

A SURVEY OF SYANTHROPIC FLIES IN KLONG LUANG DISTRICT, PATHUM THANI PROVINCE, THAILAND

Prasert Saichua^{1,*}, Rattana Tiangtip¹, and Chatanun Eamudomkarn²

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Abstract

Synanthropic flies are one of the most important vectors of protozoan and helminthic parasites. This survey was performed to determine the parasite and protozoa carriage by synanthropic flies in urban area of Klong Laung district, Pathum Thani province, Thailand. Using a sweeping net, adult flies were collected from cafeterias, fresh-food markets, garbage piles, hospitals, and chicken slaughterhouses. A total of 1,449 flies were captured, primarily consisting of six species; two species predominated, *Chrysomya megacephala* (58.59%) and *Musca domestica* (34.44%). *C. megacephala* was found mostly in garbage piles in cafeterias and markets while *M. domestica* was numerically dominant in the food selling areas of markets and in chicken slaughterhouses. Other flies found included *M. sorbens*, *Sarcophaga* spp., *Lucilia* spp. and *C. rufifacies*. No parasites were found after by examination by formalin-ethyl acetate concentration technique and modified Ziehl-Nielsen staining. Improved sanitation and proper garbage management could reduce fly populations and improve public health.

Keywords: Synanthropic flies, Pathum Thani, Thailand

Introduction

Synanthropic flies belonging to the Muscidae, Calliphoridae and Sarcophagidae families are dipteran insects, which usually live close to humans. These flies are associated with unsanitary conditions and are involved in the transmission of pathogens in the environment (Olsen, 1998). The adult flies feed on excrement and other decaying materials and

¹ Department of Preclinical Science, Faculty of Medicine, Thammasat University, Pathum Thani, 12120, Thailand; E-mail: psaichua@hotmail.com

² Department of Parasitology, Faculty of Medicine, Khon Kaen University, Thailand

* Corresponding author

carry these substrates and pathogenic bacteria and parasites onto food and food preparation surfaces (Getachew *et al.*, 2007; Chaiwong *et al.*, 2012).

Synanthropic flies are abundant in urban and rural areas of Thailand (Chaiwong *et al.*, 2012; Bunchu *et al.*, 2014; Phasuk *et al.*, 2013). In surveys, 4,615 flies captured from 51 tourist areas in 22 provinces of Thailand were found to harbor parasites such as *Ascaris lumbricoides*, *Trichuris trichiura*, hookworm, *Enterobius vermicularis*, *Taenia* spp., *Opisthorchis viverrini*/minute intestinal fluke, *Spirometra* spp., *Echinostoma* spp., *Eurytrema* spp. and *Angiostrongylus* spp. (Maipanich *et al.*, 2010). Bunchu *et al.* reported that *Toxocara* eggs were isolated from *C. megacephala* captured at fresh-food markets, garbage piles, restaurants, school cafeterias, and paddy fields in Ubon Ratchathani province, northeast Thailand (Bunchu *et al.*, 2014). These reports suggest that synanthropic flies have potential for mechanical transmission of intestinal parasites. There has never been a survey of synanthropic flies in Klong Luang district, north of the Bangkok conurbation. Therefore, we conducted a survey and report our results herein.

Materials and Methods

Area of Study and Parasite Examination

The study was conducted in Klong Luang district, Pathum Thani province, Thailand (14°3'54"N 100°38'46"E). Klong Luang district is a high density urban area, consisting of industrial complexes, universities, markets and shops. This investigation was carried out between October 2016 and June 2017 and was approved by the Animal Care and Use Committee of Thammasat University (No. 004/2559) and the Biosafety Committee of Thammasat University (No.029/2559).

The collection sites consisted of different ecological habitats, including the Thammasat University (TU) campus (cafeteria and garbage pile), 4 markets (food selling area and garbage pile), 1 hospital and 2 slaughterhouses (Figure 1). The synanthropic flies were caught

using a sweep net out up over the surfaces where flies landed from 09.00-11.00 a.m. when most flies are active (Getachew *et al.*, 2007; Motazedian *et al.*, 2014). Flies were transported to the laboratory in plastic containers. They were anaesthetised at 4°C for 20 min, counted and identified under the stereomicroscope using the taxonomic keys of Tumrasvin and Shinonaga (1977) and Tumrasvin *et al.* (1979).

Parasite detection in the flies followed a previously published method (Adenusi and Adewoga, 2013). Flies of the same species, sex and the same captured site were grouped in batches of 10 flies and placed in a sterile test-tube to which formal saline solution was added and shaken for 2–3 min to wash-off parasitic cysts, eggs or larvae from the external body surfaces. The suspension from the external body wash was then processed using formalin-ethyl acetate concentration technique. The washed flies were then removed with sterile forceps were placed in sterilized Petri dishes and dissected under a stereoscopic microscope using sterilized needles. The gut was macerated and the homogenate was filtered, centrifuged and processed as described by Adenusi and Adewoga (2013) and Getachew *et al.* (2007). A modified Ziehl-Nielsen stain was used to detect *Cryptosporidium* oocysts. The sediment and gut smear were examined microscopically for parasites.

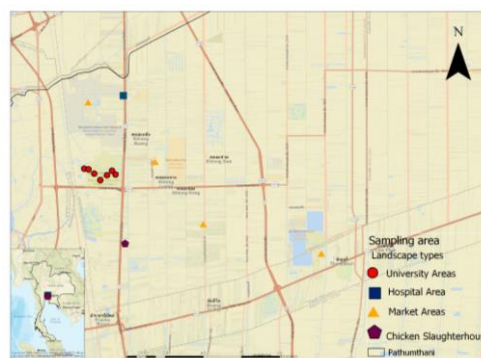


Figure 1. The collection sites for adult fly collection in Klong Luang district, Pathum Thani province, Thailand

Table 1. The synanthropic flies caught at different sites in Klong Luang district, Pathum Thani province, Thailand

Species	University campus			Hospital			Markets			Chicken slaughterhouses			Total	%
	M	F	Total	M	F	Total	M	F	Total	M	F	Total		
Family Calliphoridae														
<i>Chysomia megacephala</i>	218	381	599	1	4	5	34	168	202	14	29	43	849	58.59
<i>Chysomia rufifacies</i>	0	3	3	0	0	0	0	0	0	0	0	0	3	0.21
<i>Lucilia</i> spp.	0	6	6	0	0	0	0	0	0	0	0	0	6	0.41
Family Muscidae														
<i>Musca domestica</i>	9	5	14	6	4	10	163	202	365	31	79	110	499	34.44
<i>Musca sorbens</i>	1	4	5	4	8	12	24	37	63	0	6	6	86	5.94
Family Sarcophagidae														
<i>Sarcophaga</i> spp.	0	4	4	0	2	2	0	0	0	0	0	0	6	0.41
Total	228	403	631	11	18	29	221	407	630	45	114	159	1449	100.00
(%)			(43.55)			(2.00)			(43.48)			(10.97)		

Data Analysis

The diversity of the fly species based on the diversity index (H') were calculated using the Shannon-Wiener's Index and Simpson's Index of diversity (1-D), according to the method of Kenawy *et al.* (2014). The species evenness (J') was represented by Pielou's evenness index (Bunchu *et al.*, 2014).

Results

A total of 1,449 flies was caught from the collection sites; they were identified and classified in to three different families: Calliphoridae, Muscidae, and Sarcophagidae (Table 1). The majority of flies consisted of *C. megacephala*, accounting for 58.59%, followed by *M. domestica* (34.44%). The other fly species were *M. sorbens* (5.94%), *Sarcophaga* spp. (0.41%), *Lucilia* spp. (0.41%) and *C. rufifacies* (0.21%). The male to female ratios were 1:1.77, 1:1.6, 1:1.84 and 1:2.53 in the University campus, hospital, markets and slaughterhouses, respectively. The distributions of two dominant species showed that significantly more *C. megacephala* were collected at the garbage piles in the TU campus area than at any other site whilst *M. domestica* was associated more with markets and slaughterhouses. The least number of flies was found in the hospital area. Fly diversity (Table 2) was lowest and highest in the TU campus and hospital, respectively. No intestinal parasites were found.

Table 2. Biodiversity indices of blow fly species found at sites in Klong Luang district, Pathum Thani province, Thailand

Collecting site	Shannon index	Simpson index	Evenness index
University campus	0.27	0.01	0.15
Markets	0.91	0.55	0.83
Hospital	1.22	0.70	0.88
Chicken slaughterhouses	0.73	0.45	0.67

Discussion

This was the first study to determine synanthropic fly population in Pathum Thani province. The six species found comprised *C. megacephala*, *M. domestica*, *M. sorbens*, *C. rufifacies*, *Sarcophaga* spp. and *Lucilia* spp. The two dominant species were *C. megacephala* and *M. domestica*, consistent with previous research in Thailand, especially in urban areas (Ngoen-klan *et al.*, 2011; Chaiwong *et al.*, 2012; Phasuk *et al.*, 2013; Bunchu *et al.*, 2014). The blow fly, *C. megacephala* was the most abundant species in garbage piles on the campus and markets area. Previous work has also identified garbage piles as an important source of the blow fly in north and northeast Thailand (Ngoen-klan *et al.*, 2011; Chaiwong *et al.*, 2012;) because garbage piles have are rich sources of protein that are suitable for egg-laying and egg maturation (Phasuk *et al.*, 2013; Khoso *et al.*, 2015).

The house fly, *M. domestica*, was found in abundance in chicken slaughterhouses, and garbage piles in the market and food selling areas. This finding is in agreement with several studies associating closely *M. domestica* with human activities in markets, slaughterhouses. For example, the report from northeast Thailand found *M. domestica* was numerically dominant in markets and garbage piles (Chaiwong *et al.*, 2012). The high numbers of *M. domestica* caught from slaughterhouse in this study is similar to previous reports from Malaysia (Nurita *et al.*, 2008) and Nigeria (Adenusi and Adewoga, 2013). Such activities attract these flies because of the exposure of food and detritus. In this study, a few number of *M. domestica* were collected from the cafeterias which contrast to Nurita *et al.* (2008) and Chaiwong *et al.* (2012) who reported that *M. domestica* was abundant collected at cafeterias or restaurant. This may be due to the collection method in this survey using a sweep net but contrast to Nurita *et al.* (2008) and Chaiwong *et al.* (2012) which use the difference collection methods such as sticky paper traps, chicken liver or pork intestine for adult fly collection. The baiting system may attract to synanthropic flies because baits have protein resources for egg maturation. The asymmetry of the sex ratio in favour of females is because they search for suitable sites rich in protein to deposit their eggs. Others have also reported the same findings (Chaiwong *et al.*, 2012; Phasuk *et al.*, 2013; Bunchu *et al.*, 2014;).

Our urban-based study found low biodiversity; we identified six synanthropic fly species. This finding is consistent with another urban area in north (Bunchu *et al.*, 2014) Thailand that was conducted in Phitsanulok Province, where the number of species found was four. By contrast, greater biodiversity was found in forest and agricultural areas where 10 to 30 fly species were identified. Urban areas have fewer natural habitats for flies, exerting a selection pressure; thus, increasing urbanization results in lower biological diversity (Mulieri *et al.*, 2011).

We did not identify one fly with a parasitic infection despite using a concentration method. This was somewhat unexpected as our

findings contrast with a previous report 51 tourist areas in 22 provinces of Thailand (Maipanich *et al.*, 2010) which found helminthes eggs and larvae from trapped flies in tourist areas. In addition, the synanthropic fly species of genera such as *Musca*, *Chrysomya*, *Sarcophaga*, *Calliphora*, *Fannia* and *Lucilia* from urban slums in the Philippines (Monzon *et al.*, 1991) and semi-urban areas in Nigeria (Adenusi and Adewoga, 2013) have been isolated parasite eggs, larvae and protozoan cysts such as *A. lumbricoides*, *T. trichiura* *Taenia* spp., *Toxocara* spp., hookworm, *E. histolytica/dispar*, *E. coli* and *Giardia lamblia* from the gut and body surfaces.

Two key environmental factors in attracting flies are poor sanitation and inadequate disposal of garbage. Human faeces and rooting garbage are rich sources of parasites and bacteria which are picked up and swallowed by flies when they feed in such areas. Moreover, Getachew *et al.* (2007) reported that the trapped flies from the ground contaminated by human faeces harboured more parasitic eggs and protozoan cysts such as *A. lumbricoides*, *T. trichiura*, hookworm, *Taenia* spp., *E. histolytica/dispar*; *G. lamblia* and *Cryptosporidium* spp. compared to those trapped near from butcher shops, garbage piles and markets.

We conducted our survey in an urban area in a middle income country where the level of sanitation is high, garbage is cleared regularly and where a close toilet system is the rule. Moreover, data from Klong Luang district show a low the prevalence of intestinal parasites in human surveys - only 1.88% of 6,452 stool samples in one study (Puttaruk and Sirisabhabhorn, 2014). Therefore, the prior probability of finding parasites in flies in Klong Luang is low.

Conclusions

To conclude, our study found a zero rate parasite carriage in synanthropic flies in an urban area of Thailand. However, substantial fly numbers were found at garbage piles and

slaughterhouses and food markets. Efforts must continue to remove rapidly garbage and food likely to decay to control the fly populations and reduce the risk of transmitting parasitic infections by synanthropic flies.

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