

1 **DETERMINATION OF PARASITIC AGENTS ASSOCIATED WITH COCKROACHES IN DUTSIN-MA**
2 **TOWN, NORTHWESTERN NIGERIA**

3 **ABSTRACT**

4 **Background:** Cockroaches are known to be mechanical vectors of disease-causing agents such as parasites,
5 bacteria, fungi and viruses. This study determined parasitic agents associated with cockroaches in Dutsin-Ma Town,
6 Northwest Nigeria. A total of 600 cockroaches were collected from toilets, dumpsites, suck-away and sewages of
7 Female and Male Hostels of Federal University Dutsin-Ma, residential houses in Darawa, Hayin-Gada and
8 Kadangaru in Dutsin Ma town.

9 **Aims:** To provide the public with this knowledge, this study was put forward to determine parasitic agents
10 associated with cockroaches in Dutsin-Ma Town, Northwestern Nigeria.

11 **Study design:** The study was carried out in Dutsin-Ma Local Government Area, Nigeria. Cockroaches collected
12 from the toilets had the highest parasite load, followed by those from the suck-away, and those from the dump site
13 and then cockroaches from the sewages

14 **Results and discussion:** A total of 600 cockroaches (identified as *Periplanata americana* species) were examined,
15 95.33% were infected with several species of gastrointestinal parasites. Parasites isolated and identified include
16 *Strongyloides stercoralis* (25.26%), fluke (17.89%), *Nyctotherus ovalis* (2.98%), *Enterobius vermicularis* (13.68%),
17 *Entamoeba histolytica* (12.28%), *Toxascaris leonina* (24.46%).. More parasites were recovered from the gastro-
18 intestinal than on the external parts with prevalence rates of 97.33% and 92.67%, respectively.

19 **Conclusion:** This study has shown that *Periplanata americana* represent an important reservoir of parasites which
20 can cause disease in man. Hence public awareness is required to educate people on the potential of *Periplanata*
21 *americana* in transmitting intestinal parasites thus, there is a need to control cockroaches indoors and outside.

22 **Keywords:** *Protozoa, Nematode, Parasite, Dutsin-Ma, Nigeria*

23 **1.0 INTRODUCTION**

24 Cockroaches are the most abundant and obnoxious non-biting insect pests in residential buildings, hospitals, hostels,
25 hotels and restaurants (Piper and Antonelli, 2012). They feed indiscriminately on human food and sewage. Over
26 three thousand five hundred species of cockroaches have been identified and thirty of these species are more adapted
27 to human habitation. Of these, *Periplanata americana*, *Blattela germanica* and *Blattela orientalis* are considered the
28 most common pests of humans (Gullan and Cranston, 2005) When cockroaches run over food, they contaminate the
29 food by leaving an oily liquid that has offensive odour or bacteria that can cause food poisoning (Brenner *et al.*,
30 1987). Some parasites have been found in the external and internal body parts of cockroaches (Chan *et al.*, 2004).
31 Findings have also shown that exposure to cockroach antigens may play an important role in Asthma related health
32 problems (Montessoro *et al.*, 1998).

33 In Nigeria, the risk to human health arising from cockroach infestations have been reported (Allen, 1987).
34 Cockroaches are abundant in most homes in Nigeria, where they are fondly referred to as “landlords” in homes.
35 They are among the most notorious pests of premises, which frequently feed on human faeces and can disseminate
36 cysts of enteric protozoans in the environment if such faeces are contaminated. Besides contaminating food by
37 leaving droppings and bacteria that can cause food poisoning (Che Ghani *et al.*, 1993), they also transmit bacteria,
38 fungi, and other pathogenic microorganisms in infested areas (Kopanic, 1994; Czajka *et al.*, 2003). They feed on
39 garbage and sewage and so have high chances of disseminating human pathogens (Cotton *et al.*, 2000; Paii *et al.*,
40 2005). In addition, their nocturnal and filthy habits made them ideal carriers of various pathogenic microorganisms
41 (Allen, 1987). In 2016, Morenikeji *et al.* reported a very high prevalence (87.1%) of parasites in cockroaches
42 recovered from residential houses around Awotan dumpsite in Ido Local Government Area of Oyo State in Nigeria.

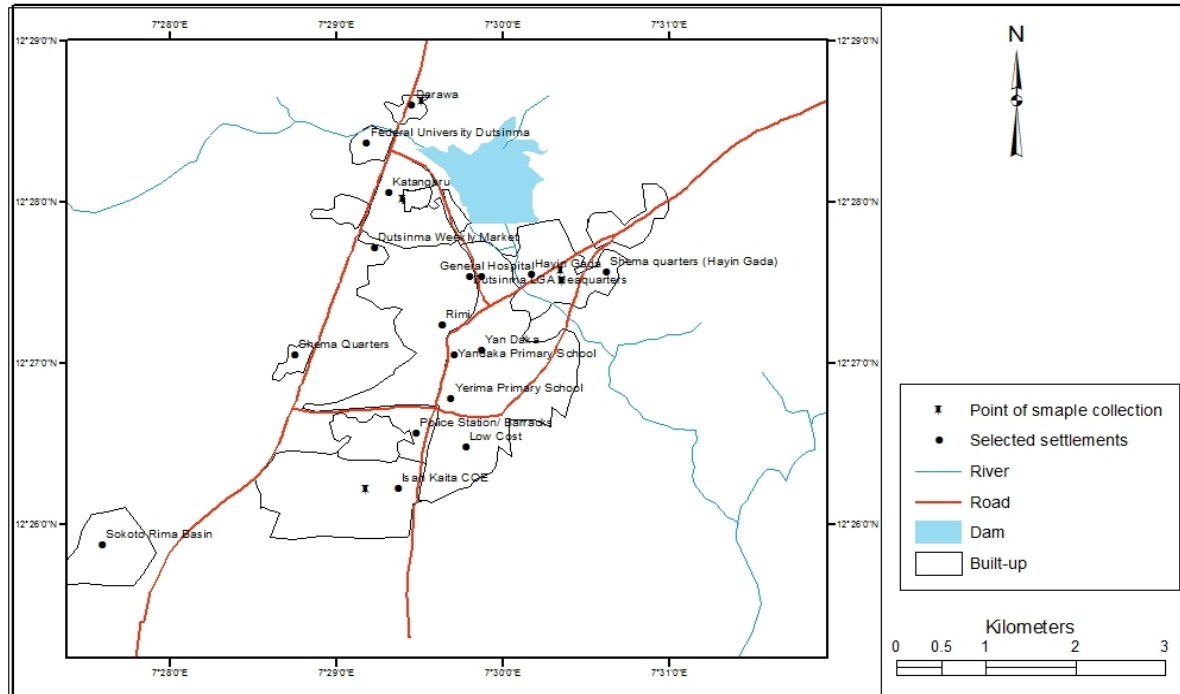
43 Despite the abundance of cockroaches in residential areas in Dutsin-Ma town and the relatively high prevalence of
44 parasitic infections in the area, there is no reported study on the roles of cockroaches as carriers of bacteria, parasites
45 and other pathogens in Dutsin-Ma Town. To provide the public with this knowledge, this study was put forward to
46 determine parasitic agents associated with cockraoches in Dutsin-Ma Town, Northwestern Nigeria.

47 2.0 METHODOLOGY

48 2.1 Study Area

49 The study was carried out in Dutsin-Ma Local Government Area on latitude 12.455' and longitude 7.4914, area of
50 527km² (Figure 1) with elevation of 605m and average temperature of 26⁰C, wind NW 2km/h 25% humidity and a
51 population of 169,671 as at 2006 census (Reference).

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Source: Google Earth 2016 & FUDMA GIS Lab

53

54 **Fig. 1:** Map showing Study Area

55 Aborigines of Dutsin-Ma are predominantly farmers, cattle rearers and traders. There has been a tremendous increase
 56 in human population, a number of houses and activities in Dutsin-Ma in the last 6 years, which is not unconnected
 57 with the siting of the new Federal University in the Town. Dutsin-Ma is a community where sanitary conditions are
 58 below standard, residential areas are under developed with inadequate pipe-borne water supply, residents relying on
 59 wells, Dutsin-Ma Dam, commercial water vendors and a few private boreholes for their water needs. Most
 60 households lack good water cistern toilet, relying majorly on pit latrines or dumping their faecal matter in the nearby
 61 dumpsites. The high numbers of almajiri schools, which mostly lack sanitary facilities, with almajiris practising
 62 open defecation also contribute to the poor sanitary condition of the area.

63 **2.2 Sample Collection, and Parasites Isolation and Identification**

64 A total of six hundred (600) cockroaches were caught using Sticky traps of cardboard paper and adhesive, three
 65 hundred sixty (360) cockroaches were from houses with open toilets and two hundred forty (240) from houses with
 66 broken sewage systems. They were examined for external and internal together with the mouth part pathogens.
 67 Selected houses around Dutsin-Ma Town were stratified into 5 cardinal points: Darawa, Hayingada, Kadangaru,
 68 Female hostel and Male hostel of the Federal University Dutsin-Ma. Cockroaches were collected from randomly
 69 selection houses from each cardinal points area of studies.

70 The prepared trap was pinned to flat wooden surfaces found in kitchens, toilets, bathrooms, bedrooms and living
 71 rooms. The traps were set at 7:00 pm and inspected at 7:00 am daily for four weeks, as described by Mogbo *et al.*

72 (2013). Cockroaches trapped were transferred into universal containers and then transported to the Laboratory for
 73 further examination. The cockroaches were put to sleep by using chloroform soaked cotton wool and examined
 74 under the dissecting microscope for identification using standard taxonomical keys by Department of Biological
 75 Sciences Federal University, Dutsin-Ma (2017).

76 Sedimentation technique as described by Brook and Sloss (1968) was used to extract parasites in each sample
 77 collected. Parasites collected were examined using light microscope $\times 40$ objective lens as described by Salehzadeh
 78 *et al.* (2007). Parasites were identified using taxonomical keys by Cheesbrough (2005) and Lee *et al.* (2000).

79 2.3 Statistical Analysis

80 Data collected are presented in tables and prevalence expressed in percentage.

81 3.0 RESULTS

82 A total of Six hundred cockroaches were Collected from five sampling areas (Female Hostel, Male Hostel, Hayin-
 83 gada, Kadangaru and Darawa toilets and dumpsite) were examined. The examination was done both externally and
 84 internally 300 samples each. A total of 300 cockroaches each for external and internal examination were found as
 85 278(92.67%) and 292(97.33%) prevalence respectively. Highest prevalence [78(28.06%)] and the lowest [26(9.35)]
 86 was recorded in Hayin-Gada and Darawa respectively (Table 1).

87 Table 2 shows the prevalence of identified parasites species on external body parts of cockroaches with highest
 88 prevalence *Toxascaris leonine* 68 (24.46%) and least prevalence of *Strongyloides stercoralis* 108 (36.98%) and none
 89 recorded as globular substrate

90 Table 3: shows overall (external and gut) prevalence of parasites according to sample area.

91 Table 4: shows the overall (external and gut) prevalence of identified species was: *Strongyloides stercoralis*
 92 144(25.26%), flukes 102(17.89%) *Nyctotherus ovalis* 17(2.98%), globular substrates 49(8.60%), egg of *Enterobius*
 93 *vermicularis* 78(13.68%), *Entamoeba histolitica* 70(12.2%), with the highest and lowest prevalence recorded in
 94 *Strongyloides starcoralis* and *Nyctotherus ovalis* respectively.

95 Table 1: Prevalence of Parasites Infestation According to cockroach Body Parts in Dutsin-Ma Town

Sampling Site	External Body Part		Internal Body Part	
	Number	Number	Number	Number
	Examined	Infested (%)	Examined	Infested (%)
Female Hostel	78	74 (94.9)	72	70 (97.2)
Male Hostel	74	64 (86.5)	80	78 (97.5)
Hayin-Gada	81	78 (96.3)	76	76 (100)

Kadangaru	41	36 (87.8)	36	36 (100)
Darawa	26	26 (100)	36	32 (88.9)
Total	300	278 (92.7)	300	292 (97.3)

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97 Table 2: Prevalence of Parasites Recovered from body parts (external and gut) of cockroach

Type of Parasite	External Body Part		Internal Body Part	
	Number Examined	Number Present (%)	Number Examined	Number Present (%)
<i>Strongyloides stercoralis</i>	300	36 (12)	300	108 (36)
Flukes	300	60 (20)	300	42 (14)
<i>Nyctotheru sovalis</i>	300	1 (0.3)	300	16 (5.3)
<i>Toxascaris leonine</i>	300	68 (22.7)	300	42 (14)
<i>Enterobius vermicularis</i>	300	26 (8.7)	300	52 (17.3)
<i>Entamoeba histolytica</i>	300	38 (12.7)	300	32 (10.7)
Glubular Substrates	300	49 (16.3)	300	42 (14)

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99 Table 3: Prevalence of Parasites Infested Cockroaches According to Sampled Sites

Sampled Site	Number Examined	Number Infested	Prevalence (%)
Female Hostel	150	144	96
Male Hostel	154	142	92.2
Hayin-Gada	157	154	98.1
Kadangaru	77	72	93.5
Darawa	62	58	93.5
Total	600	572	95.3

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102 Table 4: Prevalence of Parasites according to types of parasite isolated from cockroaches in Dutsin-Ma Town

Type of Parasite	Number of Samples examined	Number of Parasites Present	Prevalence (%)
<i>Strongyloides stercoralis</i>	600	144	24.0
Flukes	600	102	17.0
<i>Nyctotherus ovalis</i>	600	17	2.8
<i>Toxascaris leonine</i>	600	110	18.3
<i>Enterobius vermicularis</i>	600	78	13.0
<i>Entamoeba histolytica</i>	600	70	11.7
Globular substrates	600	49	8.2

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105 4.0 DISCUSSION

106 In this study, the intestinal parasites of medical importance were isolated from the body surface and guts contents of
 107 the cockroaches. 95.33% of cockroach specimens examined had been found to harbour at least one species of human
 108 intestinal parasites. This is similar to high parasites carriage rate (77.52%) had been reported from Nigeria (Bala and
 109 Sule, 2012). In contrast, no parasites species were collected from a residential area in Iran but relatively low
 110 percentage of parasites were isolated from cockroaches gotten from public hospital in the same study area.
 111 (Salehzadeh, *et al.*, 2007) Therefore the variation in the incidence of parasites load associated with cockroach varies
 112 with the hygiene condition of the environment and also the population of people living within the environment. This
 113 may account for the variation in parasites carriage rate among the different sampling areas.

114 Although no study on epidemiology of pathogens in cockroaches has been carried out in the study areas, the present
 115 study suggests cockroaches as important agents of pathogens transmission to man. In this study show that
 116 cockroaches may be agents of parasitic infection which were more contaminated were infested with six parasite
 117 *Strongyloides stercoralis*, fluke, *Nyctotherus ovalis*, *Enterobius vermicularis*, *Toxascaris leonina*, and *Entamoeba*
 118 *histolytica* species. Which is similar to the salehzadeh *et al* (2007). All the parasites recovered from the body are of
 119 medical importance and have been implicated in many gastrointestinal disorders. *Enterobius vermicularis*, hook
 120 worm and *Ascaris lumbricoides* have been reported to cause chronic diarrhea. The higher percentage of the
 121 cockroaches harbouring gastrointestinal parasites encountered in the residential environment is not a departure from
 122 the expected results as similar observation have also been reported elsewhere Adeleke *et al*; 2012. Hospital host

123 patients suffering from different ailments and these cockroaches would have been contaminated during their
124 nocturnal movements from one ward to other areas including toilets. Graczyk *et al*; 2005.

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126 5.0 CONCLUSION AND RECOMMENDATION

127 This study reveals that most cockroaches in Dutsin-Ma are carriers of different types of nematode and protozoan
128 parasites. This high prevalence of parasites in the cockroaches places them as potential transmitters/carriers that
129 could contaminate food and other items in human residents in Dutsin-Ma. It also shed light on the potential
130 mechanical transmission of human nematode and protozoan parasites that may be threats to public health if not
131 properly managed.

132 Therefore, adequate awareness needs to be created among inhabitants of the residents and students hostels on the
133 need to avoid contact or contamination of food and water with cockroaches. Proper covering and washing of any
134 food and cooking utensils should be promoted. Controlling of the cockroaches population through the use of
135 insecticides and screening of houses is highly recommended. Building of modern houses devoid of crevices that
136 support cockroaches life should be adopted.

137 Proper waste management practices should also be put in place.

138 REFERENCES

139 Adeleke, M. A., Akatah, H. A., Hassan, A. O., Sam-Wobo, S. O., Famodimu, T. M., Olatunde, G. O. and Mafiana,
140 C. F. (2012). Implication of cockroaches as vectors of gastrointestinal parasites in parts of Osogbo, South Western
141 Nigeria. *Munis Entomology and Zoology*, 7(2):1106-1110.

142 Allen, B.W. (1987). Excretion of viable Tubercle Bacilli by *Blatta orientalis* following ingestion of heat – fixed
143 sputum smear: A laboratory investigation. *Medicine and Hygiene*, 81: 98-99.

144 Allen, B.W. (1987). Excretion of viable tubercle bacilli by *Blattella orientalis* (the oriental cockroach) following
145 ingestion of heat-fixed sputum smears: a laboratory investigation. *Journal of Tropical Medicine and Hygiene*. 81: 98-
146 99.

147 Bala, A.Y. and Sule, H. (2012) Vectorial potential of cockroaches in transmitting parasites of medical importance in
148 Arkilla, Sokoto, Nigeria, *Nigerian journal of Basic and Applied Sciences*, vol.20, no.2, pp.111-115.

149 Barnes, J. (2000). Invasive disease due to extended spectrum beta-lactamase-producing *Klebsiella pneumoniae* in a
150 neonatal unit: the possible role of cockroaches. *Journal of Hospital Infection*, 44: 13-17.

151 Beament, J. W. L. (1955). Wax secretion in the cockroach. *Journal of Experimental Biology*. 32:514-538.

152 Benbrook, E. A., and Sloss, M. W., (1968). *Veterinary clinical parasitology*. Fecal examination in the diagnosis of
153 parasitism. Iowa state University press, Ames, Iowa, 1-107.

154 Brenner, R. J. In Mullen, G. and L. Durden.[Eds.], (2002).*Medical and Veterinary Entomology*. Academic Press,
155 San Diego.

156 Brenner, R.J., Koehler, P.G. and Patterson, R.S.(1987). *Health implications of cockroach infestation*. *Infections in*
157 *Medicine: Infectious Disease in Medical and Family Practice*, 4(8):349-35

158 Bundy, D.A.P., Hall A, Medley, G.F, Savioli L (1992). Evaluation measures to control intestinal parasitic infections.
159 *World Health Stat. Q.*, 45: 168-79.

160 Chan, O.T., Lee, E.K., Hardman, J.M. and, Navin,J.J. (2004). The cockroach as a host for *Trichinella* and *Enterobius*
161 *vermicularis*:implications for public health. *Hawaii. Medical Journal*, 63: 74-77.

162 Chan, O.T., Lee, T.K., Hardman, J.M., Navin, J.J. (2004). The cockroach as a host for *Trichinella* and *Enterobius*
163 *vermicularis*: implications for public health. *Hawaii Medical Journal*. 63:74-77.

164 Chandler AC, Read CP (1962). *Introduction to parasitological with special references to the parasites of man*. 10th
165 ed. New York: John Wiley & Sons.

166 Che Ghani BM, Oothuman P, Hashim BB, Rusli BI (1993). Patterns of hookworm infections in traditional Malay
167 villages with and without JOICFP Integrated Project in Peninsular Malaysia-1989. In: Yokogawa M, Editors.
168 *Collected papers on the control of soil transmitted helminthiases*, Tokyo: APCO, 5: 14-21.

169 Cheesebrough, M. (2004). *District Laboratory practices in Tropical Countries* (5th ed). Check Wah Tong
170 Printing Press Limited, Hong kong.

171 Cotton, M.F., Wasserman, E., Pieper, C.H., Van Tubbergh, D., Campbell, G., Fang, F.C., Barnes, J. (2000).
172 Invasive disease due to extended spectrum beta-lactamase-producing *Klebsiella pneumoniae* in a neonatal unit: the
173 possible role of cockroaches. *Journal of Hospital Infection*, 44: 13-17.

174 Czajka, E., Pancer, K., Kochman, M., Gliniewicz, A., Sawicka, B., Rabczenko, D., Stypulkowska- Misiurewicz, H.
175 (2003). Characteristics of bacteria isolated from body surface of German cockroaches caught in hospitals. *Przegl.*
176 *Epidemiol.*, 57: 655-662.

177 Graczyk, T.K, Knight, R., Tamang, L. (2005). Mechanical transmission of human protozoa and parasites by insects.
178 *Clinical Microbiology Review*. 18(1):126–132.

179 Gullan, P.J. and Cranston, P.S. (2005). *The Insects: An outline of Entomology*, Blackwell, Davis, Calif, USA.

180 Kopanic, R.J. (1994). Cockroches as vectors of *Salmonella*: laboratory and field trials. *Journal of Food Protection*,
181 57: 125-132.

182 Mogbo, T. (2013). Insects: Friend or enemies? *Global Journal of Agriculture, Biology and Health Science* 2(3):
183 134- 140.

- 184 Montresor A, Crompton, D.W.T., Bundy, D.A.P., Hall, A., Savioli, L. (1998) *Guidelines for the Evaluation of*
185 *Soil-Transmitted Helminthiasis and Schistosomiasis at Community Level*. WHO: Geneva. WHO/CTC/SIP/98.1.
- 186 **Morenikeji, A. O., Adebisi, A. and Oluwayose, O. A. (2016). Parasites in Cockroaches Recovered from**
187 **Residential Houses around Awotan Dumpsite in Ido Local Government Area of Oyo State, Nigeria. *Annual***
188 ***Research & Review in Biology* 9(3): 1-10.**
- 189 Pai, H.H., Chen, W.C., Peng, C.F. (2005). Isolation of bacteria with antibiotic resistance from household
190 cockroaches (*Periplaneta americana* and *Blattella germanica*). *Acta Trop.*, 93: 259-265.
- 191 Piper, G.L. and Antonelli, A.L. (2012) *Cockroaches: Identification, biology and control*. Agricultural Research Center,
192 Washington State University; 2012. Available: <http://www.pnw0186.html>
- 193 Salehzadeh, A., Tavacol, P., Mahjub, H. (2007). Bacterial, fungal and parasitic contamination of cockroaches in
194 public hospitals of Hamadan, *Iran Journal of Vector Borne Diseases*; 44: 105–110.
- 195