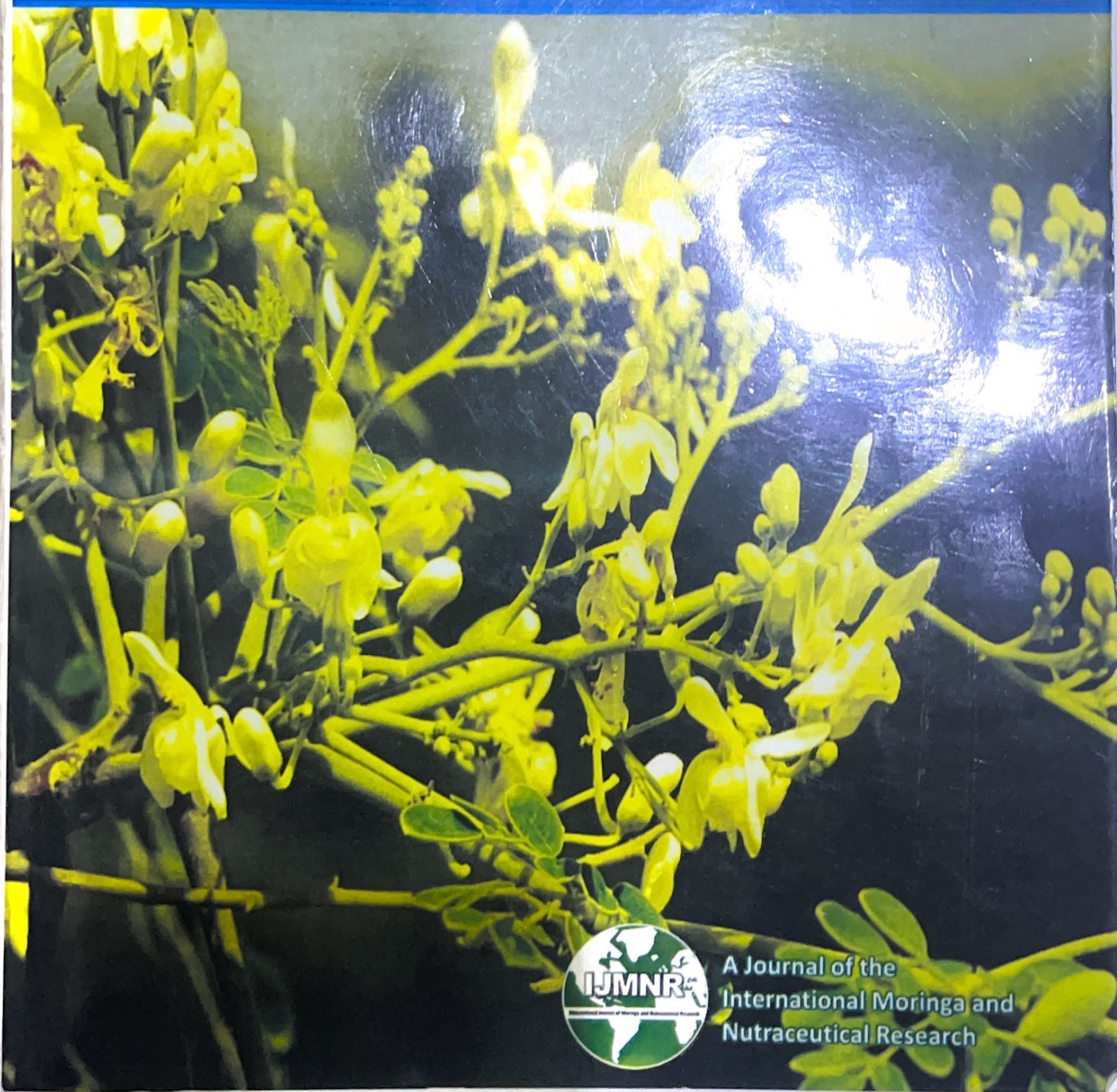


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CONTENTS

Proximate and Mineral Composition of *Cleome gynandra* (L.) Parts from Eastern Cape Province of South Africa

Sowunmi, I.L., Oyedeji, O.F., Amadi, J.O. and Adebuseyi, G.A.....1

*** The Effect of Abattoir Effluent on Physicochemical Parameters and Earthworm Abundance of Soils around Gbagi Stream (Odo-Eran), Ibadan, Nigeria**

Adeyemi-Ale, O. A., Hassan, A.T. and Aladesida, A.A..... 11

*** Bioaccumulation and Biotransfer of Lead in a Food Chain Involving Earthworm, *Eudrilus eugeniae* and Mud Catfish, *Clarias gariepinus***

Olafimihan, T. F.; Adeyemi-Ale, O. A.; Oladipo, S. O.; Anifowoshe, A. T.; Anyaele, O.....19

Evaluation of Knowledge Integration and Dissemination along Innovation Supply Chain in Ilorin Metropolis, Nigeria: A Case Study of Moringa Products

Ojo O. E., Aina V. I.; MammoMuchie, Belew K. Y. and Ezekiel A. A.....27

Structure and Efficiency of Anti-malaria Medicinal Plants Market in Kwara State, Nigeria

Adewumi, Mathew Olaniyi, Akinsola, Grace Oluwabukunmi and Olurinde, Kingsley
Olusola41

Effects of Dietary inclusion levels of graded Decorticated *Moringa oleifera* seed meal in Broiler Starter diets

Sola-Ojo, F. E., Ibiwoye, D.I., Abubakar I.A, Asaolu, T.S and Onyebuchi, U.K.....47

Genotype Disparity in Effect of *Carpolobia lutea* and *Vernonia amygdalina* on Cardiovascular Risk in Chickens

R. J. Adamu and A. A. Toyee.....53

The Effect of Abattoir Effluent on Physicochemical Parameters and Earthworm Abundance of Soils Around Gbagi Stream (Odo-Eran), Ibadan, Nigeria

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ABSTRACT

The discharge of untreated effluent into both soil and water bodies is known to degrade the natural environment, including soil quality. The present study investigates the effects of Gbagi abattoir effluent on the physicochemical properties of the soil and earthworm abundance around the abattoir. Top soil samples were collected at a depth of 0-30 cm between March 2008 and January 2010 and analysed using standard methods. Soil properties include sandy-loam soil; high organic matter content and very high electrical conductivity. The mean values of some physicochemical parameters were: pH 7.69, phosphorus, 84.81 mg/Kg, nitrate-nitrogen 635.47 mg/Kg, sulphate-sulphur 55.98 mg/Kg. Mean values of exchangeable bases were Na (1294.78 mg/Kg), K (3081.67 mg/Kg), Mg (1774.23 mg/Kg) and Ca (27826.41 mg/Kg) and the micronutrients Zn, Mn and Fe were 321.68, 420.49 and 35558.41 mg/Kg respectively; these values were higher than the values obtained from the control site. Three species of earthworms recorded throughout the sampling period were *Hyperiodrilus africanus*, *Eudrilus eugeniae* and *Dichogaster modigliani*. The results show a negative and consistent decline in soil health and earthworm diversity and abundance in the sampling location as against the control. This calls for proper treatment of effluent before release into the environment.

KEYWORDS: Abattoir, effluent, top soil, physicochemical parameters, earthworm Abundance.

INTRODUCTION

The soil is the major receiving medium of contaminants (Adeyemi-Ale, 2014) and the qualities are being degraded through the discharge of untreated effluents from various sources. These large quantities of wastewater drain into surrounding soil (Rabah et al., 2008).

In order to make life more meaningful, especially in the production of food for major populace in Nigeria, there are activities that are being practiced that lead to the negative alteration of the environment and loss of biodiversity. One of these activities includes the production of meat in abattoirs. The common practise in many developing nations including Nigeria, is the disposal of abattoir wastes into streams and rivers and

also use the same water to wash the slaughtered meat (Adelegan, 2004; Woepong and Adinyira, 2011). There is no proper treatment of effluent from abattoirs and there is negligence of proper environmental management practices. This therefore, negatively impact soil and surface water bodies (Adeyemi-Ale, 2014; Ogbonna and Ideriah, 2014).

The soil has traditionally been an important medium for organic waste disposal (Marshall *et al.*, 1996) and large quantities of wastewater that are being discharged by the meat industries drain into surrounding soil environments (Amisu *et al.*, 2003). This act alters physico-chemical properties of the soil, such as pH (Edward, 1990) and increases the quantities of elements such as iron, lead, phosphorus, calcium and zinc (Tortora *et al.*, 2007). Such alteration of soil quality often lead to loss of biodiversity in the soil environment. In heavily contaminated soil and water, there is a decrease in the population, growth and function of biota present (Kaonga and Monjerezi, 2012).

Earthworms are among the most widespread invertebrate animals found mainly in the soils of grasslands, woodlands, scrublands and forest, they are diverse in forms and in behaviour, and could be aquatic or terrestrial in nature (Abimbola *et al.*, 2013). Ecologically, they represent the dominant faunal biomass of the soil in many environments except the environments that are highly saline, moisture-limited or acidic (Edwards and Lofty, 1977; Lee, 1985). The abundance and species composition of earthworms found at a particular site and also the behaviour of individual earthworms in contact with a soil substrate can indicate the quality of the soil (Heinz-Christian *et al.*, 2011).

Contamination of Gbagi stream (Odo-eran), Ibadan by heavy metals (lead, zinc, iron and copper) from abattoir effluent has been reported by Adeyemi-Ale (2014). Heavy metal accumulation in soil poses lots of risks to man and the ecosystem (Odoh *et al.*, 2011).

To meet up with the high demand of protein by Nigerians, activities in abattoirs have been on a constant increase in recent years, leading to continuous release of contaminants into the soil environment. This study therefore aimed at assessing the physicochemical properties of soil and earthworm species diversity in soils around Gbagi abattoir (Odo-eran), Ibadan, Nigeria.

MATERIALS AND METHODS

Study Site

The study was carried out at the Gbagi stream with longitude 3047'18.2"E and latitude 7021'25.2"N. The abattoir is located very close to the popular New Gbagi market, Ibadan, Oyo State, Nigeria.

The soil and earthworm samples were collected from the soil along the bank of the stream while the Control sample was collected along Awba Stream (longitude 3053'58.6"E and latitude 7026'26.6"N) within the campus of the University of Ibadan, Ibadan, Oyo State. The control site does not receive abattoir wastes.

Sample Collection

Soil samples and earthworms were collected within a depth of 0 - 30 cm along the bank of Gbagi stream and the control site by digging and hand-sorting methods (Reynolds, 1977 and Owa, 1992). The soil samples for each visit were bulked down to one representative sample and put in well labelled polyethylene bags, while the earthworm samples were preserved in formoacetic alcohol. All samples were then transported to the laboratory. Sampling was carried out every 2 months for a total of two years (i.e. 12 sampling periods within 24 months).

Laboratory Analysis

At the laboratory, soil samples were transferred to sheets of paper and air-dried at room temperature of 27°C. Thereafter, they were pulverized separately with

porcelain mortar and pestle and sieved through different mesh-sized sieves depending on the mesh-size required for the analysis.

The physicochemical analysis of soil samples were carried out according to the standard methods described in the International Institute of Tropical Agriculture (IITA, 1979) manual and Anderson and Ingram (1993). The soil analysis was carried out at the Central Science Research laboratory of the Obafemi Awolowo University, Ile-Ife, Nigeria.

Earthworm identification was carried out using the keys provided by Owa (1992) and Aladesida (2010).

Data Analysis

Data were subjected to descriptive analysis and T-test using Statistical package for Social Sciences (SPSS) version 17.0.

Biological parameters used in analyzing earthworms' data include Shannon Wiener's diversity index for the measure of species' diversity; Shannon's evenness to measure relative density; Meinhold's index for the measure of species' richness; and Sorensen's coefficient to measure similarity.

RESULTS

Soil Physico-chemical Properties

The physico-chemical qualities are represented in Table 1. Soils of the banks of Gbagi stream and the control site had high percentages of sand and very little amounts of clay and silt. The pH of the soil samples from the Gbagi stream ranged from 6.7 to 8.9 (mean 7.49 ± 0.21). The pH tends from neutral to alkaline. These values were higher than the control that ranged from 6.0 to 7.5 (mean 6.90 ± 0.15).

The mean total organic matter of the abattoir soil was 4.18 % while that of the control site was 1.23 %. Nitrate was not detected in the control site.

Results of the heavy metal analysis (Table 2) showed that all metals analysed were within the NESREA (2011) limits. However, the differences between the study site and the control showed that the metal loads at Gbagi were significantly higher in all cases than the control soils. It was also observed that the values with * differ significantly from the control at $P < 0.05$ significant differences were consistent both during the dry and wet seasons.

Table 1: Analysis of some physicochemical parameters of the soil samples

Parameters	Gbagi soil (Mean±SEM)	Control soil (Mean±SEM)
% Sand	87.92±1.27	92.5±0.83
% Silt	2.75±0.39	2.08±0.26
% Clay	9.33±1.33	5.58±0.72
pH	7.49±0.21	6.87±0.13
EC (µS/cm)	2723.42±933.87*	209.95±52.35
% TOM	4.18±1.02*	1.23±0.29
Phosphorus (mg/Kg)	85.94±6.30*	35.79±4.49
Nitrate-nitrogen (mg/Kg)	675.47±277.02	ND
Sulphate-sulphur (mg/Kg)	55.98±43.53	15.99±4.88
Na (mg/Kg)	1138.73±337.08	610.00±93.63
K (mg/Kg)	2665.00±1672.21	721.67±247.55
Mg (mg/Kg)	1682.56±451.75*	681.64±80.31
Ca (mg/Kg)	27404.18±4148.02	23229.20±3438.10

EC Electrical conductivity, TOM Total organic matter, ND not detected

Table 2: Mean values of some heavy metals analysed in the soil samples

Metals (Mean±SEM)	Gbagi soil (Mean±SEM)	Control soil Limit	NESREA
Pb	157.92±27.61*	51.61±9.79	164
Cu	79.74±18.67*	15.83±2.77	100
Fe	34282.22±3193.60*	13146.50±1428.28	NIL
Zn	296.34±102.22*	45.34±7.13	421
Ni	18.83±1.01*	8.47±1.55	70
Cd	1.80±0.20*	0.99±0.13	0.35
Mn	444.83±51.47*	255.15±36.89	NIL
Cr	44.56±3.24*	14.13±2.20	100
CEC	167.41±34.21*	114.30±19.58	NIL

Values with * differ significantly from the control at P<0.05
Unit of measurement (mg/kg)

Earthworm Abundance and Diversity

During the study period, the total number of individuals of *Eudrilus eugeniae*, *Dichogaster modigliani* and *Hyperiodrilus africanus* found at the bank of Gbagi stream were 60, 40 and 22 individuals with percentage abundance of 49.18 %, 32.79 % and 18.03% respectively. *Eudrilus eugeniae* was the only species found within the dry months of November to March (i.e. the dry season) and only 12, non-clitellate individuals were found all through this period. The total number of individuals of *Eudrilus eugeniae*, *Dichogaster modigliani* and *Hyperiodrilus africanus* found at the bank of the control stream were 152, 188

and 87 respectively with percentage abundance of, 35.60 %, 44.03% and 20.37 % respectively. *Hyperiodrilus africanus* was the only species not found during the dry season. Shannon Wiener's diversity index of the earthworms found was 0.44. Shannon's evenness showed 0.92 (Table 3); maximum species richness with Meinhinick's index recorded 0.5; while Soresen's coefficient of community similarity showed that earthworm composition of the two sites were slightly similar (0.86).

Table 3: Diversity indices of earthworms observed at the streams

Sites	Shannon weiner	Shannons evenness	Menheinnicks Species richness	Sorensens Coefficient
Gbagi	0.44	0.92	0.50	0.86
Control	0.57	0.95	0.38	0.86

DISCUSSION

Soil is a very important component of the terrestrial ecosystem due to its key functions in fertility, decomposition processes, nutrients and energy flows (Karanja *et al.*, 2010). The results of the soil particle size distributions were in accordance with those of Ibadah soils (Adewoyin, 2016).

Enwezor *et al.* (1988) classified soils with organic matter less than 2% as low (values below critical limits); 2.1% to 3.0% as medium (values above critical limits); while greater than 3.1% as high. This indicates that the soil from the control site had low organic matter content while abattoir soil had high organic matter. The high organic matter content of the abattoir soil could be attributed to organic wastes disposed along the bank and into the stream. This is evident by the presence of organic wastes such as animal dung, body parts and blood, all of which Ubwa *et al.* (2013) noted as contributing to the organic matter content of soil.

However, the values observed at both the control and experimental sites were lower than the range of 5.57 to 24.13 % obtained by Ubwa *et al.* (2013) and higher than 2.22 - 2.32 % by Abubakar and Tukur (2014).

The high EC values may be due to the presence of soluble salts in the pores of the soil. The values were far higher than 50 - 110 $\mu\text{S}/\text{cm}$ observed by Chukwu and Anuchi (2016). Higher values of nitrate, phosphorus and sulphate found at the abattoir site could be due to the use of detergents for washing the skin of the animals after burning. Nitrate values were higher than 24.08 - 60.92 mg/Kg obtained by Chukwu and Anuchi (2016).

The higher metal values at the abattoir soil could be attributable to the presence of a mechanic workshop near the upper end of the stream and the dumping of domestic waste along this same axis. These coupled with the abattoir wastes may contribute to the accumulation of metals along the stream. Worrysome is the long term effects of the continuous dumping of these waste

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REFERENCES

- Abimbola, W.A., Amoo A.O.J. and Owa, S.O. 2013. Protozoan and helminth parasites of earthworms (*Alma millsoni* and *Libyodrilus violaceus*). *Journal of Emerging Trends in Engineering and Applied Sciences (JETEAS)* 4.2: 293-295.
- Abubakar, G.A. and Tukur, A. (2014). Impact of abattoir effluent on soil chemical properties in Yola, Adamawa state, Nigeria. *International Journal of Sustainable Agricultural Research* 1 (4): 100-107.
- Adelegan, J.A. (2004). Environmental Policy and Slaughterhouse Waste in Nigeria. Proceedings of the 28th WEDC Conference, Calcutta, India. 3-6.
- Adewoyin, O.A. (2016). Earthworm diversity and abundance in selected dumpsites and toxicity of contaminated water on associated fauna in Ibadan. Ph.D. Thesis submitted to the Department of Zoology, University of Ibadan, Ibadan.
- Adeyemi-Ale, O. A (2014). Impact of abattoir effluent on the physico-chemical parameters of Gbagi stream
- the topsoil (Neuhauser *et al.*, 1979; Neuhauser *et al.*, 1988; Edwards 1988). In terms of abundance, the population density and frequency of encountered earthworms at the control site was slightly higher than at Gbagi stream. This may be due partly to the higher heavy metal load of the soils around the stream (Mainoo *et al.*, 2008).

CONCLUSION

The results inferred that there is high contamination of the abattoir soil due to the fact that the effluents are not treated before being discharged. This affected the soil quality, therefore, the abundance and diversity of the earthworms inhabiting the soil. Therefore, there is need for the treatment of the effluent before the discharge on the soil.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

(Odo-Eran), Ibadan, Nigeria. *Ilorin Journal of Science* 1 (1): 100-109.

Aladesida, A.A. (2010). Earthworm Taxonomy, Distribution and Abundance in Southwestern Nigeria in Relation to Soil Properties. Ph.D. Thesis submitted to the Postgraduate School Olabisi Onabanjo University, Ago-Iwoye.

Amisu K.O., Coker A.O., On S.L.W. and Isokpehi, R.D. (2003). *Arcobacter butzlii* strains from poultry abattoir effluent in Nigeria. *East African Medical Journal* 80: 218-221.

Anderson, J.M. and Ingram, J.S.I. (Eds). 1993. *Tropical soil biology and fertility*. A Handbook of Methods, 2nd Edition. CAB Int, U.K. pp 221.

Bano, K., and Kale, R.D.

(1988). Reproductive potential and existence of endogenous rhythm in reproduction of earthworm *Eudrilus eugeniae*. *Proc. Zool. Soc. (Calcutta)* 38: 9-14.

Chukwu U.J. and Anuchi S.O. (2016). Impact of abattoir wastes on the physicochemical properties of soils within Port Harcourt metropolis. *The International Journal of Engineering and Science* 5 (6): 17-21.

- Dominguez, J., Edwards, C. and Ashby, J. (2001). The biology and population dynamics of *Eudrilus eugeniae* (Kinberg), (Oligochaeta) in cattle waste solids. *Pedobiologia* 45: 341-353.
- Edward O. (1990). *Microbiology of extreme environments*. 2nd Edition. Open University Press, Milton Keynes
- Edwards, C.A. (1988). Breakdown of animal, vegetable and industrial organic wastes by earthworms. In *Earthworms in waste and environmental management*, ed. C. A. Edwards and E. F. Neuhauser, 2131. SPB, the Hague, the Netherlands. In Dominguez, J. and Edwards, C.A. 2011. *Biology and Ecology of earthworms species used for vermicomposting*. By Taylor and Francis Group, LLC.
- Edwards, C.A. and Lofty, J.R. 1977. *Biology of earthworms*. (2nd edition). Chapman and Hall, London. 333 pp.
- Enwezor, W.O., Ohiri, A.C., Opubaribo, E.E. and Udoh, E.J. (1988). *A review of soil fertility investigations in southeastern Nigeria*. Vol. II. Lagos: F.D.A.
- Graff, O. (1982). Vergleich der Regenwurmarten *Eisenia foetida* and *Eudrilus eugeniae* hinsichtlich ihrer Eignung zur Proteingewinnung aus Abfallstoffen. *Pedobiologia* 23: 277-282.
- Heinz-Christian, F., Ulfert, G. and Sabina, T. (2011). Earthworms as bioindicators of soil quality. Chapter 16. Karaca, A. (ed.). *biology of earthworms*. *Soil Biology* 24. Springer-Verlag Berlin Heidelberg 2011. Pp 261-278.
- International Institute of Tropical Agriculture Manual (1979). *Selected methods for soil and plant analysis*. IITA Manual Series, I, IITA, Ibadan, Nigeria. 60 pp.
- Kaonga, C.C. and Monjerezi, M. (2012). Periphyton and earthworm as biological indicators of metal pollution in streams of Blantyre City, Malawi. *Water Pollution*. Edited by Nuray, B. ISBN 978-953-307-962-2.
- Karanja, N., Mutua, G.M., Ayuke, M., Njenga, M., Prain, G. and Kimenju, J. (2010). Dynamics of soil nematodes and earthworms in urban vegetable irrigated with wastewater in the Nairobi River, Basin, Kenya.
- Tropical and Subtropical Agroecosystems* 12: 521-530.
- Lee, K.E. 1985. *Earthworms, their ecology and relationships with soils and land use*. Academic Press, New York. In: Gonzalez, G., Huang, C.H., Zou, X. and Rodriguez, C. 2006. *Biol. Invasions*. DOI 10.1007/s10530-006-9023-7.
- Mainoo, N.K., Whalen, J.K. and Barrington, S. (2008). Earthworm abundance related to soil physicochemical and microbial properties in Accra, Ghana. *African Journal of Agricultural Research* 3 (3): 186-194.
- Marshall, T.J., Holmes, J.W. and Rose, C.W. 1996. *Soil Physics* (3rd edition), Cambridge University Press, UK.
- Mba, C.C. (1996). Treated cassava peel vermin composts enhanced earthworm activities and cowpea growth in field plots. *Resour. Conserv. Recy.* 17: 219-226.
- Neuhauser, E.F., Kaplan, D.L., and Hartenstein, R. (1979). Life history of the earthworm *Eudrilus eugeniae*. *Rev. Ecol. Biol. Sol.* 16: 525-534.
- Neuhauser, E.F., Loehr, R.C., and Malecki, M.R. (1988). The potential of earthworms for managing sewage sludge. In *Earthworms in Waste and Environmental Management*, ed. C.A. Edwards and E. F. Neuhauser, 920. SPB Academic Publishing, the Hague, the Netherlands. In Dominguez, J. and Edwards, C.A. 2011. *Biology and Ecology of earthworms species used for vermicomposting*. By Taylor and Francis Group, LLC.
- National Environmental Standards and Regulations Enforcement Agency (NESREA). National Environmental (Surface and groundwater quality control) regulations. 2011.
- Ogbonna, D.N. and Ideriah, T.J.K. (2014). Effect of abattoir waste water on physico-chemical characteristics of soil and sediment in southern Nigeria. *Journal of Scientific Research and Reports* 3 (12): 1612-1632.
- Odoh, R., Agbayi, E. B., Kagbu, J. A., Thomas, S. A. (2011). Heavy metal speciation in agricultural farmland in some selected local government areas of Benue State, Nigeria. *Archives of Applied Science Research* 3 (3): 560-573.

- Owa, S.O. (1992). Taxonomy and distribution of Nigeria earthworms of the family Eudrilidae and their use as possible indicators of soil properties. Ph.D Thesis submitted to the Department of Zoology, Obafemi Awolowo University, Ile-Ife.
- Rabah, A. B.; Ijah, U. J. J.; Manga, S. B. and Ibrahim, M.L. (2008). Assessment of Physico-chemical and microbiological qualities of abattoir wastewater in Sokoto, Nigeria. *Nigerian Journal of Basic and Applied Sciences*. 16(2):145-150.
- Reynolds, J.W. (1977). *The earthworms Lumbricidae and Spiraanophilidae of Ontario*. Royal Ontario Museum Life Sciences Miscellaneous Publications.
- Tortora, G. J., Funke, B. R. and Case, C. L. (2007). *Microbiology: An Introduction*. 9th Edition. Benjamin/Cummings Publishing Company Inc., California.
- Ubwa, S. T., Ato, G. H., Offem, J. O., Abah, J. And Asemave, K. (2013). Effects of activities at the Gboko abattoir on some physico-chemical properties and heavy metal levels of surrounding soil. *International Journal of Chemistry* 5(1):49-56.
- Wobong, C.A. and Adinyira, E.Y (2011). Operational impacts of Tamale abattoir on the environment. *Journal of Public Health and Epidemiology* 3(9):380-393