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Myiasis in Dogs in the Greater Accra Region of Ghana

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Abstract

Myiasis is the infestation of tissues of live vertebrate animals and humans with dipterous larvae. In sub-Saharan Africa, *Cordylobia anthropohaga* and *Cordylobia rodhaini* are known to be responsible for cutaneous myiasis in animals and humans. Human cases of myiasis, purportedly acquired in Ghana but diagnosed in other countries, have been reported; however, published data on its occurrence in animals in Ghana is unavailable. This study assessed the prevalence of canine myiasis among owned dogs in the Greater Accra region (GAR) of Ghana. A cross-sectional study was conducted in the Greater Accra region of Ghana, selected for being the region with the highest estimated population density of owned dogs. Physical examination and demographic characteristics of the study dogs were assessed. Management of the dogs was assessed through a questionnaire administered to the dog owners. A total of 392 owned dogs were sampled. Twenty-nine (7.4%) had cutaneous myiasis caused by *C. rodhaini*. In addition, one (0.2%) of the dogs had intestinal myiasis, with *Dermatobia hominis* as the offending larvae. Among the breeds of dogs with myiasis, the mongrel was most affected, with 24 (82.8%) out of the 29 cases. The mongrels, majority of which (24; 82.8%) were males, were left to roam freely in the community. Results from this study demonstrate that *C. rodhaini* and *D. hominis* are important causes of myiasis in owned dogs in the GAR of Ghana. Dogs could play a role in the spread of myiasis to humans, with its attendant public health implications.

Key Words: *Cordylobia rodhaini—Dermatobia hominis*—Dogs—Ghana—Myiasis.

Introduction

MYIASIS IS THE INVASION of live or dead animal or human tissue by dipterous larvae (Mathieu and Wilson 2000). Dipterous flies reported to cause furuncular myiasis in animals and man include *Dermatobia hominis*, *Cordylobia anthropophaga*, and *Cuterebra species* (Urquhart et al. 1996, Francescon and Lupi 2012).

In Central and South America, *D. hominis* is documented as the cause of cutaneous myiasis (Francescon and Lupi 2012). In sub-Saharan Africa, *C. anthropophaga* and *C. rodhaini* are responsible for cutaneous myiasis in animals and man (Logar et al. 2006, Mcgraw and Turianski 2008). Although *D. hominis* is endemic in Central and South America, cases have been reported in other parts of the world (Ward 1976, Mandell et al. 2000). Rodents and antelopes are the main hosts of *C. rodhaini* (Pampiglione et al. 1991). Humans become infected when they come into contact with contaminated soil or clothing (Veraldi et al. 2014).

In the animal industry, flies causing myiasis are noted for economic losses including reduced milk production, weight loss, reduced hide quality, and infertility (Zumpt 1965). High temperature, relative humidity, rainfall in a region, and susceptibility of the host are factors that determine the occurrence of myiasis (Urquhart et al. 1996).

Ghana has a tropical savanna climate with high temperatures (average of 21°C to 32°C) and humidity (annual mean of 50–80%), according to the Ghana Meteorological Service (www.meteo.gov.gh). These are ideal climatic conditions for breeding and spread of flies that cause myiasis. Although myiasis has been widely reported in some African countries such as Nigeria (Ogo et al. 2009) and Sudan (Adam et al. 2006), published data on the occurrence of myiasis in animals and humans in Ghana is scant. Human cases of *C. rodhaini* and *C. anthropophaga* among travelers have been reported, purportedly acquired in Ghana but diagnosed in Israel (Tamir et al. 2003) and Slovenia (Logar et al. 2006) respectively. Early on, Biggar et al. (1980) reported on

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C. anthropophaga in an American child who temporarily resided in Ghana.

Dogs serve as host for larvae of some dipterous flies. Information on the occurrence in dogs would serve as a useful tool in developing guidelines for the export of dogs, especially to nonendemic countries. Many pet dogs are exported from Ghana to other parts of the world on a regular basis. This study was carried out with the objective of assessing the prevalence of canine myiasis among owned dogs in the Greater Accra region (GAR) of Ghana.

Materials and Methods

Sampling area

A cross sectional study was conducted in the GAR of Ghana, one of the 10 administrative regions of Ghana. Selection of GAR was based on it being the second most densely populated regions in Ghana, with a population of four million people (Ghana Statistical Service, www.statsghana.gov.gh). The region has an estimated population of 82,684 owned dogs and a dog population density of 35 per km^2 (Veterinary Services Directorate 2009). Greater Accra Region has two metropolises, nine municipalities, and five districts, according to the local government system in Ghana.

Sample size and sampling

A maximum prevalence of 50% was used to calculate the sample size in the absence of published data on the prevalence of myiasis in dogs in Ghana, giving a sample size of 384, according to Smith (2006). The region was clustered into three zones based on the administrative classifications and sampled as such. Inclusion criteria involved dogs brought to the various veterinary clinics within the clusters for either routine checkups or medical care. Additionally, a house-to-house survey and community vaccination clinics were mounted, aimed at free range and hunting dogs, whose owners were available and could bring them for examination.

Demographic characteristics of the study dogs including age, sex, and breed were assessed. Once the dogs were restrained, they were physically examined for the presence of any boil-like lesions with an exudation on the body. Once a boil-like lesion with an exudation was found, the dog was sedated and the content expulsed. The larvae were placed immediately in a 70% ethanol for preservation. Fecal samples were also obtained directly from the rectum of each dogs for assessment of intestinal parasites. Larvae were identified morphologically at the Department of Veterinary Pathology, Microbiology, and Parasitology, University of Nairobi, Kenya.

A questionnaire was administered to the dog owners who consented to be interviewed. The information recorded

Table 1. Myiasis Infestation in Dogs by Age Group in the Greater Accra Region, Ghana

Age group (months)	*Total number sampled*	*Number infested*	*Age-specific prevalence*
1–6	75 (19.1%)	27 (6.8%)	93.1%
7–12	85 (21.7%)	1 (0.2%)	3.4%
13–24	85 (21.7%)	1 (0.2%)	3.4%
>25	147 (37.5%)	0	0
Total	392 (100%)	29 (7.4%)	100%

FIG. 1. A 3-month-old puppy with furuncular myiasis characterized by boil-like lesions and pit wounds with larvae protruding from them.

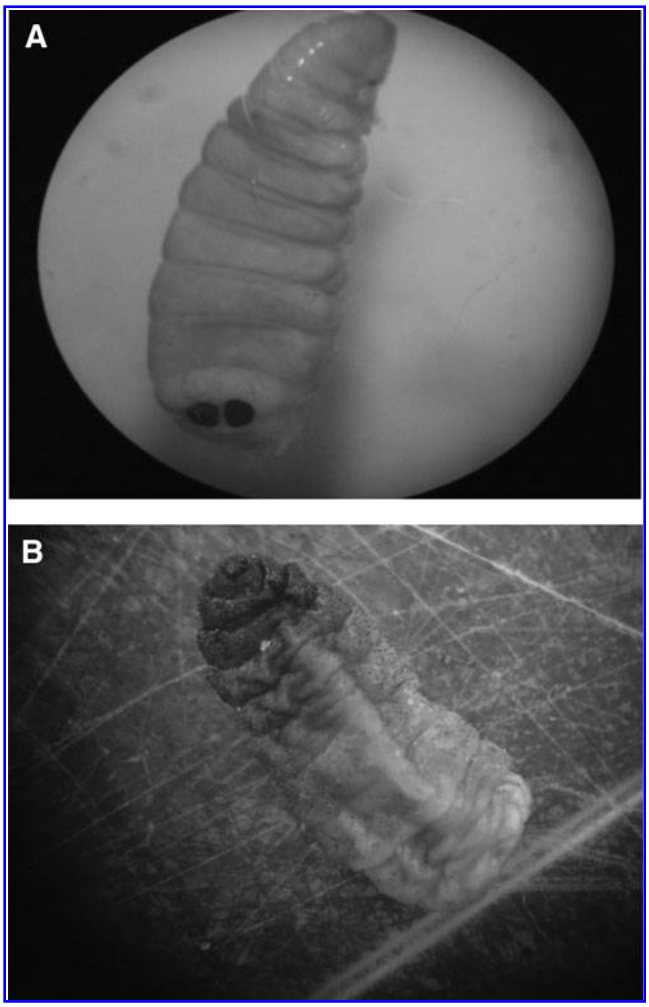

FIG. 2. **(A)** Photograph of *Dermatobia hominis* larvae freshly removed from the rectum of a dog. **(B)** *Cordolybia rodhaini* larvae preserved in 70% ethanol, showing scattered spines.

Table 2. Ectoparasite Control and the Occurrence of Myiasis in Dogs in the Greater Accra Region, Ghana

Education level of dog owners	*Total number (%) of owners* n = *204*	*Frequency of ectoparasite control*			*Number (%) of myiasis infested dogs*
		Monthly	*Bi-monthly*	*Quarterly*	
Primary	51 (25.0%)	5 (2.5%)	15 (7.4%)	31 (15.1%)	8 (15.7%)
Junior high	21 (10.3%)	0	3 (1.5%)	18 (8.8%)	9 (42.9%)
Secondary	48 (23.5%)	8 (3.9%)	24 (11.8%)	16 (7.8%)	5 (10.4%)
Tertiary	78 (38.2%)	53 (25.9%)	18 (8.8%)	7 (3.4%)	3 (3.8%)
None	6 (2.9%)	0	0	6 (2.9%)	4 (66.6%)

included demography, level of education, and management of dogs, including housing and ectoparasite control.

Data was entered and analyzed using Epi Info (version 7.1.2).

Results

Demographic characteristics of sampled dogs

A total of 392 owned dogs were sampled from 11 out of the 16 metropolises, municipalities, and districts in the GAR. Most dogs (273; 69.6%) were males and 66.1% (259) were mongrels. The age of the dogs ranged from 1 month to 14 years, with a median of 12 months. Fifty-nine percent (232) of the dogs were above 12 months of age. The dogs were mostly owned by men (270; 68.9%), family (89; 22.7%), women (20; 5.1%), children (9; 2.3%), and private companies (4; 1.0%). They were kept for security (274; 69.9%) and hunting (110; 28.1%) purposes.

Prevalence of myiasis

Twenty-nine (7.4%) of the total sampled dogs had cutaneous myiasis, one of which (0.2%) also had intestinal myiasis. Among the infested, dogs below the age of 6 months were the most affected (27/29; 93.1%), while dogs older than 25 months were not affected (Table 1).

Among the breeds of dogs with myiasis, the mongrel was the most affected with 24 (82.8%) out of 29 cases. The others were 2 (6.9%) crossbreeds, 2 Boerbuls (6.9%), and a Rottweiler (3.4%). The infected dogs were mostly males (24; 82.8%). Larvae were found (13; 44.8%) on the ventral and lateral sides of the abdomen (Fig. 1), ventral aspect of thorax (7; 24.1%), the neck region (4; 13.8%), ventral aspect of tail (3; 10.3%), and interdigital spaces (2; 6.9%). Nine (31.0%) of the infected dogs showed no clinical signs, while 8 (27.5%) had tick infestation. The clinical signs included anemia (7; 24.9%), unthriftiness (5; 17.2%), lethargy (2; 6.9%), alopecia (2; 6.9%), emaciation (1; 3.4%), and anorexia (1; 3.4%). The larvae recovered from the intestinal myiasis was identified as *D. hominis* (Fig. 2a), while those from the 28 dogs with cutaneous myiasis were identified as *C. rodhaini* (Fig. 2b).

Management of dogs

A total of 204 dog owners were interviewed. Their highest level of education ranged from primary (51; 25.0%), junior high (21; 10.3%), senior high (48; 23.5%), and tertiary education (78; 38.2%), and 6 (2.9%) had no formal education. There was a statistical difference ($p = 0.024$) in the level of education of dog owners and the occurrence of myiasis in the dogs (Table 2). Only 3 (3.8%) of the myiasis infested dogs belonged to owners educated up to the tertiary level as compared with the owners who did not have any formal education (4; 66.6%), or those with junior high (9; 42.9%), secondary (5; 10.4%), and primary (8; 15.6%) education.

The relationship between housing of dogs and myiasis infestation is presented in Table 3. Fifty-nine percent (230) of the total sampled dogs were not housed. Twenty-four (82.8%) of the 29 dogs infested with myiasis were not housed. Very few dogs housed in wooden structures (2; 6.9%) and dogs kept free within a walled house (3; 10.3%) were infested. None of the dogs housed in concrete structures were infested.

Discussion

The prevalence of 7.4% of myiasis in dogs in the GAR is significant, considering the fact that these were all owned dogs and supposedly well cared for. This is the first report of myiasis in Ghana. According to Anderson and Huitson (2004), neglect of pet animals is one of the important risk factors for developing myiasis. This was evidenced in this study in that dogs that were housed were least exposed to and infested by myiasis. The unhoused dogs were more likely to easily move about in the community in search for food and could be exposed to the dipterous flies, leading to the development of myiasis.

Lack of housing was a risk factor for the exposure and occurrence of myiasis in the dogs in this study area. Additionally, dogs whose owners controlled ectoparasites on the dogs on a regular basis were the least infested as compared with those receiving bi-monthly and quarterly ectoparasite control. Housing and control of ectoparasites on the dogs were some measures of how well kept the dogs could be. The prevalence, however, could be an underestimation of myiasis in dogs in the study area. This is because only 19% of the sampled dogs were below 6 months of age, and younger animals are documented to be more susceptible to myiasis (Kozminska-Kubarska 1981).

Although *D. hominis* is considered to be mainly native to Latin America (Roosje et al. 1992, Logar et al. 2006), it is

Table 3. Housing Status and Myiasis Infestation of Dogs in the Greater Accra Region, Ghana

Housing status	*Total number sampled (%)* n = *392*	*Number infested (%)* n = *29*	p
Free range (unhoused)	230 (58.7%)	24 (82.8%)	0.023
Housed in wooden structure	109 (27.8%)	2 (6.9%)	0.210
Free within walled house	15 (3.8%)	3 (10.3%)	0.431
Housed in concrete structure	38 (9.7%)	0	–

possible to find it in tropical Africa. *Dermatobia hominis* in Ghana is of economic and public health importance due to its capability to develop in a wide variety of definitive hosts including domestic and wild animals and man (Hendrix et al. 1998). This implies that under favorable conditions, more hosts could be infected, even in unaffected areas. High relative humidity and warm temperatures are reported to favor the incidence of *D. hominis* (Derraik et al. 2010). These conditions are rife in Ghana and may have favored the establishment and spread of the Dipterous flies. *Dermatobia hominis* is believed to be transmitted by mosquitoes through phoresis (Francescon and Lupi 2012), which increases the likelihood of its transmission from dogs to humans. Additionally, the larvae produce painful furuncular lesions with central pores, which can be all over the body of the dogs and other hosts (Harwood and James 1979). Such swellings can cause tremendous discomfort to the infected hosts. Since dogs are considered important hosts for *D. hominis*, they could serve as carriers for the spread of the disease. *Cordylobia rodhaini* is also zoonotic and its occurrence in dogs in the study area may facilitate spread of myiasis from animal to animal and humans.

In the absence of published data on human myiasis in Ghana, one could only wonder if human myiasis was not being missed or misdiagnosed. This therefore calls for measures to identify and control the flies in order to protect human beings.

Conclusion

In this study, *C. rodhaini* and *D. hominis* were found to cause myiasis in owned dogs in the GAR of Ghana. This is the first report describing myiasis in animals in Ghana. Further studies on myiasis in other animals are needed to determine which species of myiasis causing flies are involved. It would also be prudent to determine the type of larvae causing myiasis in humans in Ghana, particularly because the myiasis cases purportedly acquired in Ghana also involved *C. anthropophaga*, which was not found in this study.

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Author Disclosure Statement

No competing financial interests exist.

References

Adam AA, Abu OAR, Abdel SMN, Abdel MNI, 2006. Cutaneous myiasis due to *Dermatobia hominis:* A case report. Sudan J Med Sci 2006; 1:147–148.

Anderson GS, Huitson NR. Myiasis in pet animals in British Columbia: The potential of forensic entomology for determining duration of possible neglect. Canadian Vet Journal 2004; 45:993–998.

Biggar RJ, Morrow H, Richard H, 1980. Extensive myiasis from tumbu fly larvae in Ghana, West Africa. Clin Padiatr 1980; 19: 231.

Derraik JGB, Heath ACG, Rademake M. Human myiasis in New Zealand: Imported and indigenously acquired cases, the species of concern and clinical aspects. J New Zealand Medical Association 2010; 123:21–38.

Francesconi F, Lupi O. Myiasis. Clin Microbiol Rev 2012; 2591:71.

Harwood RF, James MT. *Entomology in Human and Animal Health*, 7th ed. New York: Macmillan Publishing Co. Inc., 1979:548.

Hendrix CM, Wohl JS, Bloom BC, Ostrowski SR, et al. International travel with pets. Part II. The threat of foreign pathogens. Compendium 1998; 20:1242–1423.

Kozminska-Kubarska A. Cordylobia anthropophaga infestation. Int J Dermatol 1981; 20:495–496.

Logar J, Soba B, Parac Z. Cutaneous myiasis cause by *Cordylobia anthropophaga*. Wien Klin Wochenschr 2006; 118:180–182.

Mandell GL, Bennett JE, Dolin R. Infectious diseases and their etiologic agents. In: *Principles and Practice of Infectious Diseases*, 5th ed. Philadelphia, PA: Churchill Livingstone, 2000:2976–2979.

Mathieu ME, Wilson BB. Myiasis. In: Mandell G, Bennett E, Dolin R, eds. *Principles and Practice of Infectious Diseases*, 5th ed. New York: Churchill Livingstone, 2000:2976–2990.

McGraw TA, Turiansky GW. Cutaneous myiasis. J Am Acad Dermatol 2008; 58:907–926.

Ogo NI, Onovoh E, Ayodele DR, Ajayi OO, et al. Cutaneous canine myiasis in the Jos metropolis of Plateau State, Nigeria, associated with *Cordylobia anthropophaga*. Vet Arh 2009; 79:293–299.

Pampiglione S, Schiavon S, Candiani G, Fioravanti ML. Osservazioni cliniche e parassitologiche su di un caso di miasi foruncolosa disseminata da *Cordylobia rodhaini* nell'uomo in Etiopia. Parassitologia 1991; 33:159–167.

Roosje PJ, Hendrikx WML, Wisselink M, Willemse T. A case report of *Dermatobia hominis* infection in a dog in the Netherlands. Vet Dermatol 1992; 3:183–185.

Smith RD. *Veterinary Clinical Epidemiology*, 3rd ed. Boca Raton, FL: CRC Press, 2006.

Tamir J, Haik J, Schwartz E. Myiasis with Lund's fly (*Cordylobia rodhaini*) in travelers. J Trav Med 2003; 10:293–295.

Urquhart GM, Armour J, Duncan JL, Dunn AM, Jennings F. *Veterinary Parasitology*, 2nd ed. Oxford: Blackwell Science Ltd, 1996:165–167.

Veraldi S, Serini SM, Suss L. Three cases of cutaneous myiasis caused by *Cordolybia rodhaini*. J Infect Develop Count 2014; 8:249–251.

Veterinary Services Directorate. Annual Report. Accra, Ghana: Ministry of Food and Agriculture, 2009.

Ward RA. Other arthropods and venomous animals 1976. In: Binford CH, Connor DH, eds. *Pathology of Tropical and Extraordinary Diseases*. Washington, DC: Armed Forces Institute of Pathology, 1976:626–630.

Zumpt F. Myiasis in man and animals in Africa. S Afr J Clin Sci 1965; 2:38–69.

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