International Journal of Entomology and Nematology Research
Vol.5, No.1, pp.11-21, 2021
Print ISSN: 2399-1151(Print)
Online ISSN: 2399-116X (Online)

ABUNDANCE, DISTRIBUTION AND INCRIMINATION OF THE HOUSE FLY -*MUSCA DOMESTICA* LINNAEUS (DIPTERA: MUSCIDAE) IN THE JOSEPH SARWUAN TARKA UNIVERSITY COMMUNITY IN MAKURDI, NORTH-CENTRAL NIGERIA

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ABSTRACT: *Flies collected from philanthropic environments are likely to be contaminated with human pathogens. Houseflies (Musca domestica) particularly pose significant public health threat owning to their ability to mechanically transmit human intestinal parasites and other disease-causing microorganisms. This study aims at determining the abundance, distribution and vectoral capacity of houseflies (Musca domestica) in the transmission of human intestinal parasites. Studies were specifically undertaken from September to October, 2019 when a total of 1,309 houseflies were collected using fresh fish as bait and the knockdown and sweep method, from three localities viz: Female Hostel, Student's Village and University Staff Quarters respectively. The flies were morphologically identified and examined for possible incrimination with parasitic faunas using available standard microscopic techniques. The highest fly abundance of 613(46.83%) was recorded from the students village, followed by 480(36.67%) from the female hostels, while the least abundance of 216(16.50%) was recorded from the University staff quarters. Meanwhile, a total of 86 pathogenic parasites belonging to 7 genera and 9 species were collected and identified using standard techniques, from the external body surfaces of the flies viz: Entamoeba histolytica 21(24.42%) > Ascaris lumbricoides 17(19.77%) > Taenia solium 12(13.95%) > Taenia saginata 9 (10.47%) > Schistosoma mansoni 8(9.30%) > Enterobius vermicularis 7(8.14%) > Schistosoma haematobium 5(5.81%) > Hymenolepis nana 4(4.65%) > Trichuris trichiura 3(3.49%) respectively. The results showed significant differences (P < 0.05) in the abundance and distribution of houseflies across the sample localities. Similarly, significant differences (P < 0.05) existed between both the genera and species of parasites collected. The results have shown that houseflies were abundant and well distributed in the study area and were incriminated as potential mechanical vectors of important human parasites and hence their role in disease transmission in the study area is suspected.*

KEY WORDS: Housefly abundance, Parasites, University Environment, Makurdi, Nigeria.

INTRODUCTION

More than 50 species of synanthropic flies have been incriminated with unsanitary conditions and human pathogen transmission (Balla *et al.,* 2014; Adetan, 2015). Flies have also been reported to be

https://doi.org/10.37745/ijenr.16

often attracted to unsanitary communities with garbage, carcasses and faeces, especially when these are scattered around dwelling places, where they help to facilitate the flies' migration into living rooms (Oyeyemi *et al*., 2016). The housefly *Musca domestica L*. is a fly of the order *Diptera*, it is the most common of all domestic flies, accounting for about 91% of family *Muscidae* and indeed one of the most widely spread insects found all over the world (Adeleke *et al.*,2017). It is considered a pest that can carry pathogens responsible for diseases (Mohammed *et al.,* 2014). Houseflies *Musca domestica* are ubiquitous in nature and are known to transmit more than 100 human and animal diseases, including bacterial infections such as salmonellosis, anthrasophthalmia, shigellosis, typhoid fever, tuberculosis, cholera and infantile diarrhea (Adeleke *et al*., 2017). It is considered as one of the most important pests which cause health problems in the environment as it accompanies man during his daily activity everywhere, on work site or in rest places causing many disturbances to him (Howard, 2011).

Houseflies are of human and veterinary concern because they act as mechanical vectors for a range of pathogens (Peter and Chiodui, 1997; Service, 2000). It has been reported that almost an invisible dot of feaces in the environment may contain the eggs or larvae of protozoa that can develop further and transmit to nearby humans (Graczyk *et al*., 2001). The filthy breeding habit, feeding mechanism and indiscriminate travel between filth and food have been known to qualify houseflies as efficient vectors and transmitters of human enteric protozoan and helminth parasites such as cysts of *Entamoeba histolytica, Entamoeba coli, Giardia intestinalis* and oocyts of *Toxoplasma gondii, Isospora spp* and eggs or larvae of *Ascaris lumbricoides, Trichuris trichiura* (Graczyk *et al.,* 2001; Goulson *et al.,* 2005).

The transmission of these human protozoan and helminth parasites by houseflies is predominantly mechanical, which occurs through mechanical dislodgement from external body surfaces, fecal deposition and regurgitation (Graczyk *et al*., 2005). Since houseflies feed on contaminated substances such as human and animal excreta, sputum, secretions/exudates from wounds, the flies can carry pathogens from their spongy mouth parts, hairy body and legs, which is directly transmitted to the next visited site, mostly human food (Oguniyi *et al*., 2015). Houseflies are also one of the most serious pests with animal production facilities worldwide (Balla *et al*., 2014). Although, various insecticides have been used extensively for controlling house flies for over a century now, this pest has shown a remarkable ability to rapidly evolve resistance (Oghale *et al*., 2013; Balla *et al.,* 2014).

Despite the awareness about the dangers posed by houseflies, the inability to maintain a good sanitation leads to an increase in the population of houseflies, especially in warm tropical countries. In Makurdi, in general and the Joseph Sarwuan Tarka University in particular, poor sanitation is becoming a problem. Indiscriminate dumping of refuse, little or no care of toilet facilities and drainage systems coupled with improper handling of food and garbage have become common practices in this community. Hence, the aim of this study is to determine the abundance and distribution of houseflies (*Musca domestica)*, as well as to assess their vectoral capacity in the transmission of human intestinal parasites across the study area.

MATERIALS AND METHODS

Study Area

Houseflies (*Musca domestica*) were sampled from dwelling places within the Joseph Sarwuan Tarka University Makurdi community, particularly in the female hostel, the staff quarters, and the village area of the University in Benue State, Nigeria. The University was established in 1988, following the recommendations of a 1987 Federal government White Paper on Higher Education curriculum and development in Nigeria (Anyanwu, 2011). The University is 10 km away from the Federal road leading to Lafia-Enugu across Benue State. It has a land mass of 8,048 hectares and share common boundaries with the river Benue and Makurdi town in the south, Federal Housing Estate in the west, Tyodugh village in the east, Agan village in the north and Guma Local Government Area in the North-east. One of the cardinal objectives of the University was the generation of high-yielding crop varieties and livestock breeds as well as other efficient agricultural technologies that are sufficiently adapted and relevant to local environments.

Data from Nigerian Meteorological Agency (NMA), Tactical Air Command Head Quarters, Makurdi, Nigeria (2011) show that the study area is characteristic of high temperatures, ranging between 30^0C - 39^0C, which is likely to be instrumental in the speedy development and hatching of housefly eggs. The University community is peri-urban with inadequate infrastructural facilities. Due to a lack of good toilet facilities in some dwelling places (Hostels and staff quarters), and organized community waste disposal systems, the inhabitants, especially students, often resort to making use of nearby bushes for these purposes. There are small and large public waste and refuse dump sites around the community of which most are close to human dwelling places, thus serving as suitable breeding sites for the houseflies and their eventual migration into nearby houses.

Geographically, Makurdi is located between longitude 8º35'E and 8º41'E and latitude 7º45'N and 9º52'N respectively and has a climate typical of the middle belt of Nigeria with distinct wet and dry seasons in a year. Meanwhile, Udo (1981) and Nyagba (1995) provided other detailed geographical and regional indices of the study area, and the map of the study area is depicted in Figure 1.

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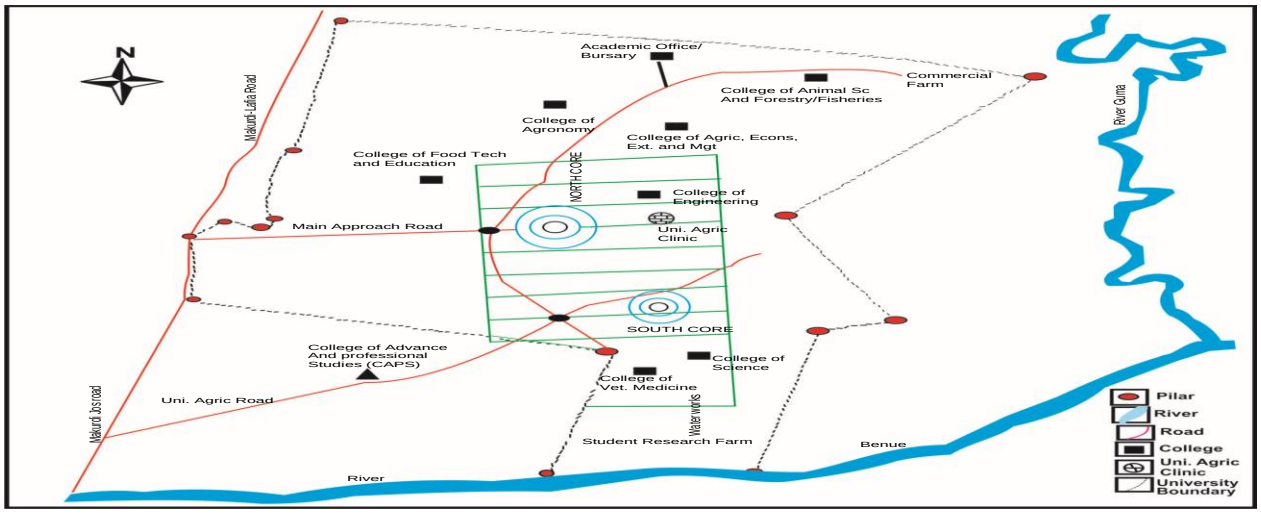

Fig 1: Map of Joseph Sarwuan Tarka University Makurdi showing Study Locality
Ministry of Lands and Survey, Makurdi (2014)

Insect vector collection and incrimination

A total of 1,309 houseflies were collected between 6.00 am and 11.00 am indoors, using fresh fish as bait and both the approaching and settled flies were knocked down from the three locations (female hostel, staff quarters and the village locality of the University, including toilets, kitchens, parlours and bedrooms in the study area, from September to October, 2019. After knock down, the houseflies were collected from the three locations through sweeping using clean brushes designated for the purpose. Each intact insect caught was placed in a sterilized sample bottle and then transported to the Applied Entomology and Parasitology Laboratory in the Department of Zoology, Joseph Sarwuan Tarka University Makurdi, Nigeria. The houseflies were identified using standard taxonomic manual andkeys as provided by D'assis Fonseca (1968) and Couri (2007).

Plate 1: Pictorial representation of *Musca domestica* feeding on animal blood. (Deakpe *et al*., 2018).

After identification, each insect was placed in a centrifuge tube containing 5 mL of normal saline (Cheesbrough, 2000; Service, 2000). The tube was shaken vigorously in order to detach any adhering parasites on the insect's external body surface. After removal of insects, the fluid was centrifuged at 3000 rpm for 3 minutes. The supernatant was decanted while the sediment was placed on a clean glass slide, and stained with Lugol's iodine, after which the preparation was viewed under the ×40 microscope objective lens for identification of eggs and cysts of parasites (Cheesbrough, 2000).

Identification of Parasites

The body washings were obtained separately and were centrifuged and decanted. The deposits were then dropped on clean grease free glass slides and a cover slip was placed upon the drop. Iodine was then pipetted from the side of the cover slip to enhance the elucidation of the parasite forms. The slide was mounted on the microscope and viewed using the X10 objective of the microscope first, then ×40 objective for confirmation. The present study did not investigate the internal parts of the flies for parasites because previous studies indicate that parasites do not survive for long in the mid gut of the flies before they are metabolized (Mawak and Olukose, 2006).

Data Analysis

Analysis of data was performed using the Predictive Analytical Software (PASW) Version 18. Descriptive statistics was used to analyze the proportion of insects infested by parasites while Chi-square (χ^2) analysis was used to determine significant differences in the proportion of houseflies infested with parasites. P-values less than 0.05 were considered to be significantly different.

RESULTS

A total of 1,309 houseflies were collected using fresh fish as bait and the knockdown and sweep method, from three localities viz: Female Hostel, Student's Village and Staff Quarters respectively. The flies were identified and examined for possible incrimination with parasitic faunas using standard microscopic techniques. The highest fly abundance of 613 (46.83%) was recorded from the students village, followed by 480(36.67%) from the female hostels, while the least abundance of 216 (16.50%) was recorded from the University staff quarters. Meanwhile, a total of 86 pathogenic parasites belonging to 7 genera and 9 species were collected and identified using standard techniques, from the external body surfaces of the flies viz: *Entamoeba histolytica* 21 (24.42%) > *Ascaris lumbricoides* 17(19.77%) > *Taenia solium* 12(13.95%) > *Taenia saginata* 9 (10.47%) > *Schistosoma mansoni* 8(9.30%) > *Enterobius vermicularis* 7(8.14%) > *Schistosoma haematobium* 5(5.81%) > *Hymenolepis nana* 4(4.65%) > *Trichuris trichiura* 3(3.49%) respectively. The results showed significant differences ($P < 0.05$) in the abundance of houseflies across the sample localities. Similarly, significant differences ($P < 0.05$) existed between both the genera and species of parasites collected. The results have shown that houseflies are abundant in the study area and are incriminated as potential mechanical vectors of important parasites and hence their role in disease transmission in the study area.

In each location, the houseflies were collected from three (3) strategic vector abundance sites. The results obtained shows an association between houseflies and some parasitic organisms. In terms of the three localities where the flies were collected, student's village had more flies, 613 (46.83%), followed by Female hostel, 480 (36.67%), while staff quarters had the least number of house flies, 216 (16.50%). The distribution of these flies varied significantly ($P < 0.05$) across the localities.The flies were sampled for two months- September and October, 2019, where September recorded more houseflies, 794 (60.66%) than October, 515 (39.34%). There was a significant difference ($P < 0.05$) in the distribution of the houseflies across the two months during which the samples were collected. Detailed results are presented in Tables1-3.

Table1. Incrimination of Houseflies (*Musca domestica)* with Parasitic Fauna in the Joseph Sarwuan Tarka University Makurdi Environment.

Parasite species	Frequency (%)
Ascaris lumbricoides	17 (19.77)
Taenia solium	12 (13.95)
Taenia saginata	9 (10. 47)
Hymenolepis nana	4 (4.65)
Schistosoma mansoni	8 (9.30)
Schistosoma haematobium	5 (5.81)
Enterobius vermicularis	7 (8.14)
Entamoeba histolytica	21 (24.42)
Trichuris trichiura	3 (3.49
Total	86 (100.00)

P > 0.05, $\chi^2 = 1.870,\quad df = 8,\ p = 19.68$

Table 2: Abundace and Distribution of Houseflies (*Musca domestica)* with Respect to Localities in the Joseph Sarwuan Tarka University Makurdi Environment.

Locality	Frequency (%)
Female Hostel	480 (36.67)
Student's Village	613 (46.83)
Staff Quarters	216 (16.50)
Total	**1,309 (100.00)**

$\chi^2 = 15.044,\ df = 2,\ P = 3.84,\ P < 0.05$

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Table 3: Abundance and Distribution of Houseflies (*Musca domestica)* with Respect to Period and Site of Collection in the Joseph Sarwuan Tarka University Makurdi Environment.

Collection site	Frequency	Period of collection (%)	
		September	October
Female Hostel	480 (36. 67)	295 (37.15)	185 (35.92)
Student's Village	613 (46.81)	363 (45.72)	250 (48.54)
Staff Quarters	216 (16.50)	136 (17.13)	80 (15.53)
Total	**1,309 (100.00)**	**794 (60.66)**	**515 (39.34)**

(a) $\chi^2 = 15.044,\ df = 2,\ P = 3.84,\ P < 0.05,$ (b) $\chi^2 = 34.329,\ df = 2,\ P = 19.68,\ P < 0.05$

DISCUSSION

The present study on the abundance, distribution and Parasitic Fauna of the housefly (*Musca domestica.* Linnaeus*)* across the Joseph Sarwuan Tarka University Makurdi community in Benue State, Nigeria have revealed that houseflies are abundant and well distributed across the study localities within the University. Housefly distribution in the study area is in agreement with those reported by Howard (2011) and Goulson *et al.* (2015), who separately found that the houseflies were evenly distributed in their study areas due to suitable environmental conditions and abundant food supplies.

The flies were also found to be incriminated with different pathogenic species of intestinal parasites, including *Ascaris lumbricoides, Entamoeba histolytica, Taenia saginata, Taenia solium, Schistosoma mansoni, Enterobius vermicularis, Hymenolepis nana, Schistosoma haematobium* and *Trichuris trichiura,* which are likely to be transmitted by the houseflies in the study community and beyond. This also demonstrates the fact that houseflies as mechanical transmitters of important diseases abound in the study community despite the growing level of community and personal hygiene which is corroborated by Adeleke *et al.* (2005).

The results of this study is in agreement with the report of Okore *et al.*, (2013) in Abia, Nigeria, and Onyenwe *et al*. (2016) in Mouau, where pathogens like *Entamoeba histolytica, Ascaris lumbricoides* and *Trichiuris trichiura* were similarly isolated from *Musca domestica.* The parasites retrieved from the external body of the houseflies as encountered in this study, has been attributed to poor personal and environmental hygiene, inadequate supply of portable water and indiscriminate defecation. The very high load encountered among houseflies captured in the student's village may be attributed to

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student's indiscriminate act of defecating in the environment, and the fact that parasitic organisms thrive more in environments contaminated with feces. This is in agreement with the findings by Oguniyi *et al.* (2015), who made similar assertion in a study in Ile-Ife, Nigeria of the parasites encountered within the body of the houseflies.

In the present study, *Entamoeba histolytica* had the highest prevalence of 24.42% with *Ascaris lumbricoides* trailing behind with 19.77%. This is in agreement with the findings of Pai *et al.* (2003) who reported a similar occurence of *Entamoeba histolytica* in *Musca domestica* in China. *Taenia solium* had a prevalence rate of 13.95%, *Taenia saginata* had a prevalence rate of 10.47%, *Schistosoma mansoni* had 9.30%, *Enterobius vermicularis* had 8.14%, *Schistosoma haematobium* had 5.81%. Meanwhile, *Hymenolepis nana* had a low prevalence rate of 4.65% and *Trichuris trichiura* had the lowest prevalence rate of 3.49%. The prevalence rates in the present study are comparatively higher than the report of Deakpe *et al*. (2018), who found similar pathogenic parasites on houseflies in Makurdi, where the Present study area (Joseph Sarwuan Tarka University) is located.

With respect to the staff quarters, parasites isolated from houseflies captured in this area were limited owing to the fact that staff quarters comprised of a lower population of people but with higher level of personal hygiene and good sanitary practices which to an extent, discouraged the breeding and proliferation of houseflies, hence a reduction in parasitic fauna in this locality. It has been reported that *Ascaris lumbricoides* and *Trichuris trichiura* are causative agents of human helminthiasis (Oghale *et al.*, 2013). The fact that these pathogens were isolated from the body of *Musca domestica* in the study localities, it is quite imperative that people will be getting infected with these parasites in the study locality if not properly handled.

CONCLUSION AND RECOMMENDATIONS

The findings from the present study have shown that houseflies are abundant in the University environment and they carry pathogenic parasites on their hairy bodies. This implies that the study area is a high risk area, therefore, it is recommended that food should be strictly protected from housefllies.This study also underscores the need to institute functional control measures such as health education and proper environmental sanitation where everyone in the study area should be made to actively participate. Basic social amenities such as potable water, proper means of waste disposal and treatment of wastes in the environment should be intensified by Federal government and the University authorities.

The practice of personal hygiene cannot be overemphasized. The control and eradication of houseflies as well as drug administration should be implemented to stop parasitic fauna transmission in the study area. Further studies should also be conducted to investigate the presence of parasites in the housefly guts, and also to determine other pathogenic microorganisms (bacteria, viruses and fungi) that might be mechanically transmitted by *Musca domestica* in the area.

References.

Adeleke, M.A., Oyewole, V.O., Olabiyi, K.O. and Oforka, L.C. (2017). Parasites and Pathogenic Bacteria Associated with Houseflies and the Public Health Implications in Osogbo, Southwestern Nigeria. *Munis Entomology & Zoology*, 12(1): 94-98.

Adentan O. E. (2015). Assessment of Parasites Pathogens of *Musca domestica* Invading Eating Houses in Jos Plateau State, Nigeria. *Proceedings of The International Academic Conference for Sub-Sahara African Transformation & Development Vol. 3 No.1 March, 12-13 2015- University of Ilorin, 1000 Capacity Lecture Theatre Hall, Ilorin, Kwara State – Nigeria.*

Anyanwu, O.E. (2011). *The Politics of Access: University Education and Nation-Building in Nigeria, 1948-2000*. University of Calgary Press. Pp 174-177.

Balla H. J., Usman Y., & Muhammad A. (2014). The Role of Housefly (*Musca domestica*) in Mechanical Transmission of Intestinal Parasites in Maiduguri Metropolis, North Eastern Nigeria. *Journal of Natural Sciences Research,* 4(8). www.iiste.org. ISSN 2224-3186.

Cheesbrough, M., (2000), District Laboratory in Tropical Countries (part 2) Cambridge University Press. India.

Couri, M.S. (2007). A Key to the Afrotropical Genera of Muscidae (Diptera). *Revisita Brasileirade Zoologia*, 24(1): 178-184.

D'assis Fonseca, E.C.M. (1968). *Handbook for the Identification of British Insects*: Diptera; Cyclorrhapha Calypterata, Section (b) Muscidae, Society and Sold, London.

Deakpe, T. E., Manyi, M.M. and Utume, L.N. (2018). Pathogenic Parasites and Bacteria associated with the Housefly (*Musca domestica*) in Makurdi-a fly-infested Area in Central Nigeria. *Nigerian Journal of Parasitology*; 39(1**):** 111-115.

Goulson D., Dewent H., and Dunn (2005). Predicting Fly Population from Weather and Probable Consequences of Climate Change. *Journal of Applied Ecology*, 42: 795-800.

Graczyk T.K, Knight R, Robert, H.G, and Michael R.C., (2001), The role of non-biting flies in the epidemiology of human infectious diseases. *Journal of Microbial Infections 3*, 231-235.

Graczyk T.K, Ronald K and Leena T (2005). Mechanical transmission of human protozoan parasites by insects. *Clinical Microbiology review 13*, 348 351.

Howard, J.J (2011) Nuisance flies around a landfill: patterns of abundance and distribution. *Waste management research* 19, 308-311.

Mawak and Olukose (2006), Vector Potential of House flies (*Musca domestica*) for Pathogenic Organisms in Jos, Nigeria. *Journal of Pest, Disease and Vector Management*, **7:** 418-423.

Ministry of Land and Survey, Makurdi (2011). Map of Benue State showing Makurdi Local Government Area.

Mohammad, H.M., Davood, M., Golnoush, M. (2014). The Role of Musca domestica as a Carrier of Parasites in Shiraz, Southern Iran. *Academic Journal of Entomology*, 7(3): 84-87.

NMA. (2011). Nigerian Meteorological Agency, Tactical Air Command Head Quarters Makurdi.

Nyagba, J.L. (1995)**.** The geography of Benue State. In: A Benue Compendium. Denga, D. I. (ed) Calabar, Rapid Educational Publishers Ltd. Pp 85 – 97.

Oghale O. O., Ebube C. A. and Oluchi U. O., (2013), Parasitic load on *Musca domestica* (Dipthera: Muscidae) from different synanthropic environments in Umuahia metropolis. *Journal of Public Health and Epidemiology*, 5(8); 309-312. DOI: 10.5897/JPHE2013.0521.

Oguniyi T. A. B., Olajide J. S. and Oyelade O. J. (2015), Human Intestinal Parasites Associated with Non-biting Flies in Ile-Ife, Nigeria .*Journal of Medical and Biological Science Research,* 1(9): 124-129. ISSN: 2449-1810.

Okore O. C, Amaechi E. and Obike O. (2013). *Parasitic load on Musca domestica* (Diptera: Muscidae) from different synanthropic environments in Umuahia Metropolis, Nigeria. *Journal of public health and epidemiology*, 5(8), 309-312.

Onyenwe E., Okore O. O., Ubiaru P. C. and Abel C., (2016), Housefly-Borne Helminth Parasites of Mouau and Its Public Health Implication for the University Community. *Animal Research International* (2016) 13(1): 2352 – 2358. ISSN: 1597 – 3115.

Oyeyemi O. T., Agbaje M. O. and Okelue, U. B. (2016). Food-borne human parasitic pathogens associated with household cockroaches and houseflies in Nigeria. *Parasite Epidemiology and Control* 1; 10 – 13.

Pai H. H, KO YC, Chen E.R (2003). Houseflies and Cockroaches as Intestinal Mechanical Disseminators of *Entamoeba histolytica*. *Acta tropica* 87: 355-359.

Peter and Chiodui, D. (1997) Tropical infections. *Journal of medicine* 2, 64-70

Service, M. W. (2000), Medical Entomology for students. 2nd Edition. Cambridge University Press, 303Pp.

Udo, K.R. (1981). Geographical Regions of Nigeria. London, Morrison and Gibb Ltd. Pp 133 – 149.