Seasonal Abundance of Blow Flies (Diptera: Calliphoridae) in Three Urban Parks of Bangkok, Thailand

Jumnongjit Phasuk1,*, Thitima Tharawoot2 and Jariya Chanpaisaeng3

ABSTRACT

Designing effective management programs for insect vectors of human and livestock diseases requires knowledge of the species composition and seasonal abundance of the vectors. The seasonality of blow flies was assessed throughout 1 yr with baited traps in three tropical, urban parks in Bangkok, Thailand. A total of 11,625 blow flies were captured and identified, consisting of five species from three genera—Chrysomya megacephala (Fabricius) (73.37%), C. rufifacies (Macquart) (22.96%), Hemepyrella ligurriens (Wiedemann) (3.27%), C. nigripes Aubertin (0.38%) and Phumosia indica (Surcouf) (0.03%). More females were collected than males with a ratio of 2.9:1, respectively. Abundance of the two most common species showed a trimodal pattern with peaks in January, September and June and the three most common species occurred in baited fly traps throughout the year. The greatest number of C. megacephala was captured in January while C. rufifacies peaked in September. Hemepyrella ligurriens was more abundant during June to October. Abundance levels of the two most common species were negatively correlated with the temperature and relative humidity.

Keywords: blow flies, Calliphoridae, seasonality, Thailand, urban ecology

INTRODUCTION

Filth flies are synanthropic and belong to the families Calliphoridae (blow flies), Muscidae (house flies) and Sarcophagidae (flesh flies). These flies are medically and veterinarily important and are thus a public health concern. In nature, adult flies feed on feces and carrion and breed in human and animal excrement, garbage, animal bedding, decaying organic matter and carcasses (Graczyk et al., 2001, 2005). Some species deposit eggs or larvae on the wounds of warm-blooded animals or humans. Invasion of living tissue by fly larvae is a condition known as myiasis (Seppänen et al., 2004). The feeding and breeding habits of filth flies make them important vectors of many pathogens of humans and domestic animals (Graczyk et al., 2005). Many studies have demonstrated that flies can serve as mechanical vectors of pathogens. For example, Getachew et al. (2007) reported that Chrysomya rufifacies and Musca sorbens had human intestinal helminthes and protozoan parasites on their cuticle and in their gut. Chrysomya megacephala and Musca domestica have been identified as bacterial vectors in urban areas of Chiang Mai province (Sukontason et al., 2007). Conn et al. (2007) demonstrated that synanthropic flies serve as mechanical vectors of both Cryptosporidium and Giardia.
Blow flies can be found near most human habitations and are also associated with animal husbandry. They can be a nuisance and can vector diseases between animals, from animals to humans (zoonoses) and can cause myiasis. Understanding the seasonal abundance of these flies will aid the design and implementation of effective control programs for them. The objective of this study was to identify the species of blow flies prevalent in Bangkok, Thailand, measure their seasonal abundance in public parks and correlate any changes in abundance with meteorological factors.

**MATERIAL AND METHODS**

**Collection sites**

The study was carried out in three adjacent public parks in Bangkok, Thailand: Chatuchak Park (13°48'16.66” N, 100°33’14.24” E); Queen Sirikit Park (13°48’24” N, 100°33’0” E); and Wachirabenchatat Park (13°48’26.07” N, 100°32’57.17” E). Bangkok province has a tropical climate and it is generally hot and humid with three seasons: the rainy season from June to October, the dry cool season from November to February and the dry hot season from March to May (Youthao et al., 2007).

**Specimen collection**

Flies were captured from March 2009 to February 2010 with two traps in each park. The commercially available traps consisted of black plastic at the base of the trap and the top was covered with a transparent plastic container (Figure 1). Four types of bait were combined in each trap: raw chicken meat mixed with cooked rice, raw pork small intestine, raw shishamo fish (*Spirinchus lanceolatus*) and fresh squid. Once per month, the traps were hung 1 m from the ground in trees standing 100 m apart. After 24 hr, the traps were placed into black plastic bags and the flies were killed with ethyl acetate vapor. All fly specimens were brought back to the Parasitology Laboratory, Faculty of Veterinary Medicine, Kasetsart University, where they were pinned, counted and identified using the taxonomic keys of Tumrasvin and Shinonaga (1977), Tumrasvin et al. (1978), Tumrasvin and Kano (1979), Tumrasvin et al. (1979).

**Data analysis**

Pearson’s correlation analysis implemented in SYSTAT® 8.0 Graphics (SYSTAT Software, 1998) was used to evaluate correlations between abundance levels of different blow fly species and monthly meteorological data for the temperature, rainfall and relative humidity. The test level for significance was set at ($P < 0.05$). Rainfall, relative humidity and temperature measurements were obtained from the Thai Meteorological Department at Don Muang airport (Station 455601; Figure 2).

**RESULTS**

Across all months, the most abundant family was Calliphoridae (91.67%), followed by Sarcophagidae (7.62%) and Muscidae (0.71%) (Table 1). A total of 11,625 calliphorid flies captured belonged to three genera—namely, *Chrysomya*, *Hemipyrellia*, and *Phumosia*. Within the three genera, five species were identified (Table 2): *Chrysomya megacephala* (Fabricius) (73.37%),

![Figure 1 Baited fly trap.](image-url)
C. rufifacies (Macquart) (22.96%), Hemipyrellia ligurriens (Wiedemann) (3.27%), C. nigripes Aubertin (0.38%) and Phumosia indica (Surcouf) (0.03%). The female to male sex ratio of flies was 2.9:1, respectively.

Calliphoridae populations had three peaks in January, September and June (Figure 3) and this pattern was driven by fluctuations in the abundance of the two most common species, C. megacephala and C. rufifacies. The three most common species were sampled in every month (Figure 4). Chrysomya megacephala was most abundant in January while C. rufifacies peaked in September; H. ligurriens was more abundant from June to October. There was no significant correlation between the total number of Calliphoridae and the temperature, rainfall and relative humidity (Table 3). The only significant

![Figure 2](image-url)  
Figure 2  Mean monthly rainfall, relative humidity and temperature from March 2009 to February 2010 from the Thai Meteorological Department at Don Muang Airport (Station: 455601).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Taxonomic composition of filth flies captured in three public parks in Bangkok from March 2009 to February 2010.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family</td>
<td>Chatuchak</td>
</tr>
<tr>
<td>Calliphoridae</td>
<td>3,003</td>
</tr>
<tr>
<td>Muscidae</td>
<td>32</td>
</tr>
<tr>
<td>Sarcophagidae</td>
<td>302</td>
</tr>
<tr>
<td>Total</td>
<td>3,337</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Number of Calliphoridae species captured in three public parks in Bangkok from March 2009 to February 2010.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>Number of flies</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td>Chrysomya megacephala (Fabricius)</td>
<td>6,105</td>
</tr>
<tr>
<td>Chrysomya nigripes Aubertin</td>
<td>40</td>
</tr>
<tr>
<td>Chrysomya rufifacies (Macquart)</td>
<td>2,247</td>
</tr>
<tr>
<td>Hemipyrellia ligurriens (Wiedemann)</td>
<td>269</td>
</tr>
<tr>
<td>Phumosia indica (Surcouf)</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>8,664</td>
</tr>
</tbody>
</table>
associations detected were negative correlations between *C. megacephala* and the temperature and relative humidity (Pearson’s correlation coefficient \((r) = -0.506, P = 0.002\) and \(r = -0.373, P = 0.025,\) respectively) and between *C. rufifacies* and the temperature and relative humidity \((r = -0.474, P = 0.004\) and \(r = -0.402, P = 0.015,\) respectively).

**Figure 3** Monthly abundance of Calliphoridae captured in three public parks in Bangkok from March 2009 to February 2010.

**Figure 4** Abundance of the main species (*Chrysomya megacephala* (Fabricius), *C. rufifacies* (Macquart), *Hemipyrellia ligurriens* (Wiedemann)) of the Calliphoridae captured in three public parks in Bangkok from March 2009 to February 2010. (Vertical lines represent \(\pm SD\); Number = 3).
In urban Bangkok, *Chrysomya megacephala* was the most abundant calliphorid, followed by *C. rufifacies*, a pattern noted by Sukontason et al. (2003). Previous studies of flies of medical and veterinary importance in Thailand reported that *Musca domestica* was the most abundant followed by *C. megacephala* (Sucharit et al., 1976; Tumrasvin et al., 1978, Sucharit and Tumrasvin, 1981), but their choice of bait may have been largely responsible for this difference. For example, Boonchu et al. (2003) demonstrated that pork viscera baits were highly attractive to adults of *C. megacephala* and they suggested that the wind direction helped spread the bait odor. Pickens et al. (1994) determined that a bait mixture consisting of cooked rice mixed with chicken was the best attractant of *M. domestica*. However, in the current study, the dearth of this species with samples of this bait mixture may have resulted from competitive interactions with calliphorids attracted by other bait components. Different species of flies may prefer different habitats or food items. For example, Leong and Grace (2009) indicated that a large number of *C. megacephala* were found in food garbage, while *C. rufifacies* was most abundant at butchery sites and in outdoor latrines (Getachew et al., 2007). Baited fly traps typically catch more females than males, presumably because females actively search for oviposition sites and require more protein food for egg maturation (Tachibana and Numata, 2006).

The population fluctuations of *C. megacephala* and *C. rufifacies* were similar during the present study. The monthly abundance of Calliphoridae was predominant in January, September and June in accordance with the rainfall. Similar observations were reported by Batista-da-Silva et al. (2011) who found *C. megacephala* in Brazil was abundant in fall (March–May) and summer (November–February). In India, the abundance of *C. megacephala* increased in correlation with the beginning of the rainy season and then declined in the dry hot season (Wall et al., 2001). Marinho et al. (2006) reported that the Calliphoridae were most abundant in May, June, September and January, coinciding with low rainfall and the most abundant species were *Phaenicia eximia* (47.0%) and *Hemilucilia semidiaphana* (23.6%) whereas the abundance of *C. megacephala* was less than 1%. The differences in abundance and species richness could probably be due to climatic and environmental differences. Analysis of the data showed a significantly negative correlation for the populations of *C. megacephala* and *C. rufifacies* with the temperature and relative humidity. Seasonal changes in the abundance and distribution of Calliphoridae frequently depend on environmental variables such as altitude, rainfall, temperature, humidity, fauna, flora, breeding substrates and human disturbance (Tumrasvin et al., 1978; Sukontason et al., 2003; Marinho et al., 2006; Baz et al., 2007; Mello et al., 2007;

### Table 3

<table>
<thead>
<tr>
<th>Weather conditions</th>
<th>Abundance</th>
<th><em>Chrysomya megacephala</em></th>
<th><em>Chrysomya nigripes</em></th>
<th><em>Chrysomya rufifacies</em></th>
<th><em>Hemipyrellia ligurriens</em></th>
<th><em>Phumosia indica</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall (mm)</td>
<td>0.234</td>
<td>-0.264</td>
<td>0.071</td>
<td>-0.170</td>
<td>0.048</td>
<td>0.099</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>-0.203</td>
<td>-0.506*</td>
<td>-0.122</td>
<td>-0.474*</td>
<td>-0.229</td>
<td>-0.176</td>
</tr>
<tr>
<td>Relative humidity (%)</td>
<td>0.220</td>
<td>-0.373*</td>
<td>-0.055</td>
<td>-0.402*</td>
<td>-0.167</td>
<td>0.127</td>
</tr>
</tbody>
</table>

* = Significant at $P < 0.05$. 
Pires et al., 2008). In addition, blow flies may occur throughout the year when food debris, garbage, decaying plants, dead animals and manure are available to sustain growing larvae (maggots). In public parks, refuse and food waste left by visitors or associated with restaurants may provide sufficient food for blow flies year-round. Insufficiently cleaned garbage bins can provide a place for flies to breed (Tahir et al., 2007). The current study suggests that environmental factors such as the temperature and relative humidity are correlated with the abundance of blow flies in an urban, tropical setting. However, seasonal changes in the deposition of garbage by park visitors may also contribute to the patterns described.

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LITERATURE CITED


