties and yield parameters of oil palm in an ultisol. Ecologia, 10: 71-77.
12. Ogunkunle, A.O., 1993. Soil in land suitability evaluation: An example with oil palm in Nigeria. Soil Use Manage., 9: 35-39.
13. Hopkin, S.P., 1997. Biology of the Springtails: (Insecta: Collembola). OUP Oxford, New York, ISBN: 9780191589256, Pages: 340.
14. Osayande, P.E., P.O. Oviasogie and E.R. Orhue, 2015. Soil nutrient status of the fresh water swamp at the NIFOR Raphia Hookeri Outstation, Otegbo. J. Biol. Agric. Healthcare, 5: 150-155.
15. Aneni, T.I., V.C. Adaigbe, C.I. Aisagbonhi, B. Ghansah and P. Pareekh, 2019. Integrated pest management of *Rhynchophorus phoenicis* in okomu oil palm plantation, Uhiere, Nigeria. J. Appl. Sci., 19: 115-120.