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PRELIMINARY SURVEY OF FORENSICALLY IMPORTANT SCUTTLE FLIES (DIPTERA: PHORIDAE) IN UNIVERSITI KEBANGSAAN MALAYSIA, BANGI

Shaz'wani Asyiqqin Shafe'i & Raja Muhammad Zuha
Forensic Science Programme, School of Diagnostic and Applied Health Sciences, Faculty of Health Sciences, Universiti Kebangsaan Malaysia Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur, Malaysia
Corresponding author: rmzuha@ukm.edu.my

ABSTRACT

Scuttle flies (Diptera: Phoridae) are diversified insect group of forensic importance with variety of habitats and feeding habits. Previous research showed diversity of scuttle flies associated with decomposing animal were abundant and their life cycles could likely be used as reference for minimum post mortem interval (PMI_{min}) in forensic entomology. The objective of this research was to record and identify forensically importance scuttle fly species based on their sarcosaprophagous activity towards decomposed cow's liver. Baited traps were placed at three selected locations in Universiti Kebangsaan Malaysia, Bangi, i.e. a secondary forest at Forensic Science Simulation Site, UKM lake and a pond for a period of 14 days. A total of 158 scuttle flies were collected (♀=153, ♂=5), representing 14 species and 7 genera. *Dohrniphora cornuta* (Bigot) was abundant at simulation site and pond while *Megaselia scalaris* (Loew) was

the most frequent species found at the lake. A total of 42 specimens from genus *Megaselia*, *Puliciphora*, *Spiniphora* and *Woodiphora* could not be named until they are linked with their known males or females. These findings extend the information about the abundance and diversity of forensically important scuttle fly species in Malaysia.

Keywords: scuttle flies, Phoridae, forensic entomology, distribution

ABSTRAK

Lalat mencalai (Diptera: Phoridae) adalah kumpulan serangga berkepentingan forensik yang mempunyai kepelbagaian habitat dan tabiat memakan. Kajian terdahulu menunjukkan limpahan diversiti lalat mencalai yang berkait rapat dengan bangkai haiwan mereput dan kitar hidupnya berpotensi untuk digunakan sebagai rujukan selang masa pasca kematian minimum (PMI_{min}) dalam entomologi forensik. Objektif kajian ini adalah untuk merekodkan dan mengenal pasti lalat mencalai berkepentingan forensik berdasarkan aktiviti sarkosaprofagus terhadap hati lembu reput. Perangkap umpan diletakkan di tiga lokasi berasingan di Universiti Kebangsaan Malaysia, Bangi, i.e. hutan sekunder di Tapak Simulasi Sains Forensik, tasik UKM dan kolam selama 14 hari. Sebanyak 158 lalat mencalai dikutip (♀=153, ♂=5), diwakili oleh 14 spesies dan 7 genera. *Dohrniphora cornuta* (Bigot) adalah yang terbanyak direkodkan di tapak simulasi dan di kolam manakala *Megaselia scalaris* (Loew) paling kerap dijumpai di tasik. Sebanyak 42 spesimen terdiri daripada genus *Megaselia*, *Puliciphora*, *Spiniphora* and *Woodiphora* tidak dapat dinamakan sehingga dihubungkan dengan pasangan jantan atau betinanya. Penemuan ini meluaskan lagi maklumat mengenai limpahan dan diversiti spesies lalat mencalai di Malaysia.

Kata kunci: lalat mencalai, Phoridae, entomologi forensik, taburan

INTRODUCTION

Scuttle flies (Diptera: Phoridae) are a group of small flies with humpbacked appearance and recognized by its rapid movement (Disney 1994). For the past decades, the scuttle flies has been represented by more than 4,000 species and still, there are new species yet to be discovered (Marshall 2012). Although they were recorded having diverse habitats and feeding behaviors, many of these flies are actually decomposers of organic materials including corpses and vertebrate carcasses (Disney and Sinclair 2008). In forensic entomology, scuttle flies have been featured as reference to estimate minimum post mortem intervals (PMI_{min}). Due to their small size and ability to penetrate narrow space, scuttle flies could be considered as one of primary indicators to determine PMI_{min} for death in concealed environments (Campobasso et al. 2004; Reibe and Madea 2010). Studies conducted in recent years showed there were more scuttle flies likely to be found associated with decomposing vertebrates (Zuha and Disney 2014; Zuha et al. 2014). Therefore, this study was intended to survey the distribution of scuttle fly species at three selected locations in Universiti Kebangsaan Malaysia (UKM), Bangi.

MATERIALS AND METHODS

This study was conducted at three different locations in UKM Bangi (Figure 1). These three locations varied in terms of geographical conditions ecological features.

i. Forensic Science Simulation Site, Faculty of Health Sciences (2.912ºN, 101.789ºE)

Study was conducted from 10 November until 24 November 2015 with ambient temperature ranged between 24 - 32°C. This land consists of a secondary forest, a river and two oxidation ponds. There were also research buildings approximately 200 m from research location. The specific location for this study was within the secondary forest, shaded throughout the day and very minimal human activity.

ii. UKM Lake near Faculty of Engineering and Built Environment (2.924ºN, 101.771ºE)

Study was conducted from 2 December until 15 December 2015 with ambient temperature ranged from 24 - 34°C. This is a recreational area with jogging tracks and fitness facility around the lake. Faculty of Engineering and Built Environment buildings are located to the southeast of the lake while the lake itself is adjacent to Jalan Bangi to the north. Few trees were grown in this area and concentrated to the east side of the lake. Specific site used in this study was bushes beside the lake and exposed to direct sunlight. Human activities were observed more frequent from 0800 – 1100 hrs and 1700 – 1900 hrs mainly for recreational and fitness activities.

iii. A pond adjacent to Nuclear Science Program building and Fernarium UKM (2.921ºN, 101.782ºE)

Study was conducted from 29 February until 14 March 2016 with ambient temperature ranged from 23 - 31°C. This is a catchment from nearby landscape, possibly from Nuclear Science Program building and Fernarium UKM.

Specific site used in this study was bushes near the pond and exposed directly to sunlight. Human activities were restricted to the building which mainly consists of research laboratories. The Fernarium UKM is a conservation and education botanic garden, managed by the Faculty of Science and Technology and occasionally attended by visitors.

A total of five baited traps were used in each location and placed approximately 5 - 7 m away from each other. Baits, consist of 15-20g decomposed cow's liver were placed inside 60 ml cylindrical plastic containers. Containers were covered with plastic wire mesh consists of 1.5 mm holes to allow entry of adult scuttle flies and to avoid larger sized flies from ovipositing on the baits. Adult scuttle flies attracted to the baits were aspirated and preserved in glass vials containing 70% ethanol.

In the laboratory, adult scuttle flies were removed from 70% ethanol and dried on tissue papers. Mounting procedure was based on Disney (1994). Specimen was placed in a drop of Berlese Fluid and body parts were dissected using fine-tip forceps. The head, thorax, wing, front legs, mid legs, hind legs and abdomen were mounted separately in Berlese Fluid on the same slide and covered with 5-7mm rounded coverslips. Each mounted specimen was labelled according to date of collection, locations, collector's name and species. Finally, the mounted specimens on slides were dried in oven at 40°C for 3-5 days. Taxonomic identification was carried out based on genera descriptions in Disney (1994) and species descriptions in Borgmeier (1966, 1967).

RESULT

A total of 15 phorid species were recorded from the three locations (Figure 2). Scuttle fly species were more diverse at Forensic Science Simulation Site (12 species) compared to UKM Lake (7 species) and the pond (2 species). *Dohrniphora cornuta* (Bigot) was the most frequent species collected at the simulation site (n=76) and the pond (n=10). At UKM lake, *Megaselia scalaris* (Loew) was the most frequent species collected from the baits (n=19). It was found that majority of the species were represented by female except for a few male *Megaselia* D and *Puliciphora* A. Several species from genus *Megaselia*, *Spiniphora* and *Woodiphora* were not in any current taxonomic description and could not be named until they are linked with their males. In genus *Puliciphora*, the unknown male species could only be named until it is linked with their females.

DISCUSSION

In this study, a total of 158 scuttle flies were collected representing 14 species and 7 genera from three different places in UKM. *Dohrniphora cornuta* was found to be the most common species collected (n=87). It is a cosmopolitan species and breeds on decaying organic materials including molluscs, insects and decomposing vertebrates (Barnes 1990; Disney and Sinclair 2008; Zuha et al. 2015). Recently, this species was also featured in forensic cases (Disney et al. 2014). In this study, no male *D. cornuta* was collected, suggesting the preference towards decomposing materials only for female adults.

Another cosmopolitan species, *M. scalaris*, was found to be abundant at UKM lake. The natural history of this species has been described and the larvae were notorious for its wide spectrum of feeding habits (Disney 2008). *Megaselia scalaris* has also been reported in many medical cases as agent of myiasis (Wakid 2008), contaminants in laboratory invertebrate colonies

(Costa et al. 2007) and recorded found on corpses (Campobasso et al. 2004; Reibe and Madea 2010) including in Malaysia (Thevan et al. 2010). This close relationship between *M. scalaris* and human could possibly be observed from this study where they were abundant in location with frequent human activity.

Although distribution of *Diplonevra peregrina* (Wiedemann) is widespread, the occurrence on decomposed animal tissue in this study was new for UKM. This species was previously recorded in Malaysia based on larvae found on dead bats in Batu Caves (McClure et al. 1967). The only specimen collected in this research was at the secondary forest but in China, *D. peregrina* was a common indoor species (Feng and Liu 2012). *Gymnoptera simplex* has been previously known by its synonym, *Gymnoptera orientalis* (de Meijere) and recorded for the first time in Malaysia from dead molluscs (Beaver 1987). Its other synonym, *Gymnoptera molluscovora* (Bohart) was also recorded from the same type of decomposing materials including dead beetles and rat, and could be considered as sarcosaprophagous species (Bohart and Gressitt 1951; Disney and Sinclair 2008). The male and female *G. simplex* are sexually dimorphic (Colyer 1957) and they have been reported breeding in concealed environments in Malaysia (Zuha and Disney 2014).

Some female specimens collected in this study such as *Megaselia* A-C and *Woodiphora* A-C could not be named until they are linked to their males. These two genera were common in forested areas (Idris and Sajap 2002) and in this research, they were believed to be associated with decomposed animal tissues. The only unknown male *Megaselia* was the *Megaselia* D and hitherto considered as an undescribed species. Its appearance closely resemble *Megaselia rufipes* (Meigen) but differentiated by the characteristics of bristles on hypopygium. The taxonomy of genus *Puliciphora,* in the other hand, relies on the wingless

female descriptions. Both *Puliciphora* A and B found in this study could not identified based on current available description.

All unknown species collected in this study justified the needs for further examinations and will be described in separate papers. They could possibly be specimens of undescribed or new species but further examinations are required to determine their identity. However, due to current 'paradoxical' state of phorid taxonomy which many rely on single-sex descriptions while at the same time exhibit dimorphisms between male and female, further taxonomic studies especially on the Malaysian scuttle flies should be conducted.

CONCLUSION

This study reveals there were more scuttle fly species potentially to be featured in forensic cases than previously recorded in Malaysia. Both *D. cornuta* and *M. scalaris* were common species in UKM and their importance in forensic entomology could be studied further. Although the findings could not conclusively associate the species with its geographical locations around UKM, there were patterns indicating some species were more common in certain locations. These findings also serve as baseline for further research in two aspects i.e. the taxonomy of Malaysian scuttle flies, particularly on the unknown species and its bionomics.

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Researchers Incentive Grant, GGPM-2014-018 of the second author. Taxonomic description, systematic reviews and bionomics of forensic scuttle flies in Malaysia, mainly of forensically importance, are currently undergoing.

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Figure 1 Sampling locations in UKM Bangi (Source: Google Earth™).

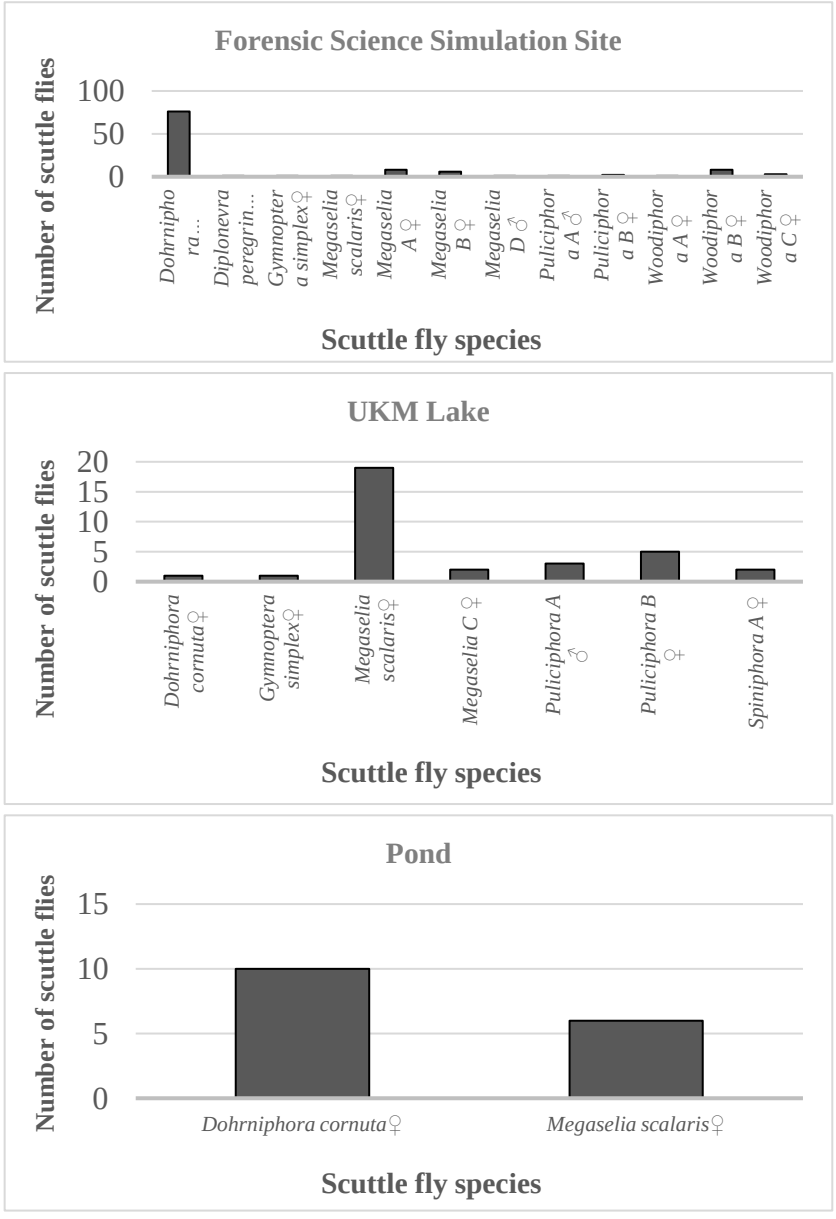

Figure 2 Total abundance of scuttle flies at three locations in UKM Bangi.