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Relative abundance of synanthropic flies with associated parasites and pathogens in Minna Metropolis, Niger State, Nigeria

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Abstract

Synanthropic flies constitute a global problem. They are responsible for the transmission of wide varieties of protozoan parasites and other pathogens such as viruses, bacteria and fungi in human and animals. This study was carried out to investigate parasite and pathogens associated with synanthropic flies in Bosso, Chanchaga and Maikunkele in Minna from 4 sampling sites, abattoir, dump sites, open fields and kitchens. The flies were collected with locally designed traps between April and August, 2014. A total of 682 synanthropic flies were sampled and 6 different species identified. Flies identified were *Musca domestica* 252 (36.95%), *Musca sorbens* 32(4.92%), *Fannia canniculari*s 137 (20.09%), *Sarcophaga sp* 164 (24.05%) while *Phormia regin*a and *Stomoxys calcitrans* are 24 (3.52%) and 75 (10.10%) respectively. In all the locations, *Musca domestica* has the highest population 252 (36.95%) and *Phormia regin*a 24 (3.52%) the least. Five parasites and four bacteria were isolated from the flies which include *Entamoeba histolytica* 30 (53.57%), *Ascaris lumbricoides* 8 (14.29%), *Strongyloides stercoralis* 6 (10.71), Hookworm ova 5 (8.93%) and *Trichiuris trichiura* 7 (12.50%). Bacteria isolated are *Streptococcus*, *Proteus*, *Pseudomonas*, *Bacillus* and *Klebsiella* species. Results showed that synanthropic flies pose a serious health risk to the inhabitants of Minna Metropolis and therefore need to be controlled.

Keywords: synanthropic flies, parasites, pathogens, viruse, fungi.

Introduction

Synanthropic flies adapted to live in close association with human habitations and are capable of transmitting human pathogens either mechanically or biologically through this close relationship [1]. The link between human pathogens and fly transmission is due to the fact that adults feed on animal manure, trash, human excrement, and other decaying materials; readily moving between these habitats and food, food preparation surfaces and humans themselves [2]. Species of flies in the families Muscidae (house flies, latrine flies, and relatives), the Calliphoridae (blow flies and bottle flies), and the Sarcophagidae (flesh flies) have evolved to live in close association with human development. There are over 50 species of synanthropic flies that have been reported to be associated with unsanitary conditions and involved in the dissemination of human enteropathogens [2]. In addition, the larvae of these flies can also cause myiasis in human and livestock [3]. The annoyance and public health risks associated with large populations of such flies is thus considerable.

Human activities produce large quantities of organic waste suitable as breeding sites for calyptrate fly species. Synanthropic flies and their association with unsanitary conditions are important for public health reasons since they may be carriers of enteric pathogens [2, 4, 5, 6, 7]. The aim of this study was to determine the synanthropic fly species composition in Minna metropolis and to identify the parasite and pathogen associated with the flies.

Materials and methods

Description of study area

Minna, the capital of Niger State, Nigeria, is located within Longitude 6°33′E and Latitude 9°37′N, covering a land area of 88 km² with an estimated human population of 1.2

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million [8]. It has a tropical climate with mean annual temperature, relative humidity and rainfall of 30.2°C, 61% and 1,334 mm, respectively. The climate presents two distinct seasons; a rainy season between April and October, with highest mean monthly rainfall in September, and a dry season (November-March) completely devoid of rains. Its vegetation is typically grass dominated savannah with scattered short trees often subjected to annual bush burning. Minna is a heterogeneous mixture of different ethnic groups (namely, Nupes, Fulani, Kadara, Koro, Gbagis, Hausas, Kambari, Ganagana, etc.), with district cultural believes. The residents of the area engage in different vocation such as civil service, trading, farming and fishing.

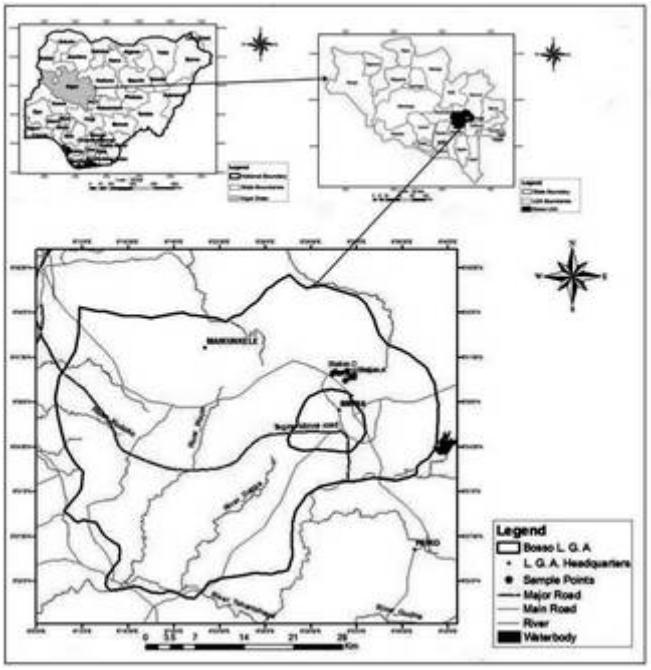

Figure 1. Map of Niger State showing the study-areas.

Fly collection, processing and identification

Fly surveys were conducted in three sites of Bosso, Maikunkele, and Chanchaga area in Minna Metropolis. Collections were carried out at three collection sites in each of the area between April-June 2014. The collection sites selected were based on places where people and flies would most likely interact with respect to enteropathogenic bacteria transmission, including abattoir, house environment (kitchen) open field and dumpsites [9]. Adult flies were collected using specifically designed trap made of transparent plastic bucket about 2 litres manually perforated with tiny holes to provide ventilation for the flies and fly bait. The bait used in this study is 250 g of 1day old beef tainted at room temperature for 24 hours [10]. As the flies were attracted to the bait inside the bucket, the bucket was swiftly covered with lid. The trapped flies were taken to the Department of Biological Sciences (Applied Parasitology and Entomology Unit), Federal University of Technology, Minna, for identification and processing using keys described by Service [11].

Preparation of flies for parasite isolation

Ten chilled flies were dropped into a sterilized clean test tube or centrifuge tube containing about 10 ml of distilled water and washed thoroughly by rocking (hand-shaking) it from side to side for about 3 minutes to dislodge all parasites and their stages attached to the bodies of the flies into the water. The suspension resulting from washing of the flies was used to isolate the parasites and their stages attached to the bodies of the flies. Zinc sulphate solution (1.18-1.20 specific gravity) was also used to identify the cysts and eggs of helminths [12].

Isolation and identification of bacteria

The pour-plate method [12] was employed for the determination of microbial load of samples using different solid media; tenfold serial dilutions of the samples were made and in 10^{-5} dilution of the samples from different location were plated out on Nutrient agar, Eosin methylene blue agar, mannitol salt agar buffered peptone water, starch agar, urea agar, *Salmonella shigella* agar, triple sugar ion agar and Kovac'sindole reagent using the spread plate method, after incubation observed colonies were counted and isolated [12]. The bacteria isolated were further examined for their ability to ferment sugar, carbohydrate production of indole from tryphtophan citrate utilization, catalyze production and oxides text; the bacteria isolated were identified by comparing their characteristics with those of known taxa as described by Oyeleke and Manga [13].

Statistical analysis

Data generated from the study were analyzed statistically using simple percentage, t test and ANOVA. A value of <0.05 was considered indicative of a statistically significant difference.

Results

Relative abundance of synanthropic flies in the study-area

A total of six species of synanthropic flies were collected and identified. Bosso recorded the highest 256 (41.36%) while Chanchaga and Makunkele accounted for 193 (31.18%) and 172 (27.79%) respectively. Of all the six synanthropic flies species identified, *Musca domestica* had 232 (37.48%), *M. sorbens*32 (5.17%), *F. cannicularis*122 (19.71%), while *Sarcophaga* sp., *S. calcitran* and *P. regina* had flies species abundance of 137 (21.13%), 73 (10.70%) and 24 (3.88%) respectively (Table 1). There was a significant ($p<0.05$) difference in fly species in relation to the study areas.

Distribution of synanthropic flies in four sampling sites in Bosso, Chanchaga and Makunkele, Minna

A total of 682 synathropic flies were sampled and six species were identified. Abattoir had 301(44.13%), followed by Open field 135 (19.79%) while dumpsite and Kitchen had 124 (18.18%) each. Species identified were *M. domestica* 252 (36.95%), *M. sorbens* 32 (4.92%), *F. cannicularis* 137

(20.09%), *Sarcophaga* sp. 164 (24.05%), *S. calcitran* 75 (10.10%) and *P. regina* 24 (3.52%) respectively. *M. domestica* had the highest and *P. regina* the least. There was a significant ($p<0.05$) difference in the distribution of flies in the four sampling sites in Bosso (Table 2).

Parasites isolated from synanthropic flies from four sampling sites in Bosso, Chanchaga and Makunkele, Minna

A total of 56 parasites were identified from synanthropic flies. Parasites identified from *M. domestica* were *E. bahistolytica* 20 (43.48%), *A. lumbricoides* 8 (17.39%), *S. stercoralis* 6 (13.04%) while Hookworm and *T. trichura* had 5(10.87%) and 7(15.22%) respectively. *F. cannicularis* had 5 (100.00%), *S. calcitran* 3 (100.00%) and *P. regina* 2 (100.00%). No parasite was isolated from *M. sorbens* and *Sarcophaga* sp. There was no significant ($p>0.05$) difference in the number of parasites isolated (Table 3).

Bacteria isolated from different fly species encountered during the study

Eight species of bacteria isolated from the synanthropic flies in the study areas; *S. aureus, Streptococcus* sp., *E. coli, Bacillus* sp., *S. typhi, Pseudomonas* sp., *Klebsiella* sp. *and Proteus* (Table 4).

Total bacteria hetetropic plate count base on study areas

Musca domestica had higher bacteria count of $11.7x10^4$ in Bosso and lower bacteria count of $1.7x10^4$ in *F. cannicularis* in Maikunkele (Table 5).

Table 1. Relative Abundance of synanthropic flies in Minna, Niger State.

No. Sampled (%)	*Musca domestica* No. sampled (%)	*Musca sorbens* No. sampled (%)	*Fannia cannicularis* No. sampled (%)	*Phormia regina* No. sampled (%)	*Sarcophaga species* No. sampled (%)	*Stomoxys calcitran* No. sampled (%)
256 (41.36)	88 (34.38)	32 (12.50)	38 (14.84)	24 (9.38)	48 (18.75)	26 (10.16)
193 (31.18)	86 (44.56)	0 (0)	41 (21.24)	0 (0)	40 (20.73)	25 (12.95)
172 (27.79)	58 (33.72)	0 (0)	43 (25)	0 (0)	49 (28.49)	22 (12.72)
621 (100)	232 (37.48)	32 (5.17)	122 (19.71)	24 (3.88)	137 (21.13)	73 (10.70)

Table 2. Distribution of Synanthropic flies in four collection sites in Bosso, Chanchaga and Maikunkele, Minna.

Collection sites	*Musca domestica* No. sampled (%)	*Musca sorbens* No. sampled (%)	*Fannia cannicularis* No. sampled (%)	*Sarcophaga spieces* No. sampled (%)	*Stomoxys calcitrans* No. sampled (%)	*Phormia regina* No. sampled (%)	Total
Abattoir	114 (45.23)	11 (34.38)	44 (32.12)	117 (71.34)	0 (0.00)	15 (62.50)	301 (44.13)
Dumpsite	47 (18.65)	8 (25.00)	27 (19.71)	19 (11.59)	23 (30.67)	0 (0)	124 (18.18)
Open field	45 (17.86)	4 (12.50)	37 (27.00)	15 (9.15)	34 (45.33)	0 (0)	135 (19.79)
Kitchen	46 (18.25)	9 (28.13)	29 (21.17)	13 (7.93)	18 (24.00)	9 (37.50)	124 (18.18)
Total	252 (36.95)	32 (4.92)	137 (20.09)	164 (24.05)	75 (10.10)	24 (3.52)	682

Table 3. Parasites isolated from synanthropic flies from four sampling sites in Bosso, Chanchaga and Makunkele, Minna, Niger State.

Synanthropic flies parasite	*E. histolytica* No. sampled (%)	*Ascaris lumbricodes* No. sampled (%)	*Strongyloides stercoralis* No. sampled (%)	*Hookworm* No. sampled (%)	*Trichiuris trichiura* No. sampled (%)
Muscadomestica	20 (43.48)	8 (17.39)	6 (13.04)	5 (10.87)	7 (15.22)
Muscasorbens	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Fanniacanniculans	5 (100.00)	0 (0)	0 (0)	0 (0)	0 (0)
Sarcophaga species	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Stomoxyscalcitrans	3 (100.00)	0 (0)	0 (0)	0 (0)	0 (0)
Phormiaregina	2 (100.00)	0(0)	0 (0)	0 (0)	0 (0)
Total	30 (53.57)	8 (14.29)	6 (10.71)	5 (8.93)	7 (12.50)

Table 4. Biochemical characteristics of isolated bacteria.

	Sugar Fermentation																TSI			Remark
Isolated	Glucose	Sucrose	Lactose	Maltose	Fructose	Manittol	Catalase	Coagulase	Motility	Citrate utilization	Urease	Indole	Starch hydrolysis	Oxidase	MR	VP	Slope	Butt	H_2S	
1	+	+	+	-	+	-	-	-	+	-	-	-	-	+	-	+	Y	R	-	*Pseudomonas specie*
2	+	+	-	+	+	+	+	+	-	-	+	-	-	-	-	+	-	-	-	*Staphylococci specie*
3	+	+	+	+	+	-	-	-	+	+	-	+	-	-	+	-	Y	R	-	*Escherichia coli*
4	+	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	*Streptococci species*
5	-	-	-	-	+	+	+	-	-	-	-	-	+	+	-	+	Y	R	-	*Bacillus subtilis*
6	+	+	-	-	+	_	-	-	-	_	+	_	+	+	-	+	Y	-	-	*Klebsiella specie*
7	+	+	+	-	+	-	+	+	-	+	+	-	+	+	-	-	-	R	-	*Proteus*
8	+	+	+	+	+	-	-	+	-	-	+	-	-	+	+	+	Y	-	-	*Salmonella typhi*

Key
+ = Positive.
– = Negative *p*; = Red – Pink (alkaline).

Table 5. Total bacteria heterotopic plate count base on study area.

Study area/ synanthropic flies	*Musca domestica*	*Musca sorbens*	*Fannia canicularis*	*Phormia regina*	*Sarcophaga* sp.	*Stomoxys calcitrans*
Bosso	11.7×10^4	8.0×10^4	10.1×10^4	7.9×10^4	5.8×10^4	4.8×10^4
Chanchaga	10.6×10^4	–	4.0×10^4	–	7.2×10^4	4.8×10^4
Maikunkele	3.4×10^4	–	2.7×10^4	–	1.7×10^4	3.2×10^4

Discussion

The abundance of synanthropic flies in this study show that Minna Metropolis can support different species of flies leading to high species diversity in the area. Olsen, [12] reported that over 50 species of synanthropic flies have been reported to be associated with unsanitary condition and are involve in the dissemination of human pathogen in the environment. The abundance of flies in the study sites is probably due to existence of favourable breeding sites and tropical climate which increases their rate of development.

Six synanthropic flies species sampled in different sites showed that *M. domestica*is the most prevalent. Despite the abundance of these flies, there is little information on their role as mechanical transmitters of parasite infection in Minna. The numerical dominance of *M. domestica* was observed in abattoir and least in kitchen.

Musa domestica was found to harbour four soil transmitted helminthes *A. lumbricoides,* Hookworm, *S. stercoralis*, *T. trichiura* and a protozoan cyst, *E. histolytica*. This result is similar to work of Graczyk [14] on mechanical transmission of human protozoan parasite by insect and also work of Umeche and mandah [15] on house flies as a carrier of intestinal helminthes. They also observed that flies could carry and spread parasite and pathogens to other places, since they are able to travel up to 20 miles to unsanitary places. The observation of *T. trichiura* and Hookworm ova corroborate with the findings of Umeche and Mandah [15] that flies are mechanical transmitters of soil-transmitted helminthes (STH). *F. canicularis*, *S. calcitran* and *P. regina,* according to Graczyk [16], reported that these flies carry pathogens on sponging mouth parts, body and legs and the sticky pads of their feet which make them to be potential vectors for disease transmission.

The parasites isolated are of great medical and public health importance; chronic infection with hookworm leads to iron deficiency, Anaemia, restlessness and the general retardation of development of afflicted children [17]. In moderate and heavy infection at *A. lumbricoides* has been recorded to cause malnutrition, under development and impairment in children [18]; it also causes intestinal blockage, insomnia, restlessness and lung damages.

Generally, the bacteria isolated from synanthropic flies in the study-area are; *E. coli*, *Staphylococcus* sp, *Bacillus subtilis*, *Salmonella typhi*, *Klebsiella*, and *Proteus* sp. The high bacteria-load can be attributed to the prevalent availability of unsanitary waste in the study-area. This work is similar to work of [19] who compared bacteria

transmitted between housefly and American cockroach, *Periplanata americanus*, as an evident that further studies using different insect and different part or secretion of these insects as dispersing bacteria diseases. This work is also related to the study of [20] that isolated eighteen [21] species of bacteria from flies in Malaysia [22].

Microbes such as *Staphylococcus* sp and *Bacillus* sp are viable and can cause various infectious diseases in human. *Staphylococcus* sp is capable of causing toxigenic food poisoning and some other infectious diseases which would result in diarrhoea [23].*Salmonella* is often pathogenic for humans or animal when acquired by oral route.

Conclusion

Synanthropic flies carry both parasites and pathogens which pose significant health risk to both man and animals. Thus, there is need to institute a functional control measures such as community health awareness and enforcement of strict environmental sanitation programme to reduce mechanical transmission.

References

1. Gabre, R. M. and AbouZied, E. M. 2003. Sarcosaprophagous flies in Suez province, Egypt II-synanthropic and abundance degrees," *Bulletin of Entomological Society of Egypt*, *80*, 125-132.
2. Graczyk, T. K., Knight, R., Gilman, R. H. and Cranfield, M. R. 2001. The role of non-biting flies in the epidemiology of human infection diseases. *Microbes Infections*, *3*, 231-35.
3. Hall, M. J. R. and Smith, K. G. V. 1997. Diptera causing myiasis in man. In: Medical Insects and Arachnids, R. P. Lane and R. W. Crosskey, Eds., Chapman and Hall, London, UK.
4. Greenberg, B. 1971. *Flies and disease* Ecology, classification and biotic associations. 1: 896pp. New Jersey: Princeton University Press.
5. Olsen, A. R. 1998. Regulatory action criteria for filth and other extraneous materials. III. Review of flies and food borne enteric disease. *Reg. Toxicology. Pharmacology*, *28*, 199-211.
6. Bernard, D. R. 2003. Control of fly-borne diseases. *Pesticide Outlook*, *14*, 222-8.
7. Banjo, A. D., Lawal, O. A. and Adeduji, O. O. 2005. Bacteria and fungi isolated from house fly, *Musca domestica* L., larvae. *African Journal of Biotechnology*, *4*, 780-4.
8. National Population Commission. 2006. *Republic of Nigeria Official Gazzete 24 (94)*, 175-198.
9. Nmorsi, O. P. G., Ukwandu, N. C. D. and Agbozele, G. E. 2006. Detection of some gastrointestinal parasites from four synanthropic flies in Ekpoma, Nigeria. *Journal of Vector Borne Diseases*, *43(3)*: 136-139.
10. Bunchu, N., Sukontason, K. L., Olson, J. K., Kurahashi, H. and Sukontason, K. 2008. Behavioural responses of Chrysomy amegacephala to natural products, *Parasitology Research*, *102(3)*, 419-429.
11. Service, M. W. 1980. *A Guide to Medical Entomology*. Macmillan Press Ltd, London, pp. 102-109.
12. Banjo, A. D., Lawal, O. A. and Adeduji, O. O. 2005. Bacteria and fungi isolated from house fly, *Musca domestica* L., larvae. *African Journal of Biotechnology*, *4*, 780-4.
13. Webster, A. B., Hinkle, N. and Thompson, S. A. 2007. Commercial egg tip: Can in-house composting reduce flies in high-rise layer houses. In: *University of Georgia CES Poultry*, *101*: 243-246.
14. Graczyk, T. K., Knight, R., Gilman, R. H. and Cranfield, M. R. 2001. The role of non-biting flies in the epidemiology of human infectious diseases. *Microbes. Infection*, *3*, 231-235.
15. Umeche, N. and Mandah, E. 1989. *Muscadomestica* as a carrier of intestinal helminthes in Calabar, Nigeria. *East African Medical Journal*, *66*, 349-352.
16. Graczyk, T. K., Grimes, B. H., Knight, R., DaSilva, A. J., Pieniazek, N. J. and Veal, D. A. 2003. Detection of *Cryptosporidium parvum* and *Giardia lamblia* carried by synathropic flies by combined fluorescent in situ hybridization and a monoclonal antibody. *American Journal of Tropical Medicine and Hygiene*, *68*, 228-232.
17. Graczyk, T. K., Cranfield, M. R., Fayer, R. and Bixler, H. 1999. House flies, *Muscadomestica*, as transport hosts of *Cryptosporidium parvum*. *American Journal of Tropical Medicine and Hygiene*, *61*, 500-504.
18. Graczyk, T. K.,Fayer, R. and Cranfield, M. R. 1997. Zoonotic transmission of *Cryptosporidium parvum*: implications for waterborne cryptosporidiosis. *Parasitology*, *13*, 348-351.
19. Graczyk, T. K., Fayer, R., Knight, R., Mhangami-Ruwende, B., Trout, J. M., DaSilva, A. J. and Pieniazek, N.J. 2000. Mechanical transport and transmission of *Cryptosporidium parvum* oocysts by wild filth flies. *American Journal of Tropical Medicine Hygiene*, *63*, 178-183.
20. Kurahashi, H. and Chowanadisai, L. 2001. Blow flies, *(Insecta: Diptera: Calliphoridae*, from Indochina. *Species Diversity. 6(3)*: 185-242.
21. Kobayashi, M., Sasaki, T., Saito, N., Tamura, K., Suzuki, K., Watanabe, H. and Agui, N. 1999. House flies: Not simple mechanical vectors of enterohemorragic *Escherichia coli* O157:H7. *American Journal of Tropical Medicine and Hygiene*, *61*: 625-629.
22. Omalu, I. C. J., Ayanwale, A. V., Ajalaruru, A. B., Mohammed, A. Z. Bala, D. J. and Chukwuemeka, V. 2011. Isolation of Fungi and Bacteria from Housefly, *Muscadomestica* L., Larvae. *Internet Journal of Microbiology*, *9(1)*: 1-6.
23. Pai, H. H., Ko, Y. C. and Chen, E. R. 2003. Cockroaches, *Periplaneta americana* and *Blattella germanica*, as potential mechanical disseminators of Entamoeba histolytica. *Acta Tropica*, *87*, 355-359.