

# Diversity of Forensically Important Insects in Sabah

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## ABSTRACT

Diversity of forensically important insects were documented from two experiments using a monkey (long-tailed macaque, *Macaca fascicularis* Raffles) and a pig (*Sus scrofa* L.) carcasses. The experiments were conducted in shrub area of Universiti Malaysia Sabah (UMS), Kota Kinabalu and in rural area of Menggatal district, Kota Kinabalu, Sabah respectively. Records were made daily on insects visiting the carcasses, the environmental temperatures and relative humidity. Blowflies, *Chysomya megacephala* (Fabricius), *Chysomya rufifacies* (Macquart) and *Sarcophaga brevicornis* (Ho) were the earliest species to be recorded in both studies. Other species of flies recorded from both carcasses include *Lucilia cuprina* (Wiedemann), *Hydrotea spinigera* (Stein), *Muscadomestica* (Linnaeus) and *Fannia* spp. Additional species observed on pig carcass were *Hypopygiopsis violacea* (Macquart), *Stomorhina* sp. (Rondani) and beetles, *Diamesus osculans* (Vigors) (Coleoptera: Silphidae). Information from this study provides important base data on the local carrion fauna which help to improve the post mortem interval determination in local forensic cases.

**Keywords:** Forensically important insects, Sabah, East Malaysia

## INTRODUCTION

Medicolegal forensic entomology is the study of insects associated with a human corpse, primarily in the estimation of postmortem interval (PMI). PMI is the period of time between death and corpse discovery, which can be difficult to determine after 72 hours of death<sup>1</sup>. Therefore, entomological data is frequently the only method to estimate the PMI in decomposing body.

In Malaysia, studies on the insect fauna associated with decomposing carcasses had been conducted mainly in peninsular region <sup>2</sup>. To date, no forensic entomological information has been documented from Sabah, the northern part of Borneo which is well known for its unique diversity.

Since insect succession patterns are varied dependent on geographical locations <sup>3</sup>, the entomological data collected in peninsular Malaysia might be accurate only for the respective localities where the studies were done but might not be practical for its counterpart region. Correct identification of the species encountered, their biology and ecological relations with the fauna surrounding the body is fundamental to faunal analysis in order to estimate the PMI.

The objective of this study is therefore to document the diversity of forensically important insects in Sabah which will provide the basic knowledge of local carrion fauna to aid in forensic investigation of local human death caseworks.

## **MATERIALS AND METHODS**

Two experiments had been conducted for the collection of forensically important insects presented in this paper. The first experiment began on 8<sup>th</sup> August, 2013 using a 3.20kg recent road-killed monkey (*Macaca fascicularis* Raffles) as animal model. The monkey carcass was placed in an isolated shrub area within the Faculty of Medicine and Health Sciences compound, Universiti Malaysia Sabah (UMS), Kota Kinabalu. The study site was about 100 metres from a lake and partially shaded by *Acacia mangium* (Willd.) trees. Other types of vegetation in the immediate surrounding included cogon grass *Imperata cylindrical* (L.) P. Beauv., Siam weeds *Chromolaena odorata* (L.) King & H.E. Robins and tapioca plant *Manihot esculenta* (L.) Crantz.

The second experiment was conducted on 4<sup>th</sup> April, 2014 using a 28.0kg domestic pig (*Sus scrofa* L.) which died from cardiac puncture. The experiment taken place in Kg. Tombongon, a rural village surrounded by tropical rainforest approximately 10km away from Menggatal Township. The pig carcass was placed in the compound of a village house, and was partially shaded by a *Euphoria malaiensis* (Griff.) tree.

Both carcasses were placed inside metal cages measuring 90cm x 50cm x 65 cm to protect them from large scavengers such as dogs. The cage bottom trays were removed and the cages were anchored to the ground securely.

Carcasses were monitored hourly for the first 48 hours and four times daily from day 4 onwards until the emergence of new adult flies and only bones were left. Records were made on insects visiting the carcasses daily. Adult insects visited the carcasses were collected by using a hand net. Representative

samples of larvae were collected with forceps and put into glass vials containing 70% of ethanol. Pupae were also collected, kept in top-ventilated containers and placed nearby the carcasses on the sites to monitor for the adult emergence. All specimens were then brought to laboratory for mounting and identified using the keys of Senior White and Kurahashi<sup>4, 5</sup>.

## RESULTS

The insects recovered from both experiments are listed in Table 1.

**Table 1:** Summary of insects collected from or observed at monkey and pig carcasses placed in shrub area of University Malaysia Sabah (UMS), Kota Kinabalu, Sabah; and rural village of Kg. Tombongon, Menggatal respectively. The experiments began on 8<sup>th</sup> August 2013 and 4<sup>th</sup> April 2014 respectively.

Insect fauna	Order	Family	Species	Monkey	Pig	
Flies	Diptera	Calliphoridae	<i>Chrysomyamegacephala</i>	+	+	
			<i>Chrysomyarufifacies</i>	+	+	
			<i>Luciliacuprina</i>	+	+	
			<i>Hypopygiopsisviolacea</i>		+	
			<i>Stomorhinalunata</i>		+	
			<i>Stomorhina discolor</i>		+	
		Muscidae	<i>Hydroteaspinigera</i>	+	+	
			<i>Muscadomestica</i>	+	+	
		Sarcophagidae	Fanniidae	<i>Sarcophagusbrevicornis</i>	+	+
				<i>Fanniaprisca</i>	+	
			<i>Fanniaflavipalpis</i>		+	
		Rhiniidae	<i>Isomyiaborneensis</i>		+	
Beetle	Coloeptra	Siphidae	<i>Diamesusosculans</i>		+	
Ants	Hymenoptera	Formicidae	<i>Pheidologeton sp.</i>	+		

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	<i>Ocoephyllasmaragdina</i>	+
Vespidae	<i>Vespa affinis</i>	+

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The species to arrive first in both experiments were *Chysomyamegacephala* (Fabricius) and *Chrysomyarufifacies* (Macquart) which came immediately after placement of the carcasses. Individuals of *Sarcophagabrevicornis*(Ho) arrived within the next thirty minutes to feed on the exudates.

Other fly species recorded during the fresh stage of monkey carcass include *Hydroteaspinigera* (Stein) and *Fanniaprisca* (Stein) which continued to visit throughout the experiment. Individuals of *Muscadomestica* (Linnaeus) were observed during bloated stage of monkey carcass. However in the pig experiment, this species were spotted earlier during the fresh stage period. *Luciliacuprina* (Wiedemann) was present abundantly throughout the active to advance state of decomposition in both experiments.

In addition to *Ch. megacephala* and *Ch. rufifacies* species, two individuals of *Hypopygiopsisviolacea* (Macquart) were recorded as the early colonizers on pig carcass during the fresh stage period. The fly oviposited in the mouth orifice almost immediately upon arrival. *Fanniaflavipalpis*(Stein) were collected during the advanced decay stage of the pig carcass. A carrion beetle, *Diamesusosculans* (Vigors) (Coleptera: Silphidae) was observed on nearby vegetation during the beginning of active decay stage of pig carcass. More *D.osculans* arrived during nocturnal hours and settled in the orifices of the carcass to feed on fly larvae. The number of *D. osculans* dropped during daytime with only about 10 of them was observed under the head of the pig carcass, and dropped to zero during advanced decay stage of decomposition.

## DISCUSSION

As in most studies conducted in Malaysia, *Ch. megacephala* and *Ch. rufifacies* remain as the common fly species recovered during fresh and bloated stage of decomposition and therefore served as important forensic indicators<sup>1, 6-9</sup>. In addition, our findings also recorded *Hy. violacea* as one of the earliest ovipositors on pig carcass. *Hy.violacea* (Diptera: Calliphoridae) is a very large fly (15 mm or more) with its hypopygium strongly developed in males. This species was only observed during the fresh and bloated stage of decomposition. *Hy. Violacea* is considered as forensically important fly and had been reported in literatures as being the first colonizers on animal carcasses placed outdoors in estates and forested areas<sup>1, 3, 10</sup>. The first study on the larval growth parameter and growth rate of this blow fly species was reported by Chen in 2008<sup>11</sup>. The larvae of *Hy.violacea* were recovered from a corpse for the

first time by Ahmad Firdaus in 2010<sup>12</sup>. The absence of this species from monkey carcass placed in the campus shrub area is expected as *Hy. violaceais* a forested species.

Previous succession studies in tropical rainforest of Malaysia using three different animal models revealed higher arthropod taxon richness on rabbit and monkey carcasses as compared to rat carcasses<sup>13</sup>. This was attributed to the size of food (animal size) and period of decomposition. In our study however due to different locations, it would be difficult to assess the significant difference between the usages of different animal models. Nonetheless, we found that higher diversity of arthropod assemblage on pig carcass could be more likely due to the study site. Moura (2005)<sup>14</sup> also found that carrion left in forested area had higher species richness than that left at urban site.

## CONCLUSION

To conclude, our study documents basic forensic entomology information for Sabah locality. This information will provide the knowledge of local carrion fauna to aid in forensic investigation of local human death cases, especially estimation of post mortem interval (PMI). More ecological studies on carrion in different locations of Sabah should be carried out in order to obtain more complete entomological database. Reliable estimation of PMI which can be used in court hearings requires good data on insect species that colonize cadavers and in different environmental settings.

## CONFLICT OF INTEREST STATEMENT

We declare that we have no conflict of interest.

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