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The effectiveness of basic bait traps for collecting adult flies

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Abstract: The aim of the present study is to compare the effectiveness of pork liver bait traps (PLBTs) and fish meat bait traps (FMBTs) for collecting adult flies. Bait traps used to collect these species can be damaged by anthropogenic or environmental effects. In this study, PLBTs and FMBTs were hung from trees in the three areas (tree near the pig farm, tree near the dormitories and tree near the fresh market) of the Kasetsart University, Kamphaeng Saen Campus, Nakhon Pathom Province, Thailand. This activity was carried out on the first Monday of each week for two months. During the study, 4,252 specimens were collected. Of all these species, 2903 (68.27%) were obtained from PMBTs, while 1,349 (31.73%) were obtained from FMBTs. Calliphoridae, belonging to three species [*Chrysomya megacephala* (Fabricius), *C. rufifacies* (Macquart) and *C. nigripes* (Aubertin)] were the most abundance in this study. The number of species collected from PMBTs was the same found in the FMBTs, but the number of each individual in each species was different. This study provides baseline information on the necrophilous fauna for estimating postmortem interval in cases of human death in Thailand.

Keywords: Basic meat bait trap; biodiversity; Diptera, forensic entomology.

Introduction

Fauna studies were conducted to determine bioavailability in a region. It is extremely important to understand and evaluate processes that appear in nature as a result of gradually increasing anthropogenic effects and resultant climatic changes. Results of fauna studies are commonly used in applied sciences including entomology, veterinary science, public health care, agriculture, forestry and ecology, and in the protection of the environment in addition to basic sciences such as zoology, zoogeography, population genetics, systematics, microbiology and parasitology (Braioni, 1994; Tamutis et al., 2011). Fauna studies are also useful in elimination of the order of Diptera, Calliphoridae, Sarcophagidae, Oestridae and Muscidae in public health and veterinary studies, which lead to myiasis by leaving their larvae and eggs on the wounds of humans and animals (Green et al. 2005; Sankari & Ramakrishnan 2010; Avula et al. 2011; Aggarwal et al. 2014; Jervis-Bardy et al. 2014). Another applied science benefiting from the results of fauna studies is forensic entomology, which determines postmortem interval, cause of death and whether corpses have been moved, which contribute to solving forensic cases.

In studies in basic and applied sciences, bait traps used to attract flies to determine the fauna of a region depend on the sense of smell and types of nutrition of flies (Cavallari et al. 2014). The most well-known traps are carrion-baited Martín-Vega et al. 2013; Martín-Vega & Baz 2013), followed by basic meat bait traps (BMBTs), sticky traps, synthetic smell traps and chemical (insecticide) traps (Boonchu et al. 2003; Harvey et al. 2010; Nurita & Abu 2010). BMBTs, usually prepared with beef and beef liver, are the first traps to be preferred in that they are inexpensive and effective (Boonchu et al. 2003). The goal of the present study is to compare the effectiveness of pork liver bait traps (PLBTs) and fish meat bait traps (FMBTs) the collection of flies.

Materials and Methods

Insect collection

Traps were prepared as shown in Figure 1. Pork liver bait traps (PLBTs) and fish meat bait traps (FMBTs) to serve as attractant, each 200 g, were placed in the traps. As shown in Figure 1, the upper part of each trap, raincoats and the ropes used in hanging the traps were secured on the same place on the pipes. The traps were hung on the pipe under the tree near the fresh market (Figure 1A), the tree near the dormitories (Figure 1AB) and the tree near the pig farm (Figure 1C) in the Kasetsart University, Kamphaeng Saen Campus, at 08.00 h on the first Monday of each month. Then, traps were left in that place until 17.00 h on the Friday of that same week. The traps were operated during February and March 2019.

On the first Friday of each week, live adults in the PLBT and FMBT were killed with chloroform. All the adult, larvae and pupae in both the PLBT and FMBT were removed. Ambient temperatures and relative humidity were obtained from Nakhon Pathom Meteorological Station which is located near the sampling sites.

Statistical analysis

In order to determine the diversity of species in PLBT and FMBT sample groups in our study, Shannon Wiener and Simpson diversity and evenness indices were used. Diversity indices were calculated using PC-ORD ver.5.1 (McCune and Mefford, 2006).

To compare the mean temperature and relative humidity in each collection time, a *t*- test was used to obtain a 95% confidence level. To evaluate the relationship between environmental factors and insect species, a Pearson correlation coefficient was used. Statistical analyses were performed using SPSS software (version 16.0).

Result & Discussion

Average relative humidity and temperatures at the study sites are shown in Table 1. For the duration of the experiment, the mean temperature ranged 24.99±1.21−29.33±1.73°C, whereas the relative humidity ranged 71.07±7.19−80.29±5.47. There was not a significant difference ambient temperatures measured and relative humidity at the experimental site in each collection time (Table 1.).

A total of 4,252 specimens were collected during two months of the experiment. Of all these species, 2,903 (68.27%) were obtained from PMBTs, while 1,349 (31.73%) were obtained from FMBTs (Table 2.). Calliphoridae, belonging to three species [*Chrysomya megacephala* (Fabricius) (Figure 2.), *C. rufifacies* (Macquart) (Figure 3.) and *C. nigripes* (Aubertin) (Figure 4.)] were the most abundance in this study. The other insect group found in these trap were Muscidae (*Musca domestica*), Sarcophagidae (*Sarcophagida dux*), Histeridae (*Saprinus* sp.) and Dermestidae (*Dermestes maculatus*). The number of species collected from PMBTs was the same found in the FMBTs, but the number of each individual in each species was different.

The purpose of the present study is to compare the effectiveness of pork liver bait traps (PLBTs) and fish meat bait traps (FMBTs) in the collection of flies. Table 3 showing the diversity index results, similarities are seen in terms of species composition in both samples. Thus, in terms of species composition of the traps, rates are similar. The value of diversity index in both tarps was not high because of the area that expose to insect is limit. The proper range of Shannon`s diversity index ranged 1−3 (Magurran, 1988).

According to the Pearson correlation test, the meteorological factors were associated with the Calliphoridae species, *Chrysomya megacephala* and *Chrysomya nigripes* (Table 4.). This fact emphasizes that the bait traps temperatures are important with respect to the rate of bait traps decomposition; relative humidity is also important because it acts directly on the decomposition of the bait trap meat and promotes the emergence of an alternative decomposition stage (Moura et al., 1997). Because temperature and relative humidity conditions throughout the study exhibited was not variation, it was not possible to demonstrate the influence of these factors on the presence of insects on the carcass or on the decomposition process itself (Rungsri et al., 2018).

Conclusion

This was a preliminary study. It is necessary to repeat and replicate it at different times of the year so as to provide multiple sets of baseline succession data for Thailand that encompass all seasons. However, the information obtained during this study could be useful for providing initial database information as no succession data was previously available in central Thailand. Furthermore, these results could also possibly stimulate other entomologists in Thailand and initiate future studies. The use of fresh meat traps can increase the number of flies collected. The fact for this study, flies meat bait traps (FMBTs) was attached flies more than pork liver bait traps (PLBTs). Unfortunately, fish meat bait traps was destroyed by some vertebrate in this area. Fauna studies have scientific and sociocultural importance. Subsequently, they play an important role in raising public awareness in the determination of endemic species, climatic change and natural history, and in the protection of nature.

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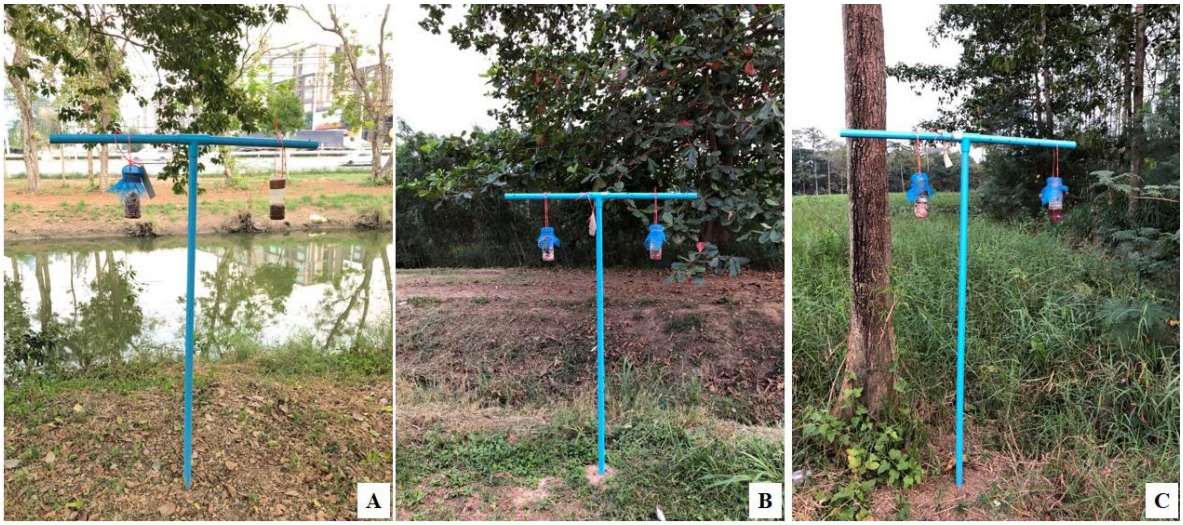

Figure 1. Design of liver of pork meat bait traps (PMBTs) and fish meat bait traps (FMBTs) operated under the tree near the fresh market (A), the tree near the dormitories (B) and the tree near the pig farm (C) in the Kasetsart University, Kamphaeng Saen Campus, Nakhon Pathom Province, Thailand.

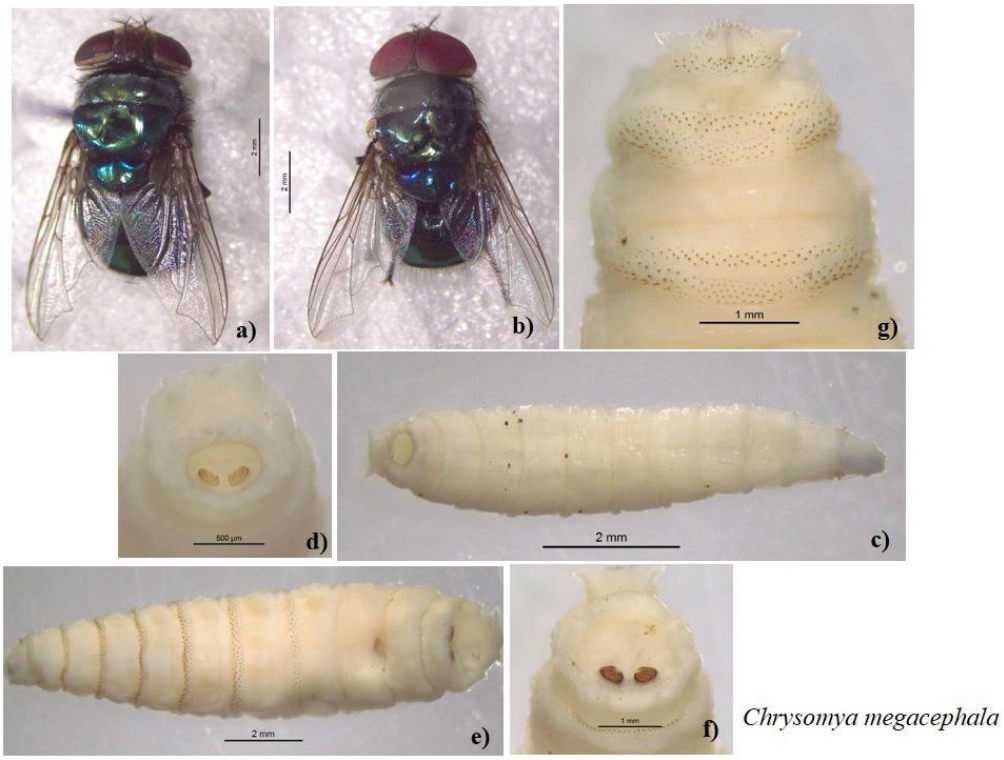

Figure 2. Adult and larvae of *Chrysomya megacephala*.

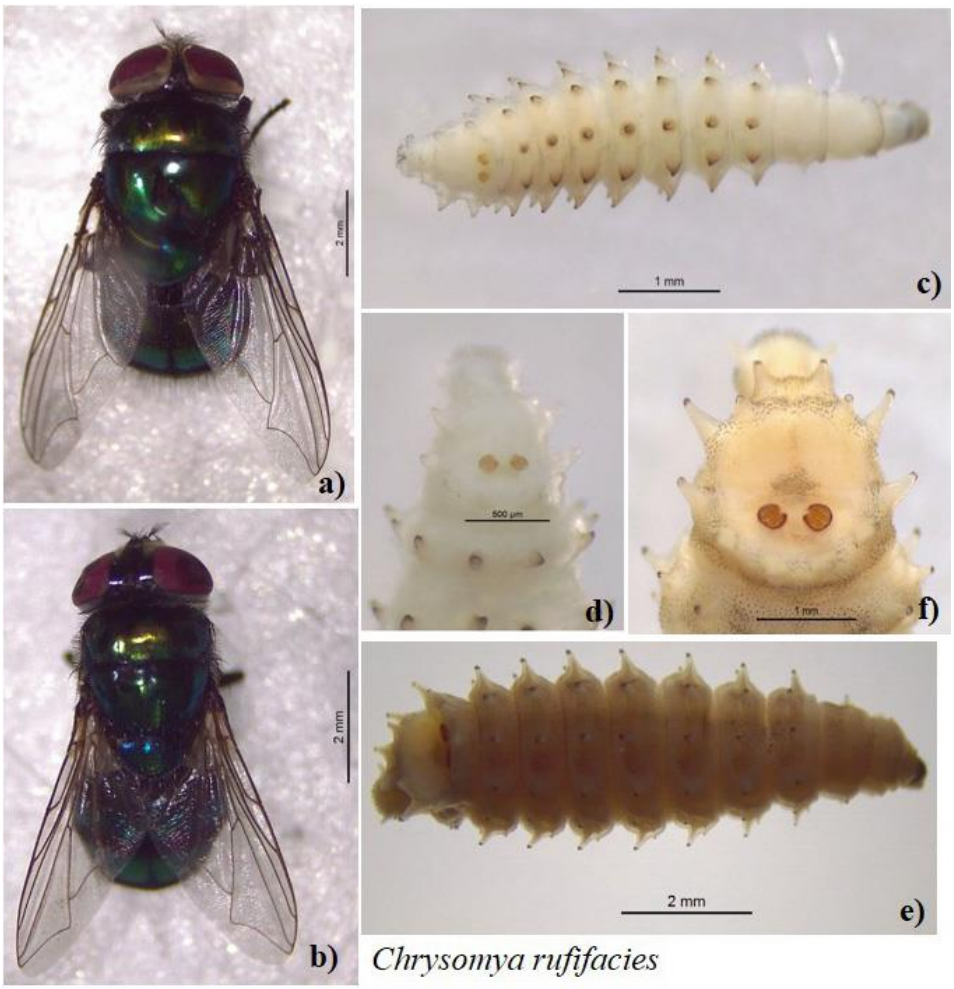

Figure 3. Adult and larvae of *Chrysomya rufifacies.*

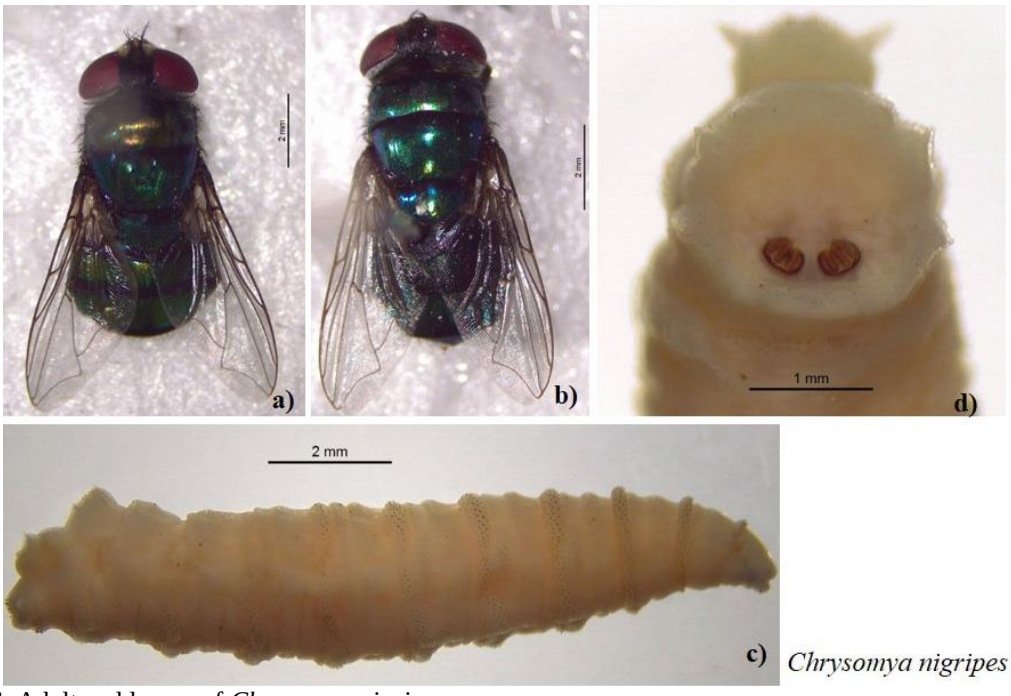

Figure 4. Adult and larvae of *Chrysomya nigripes*.

Table 1. Environmental variable in the study area. (Data from Nakhon Pathom meteorological Station).

Sampling date	Air temperature (ºC)	Humidity (%)
January 7, 2019	24.99 ±1.21[a]	75.86 ±4.53[a]
January 14, 2019	27.14 ±1.52[a]	80.29 ±5.47[a]
January 21, 2019	26.85 ±1.44[a]	78.64 ±5.59[a]
January 28, 2019	25.12 ±1.80[a]	72.14 ±7.40[a]
February 5, 2019	27.59 ±1.81[a]	73.93 ±6.53[a]
February 12, 2019	29.13 ±1.60[a]	76.43 ±5.96[a]
February 19, 2019	28.79 ±1.45[a]	75.50 ±6.11[a]
February 26, 2019	29.33 ±1.73[a]	71.07 ±7.19[a]

Remark: a, b, c = the relationship of environmental factors is similar in the sampling sites.

Table 2. Abundance of flies species collected in the pork liver bait traps (PLBTs) and fish meat bait traps (FMBTs); L_1 = first instar larval; L_2 = second instar larval; L_3 = third instar larval; P = Pupae; A = Adults)

Family	Genus/Species	Stage	Site 1		Site 2		Site 3	
			FMBT	PLBT	FMBT	PLBT	FMBT	PLBT
Calliphoridae	*Chrysomya megacephala*	A	126	319	126	200	49	223
	(Fabricius)	L1	0	0	0	0	0	51
		L2	22	37	3	63	0	110
		L3	351	448	87	283	173	517
		P	0	0	1	0	0	0
	Total		499	804	217	546	222	901
	%		74.48	22.37	55.93	70.45	76.29	77.81
	Chrysomya rufifacies	A	50	21	0	55	5	26
	(Macquart)	L2	0	0	0	0	0	123
		L3	73	0	79	77	54	11
	Total		123	21	79	132	59	160
	%		18.36	2.16	20.36	17.03	20.27	13.82
	Chrysomya nigripes	A	6	25	14	21	0	11
	(Aubertin)	L3	31	112	78	72	9	79
	Total		37	137	92	93	9	90
	%		5.52	14.12	23.71	12	3.09	7.77
Muscidae	*Musca domestica*	A	0	4	0	0	0	5
	Total		0	4	0	0	0	5
	%		0	0.41	0	0	0	0.43
Sarcophagidae	*Sarcophagida dux*	A	0	4	0	0	0	2
	Total		0	4	0	0	0	2
	%		0	0.41	0	0		0.17
Histeridae	*Saprinus* sp.	A	6	0	0	3	0	0
	Total		6	0	0	3	0	0
	%		0.90	0	0	0.39	0	0
Dermestidae	*Dermestes maculatus*	A	5	0	0	1	1	0
	Total		5	0	0	1	1	0
	%		0.74	0	0	0.13	0.34	0
	Total		**670**	**970**	**388**	**775**	**291**	**1158**
	%		100	100	100	100	100	100

Table 3. Biodiversity indices.

Indices	Pork liver bait traps (PLBTs)			Fish meat bait traps (FMBTs)		
	Site 1	Site 2	Site 3	Site 1	Site 2	Site 3
Species number	5	5	5	5	3	4
Number of individuals	970	775	1158	670	388	291
Evenness	0.348	0.517	0.436	0.478	0.901	0.474
Shannon`s diversity index	0.560	0.833	0.702	0.769	0.990	0.657
Simpson`s diversity index	0.2925	0.4602	0.3695	0.4084	0.5895	0.3759

Table 4. The relationship between the environmental factors and insect species.

Taxon/factor	Air Temperature (ºC)				Humidity (%)			
	FMBTs		PLBTs		FMBTs		PLBTs	
	r	sig	r	sig	r	sig	r	sig
Chrysomya megacephala	0.359	0.552	0.958**	0.001	-0.889*	0.044	-0.435	0.465
Chrysomya rufifacies	-0.718	0.282	0.611	0.582	0.601	0.399	0.837	0.369
Chrysomya nigripes	0.440	0.459	-1.000**		-0.880 *	0.049	-1.000**	

Remark: * Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).