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Review of Forensic Entomology Cases from Kuala Lumpur Hospital and Hospital Universiti Kebangsaan Malaysia, 2002

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Abstract

Forensic entomology was utilized to determine the post-mortem interval of eight forensic cases sent for autopsy examination at Kuala Lumpur Hospital and Hospital Universiti Kebangsaan Malaysia between January to December, 2002. Five species of sarcosaprophagous flies: *Chrysomya megacephala, Ch. rufifacies, Hermetia illucens, Eristalis tenax* and a sarcophagid fly were found among the maggot specimens received by the Forensic Entomology Laboratory, Department of Parasitology and Medical Entomology, Universiti Kebangsaan Malaysia. The maggots were collected from dead bodies found, among others, in packed curtains, a building, a secondary forest, an oil-palm estate, inside a tank, and a river. *Ch. megacephala* was the main species found in all cases. The estimated Post-mortem Interval (PMI) ranged between 4 days and > 30 days.

Keywords: forensic entomology, post-mortem interval, decomposing bodies

Introduction

Forensic entomology is the scientific study of insects and other arthropods related to legal investigations. It can be divided into three sub-areas: urban, stored-product, and medico-legal/ medico-criminal entomology [1]. Insect evidence has been helpful in determining post-mortem interval or site of human death, to link a suspect to the scene of a crime, to prove the removal of a corpse to a different location, or to determine drug levels in a deceased person. The use of entomological data to determine post-mortem interval (PMI) is still in its infancy, and only a few studies had been recorded in Malaysia [2-6]. Forensic entomology is inextricably linked with the broader scientific field of medical entomology, taxonomy, and forensic pathology.

Materials and methods

Specimens were received from the Kuala Lumpur Hospital and Hospital Universiti Kebangsaan Malaysia. Each bottle of specimens was labeled with hospital identification number, police report number, name of deceased (if known), date and time of collection, and name of collector. Request forms describing the cases, signed by the attending forensic pathologist, were received with the specimens.

Specimen collection

Immature flies (eggs, larvae or pupae) from decomposing bodies were collected based on the methods described in [7,8]. Larval samples were preserved in universal bottles containing 70% alcohol; live ones were later bred in containers with fresh beef liver.

Preparation of preserved larval samples

Larvae were placed in 70% alcohol for at least 3 days to allow for absorption of alcohol into the tissues, rendering them adequately preserved for the next preparation steps. A transverse excision was made along the eleventh segment of each larva, separating it into two parts. The anterior and posterior parts were then immersed in 10% potassium hydroxide (KOH), normally for > 24 hours, depending on the size of the larva. The larva was then placed in glacial acetic acid for 7 minutes to neutralize the KOH solution. Gut and muscle contents were thoroughly removed by forceps. The larva was then passed through ascending concentrations of alcohol solutions (80, 90, and 95%) and absolute alcohol, for 30 minutes each. The larva was then placed in clove oil, followed by xylene, for approximately 30 minutes each. It was then placed on a glass slide and mounted with Canada balsam. The instar and larva species was identified based on [9] and reference calliphorids maintained at the Department of Parasitology and Medical Entomology, Faculty of Medicine, Universiti Kebangsaan Malaysia.

Preparation of live larval samples

Live eggs or larvae obtained from the morgues were cultured in plastic containers and fed on beef liver *ad libitum*. On reaching the pre-pupal stage, the larvae were transferred to drier containers containing saw dust. The adults that subsequently emerged were pinned and their species identified using the key provided [10].

Case histories of corpses sent for autopsy

A. Cases from Kuala Lumpur Hospital (KLH)

A total of 2 cases was received from Kuala Lumpur Hospital, for 2002. The first was a decapitated 27-year-old Indonesian male who was found in an oil palm estate. The second was an unidentified person aged 30-40 years. The body was found in a river. Maggots were found on the clothes of the latter case.

B. Cases from Hospital Universiti Kebangsaan Malaysia (HUKM)

A total of 6 cases were received from Hospital Universiti Kebangsaan Malaysia, for 2002. The first was a 47-year-old Chinese male who was found inside a condominium. The second was an unidentified body found inside an empty house; syringes and morphine were also found. The body was already in an advanced stage of decomposition, with disappearance of the soft tissues, and was partially skeletonized. The third case was a 22-year-old Chinese male who was allegedly murdered. The body was skeletonised. The fourth case was a 68-year-old Chinese male found inside a house. The fifth was an unidentified body, which was wrapped in pink flowery curtains, packed in a box. No eggs or puparia were found. The sixth case was the body of an unidentified newborn boy, found inside the tank of a garbage truck. The deceased had already undergone generalized decomposition. No evidence of ante-mortem injury was found on the body of the sixth case.

Results

The species identified and the estimated post-mortem interval (PMI) for each case are shown in Table 1**.** For most of the cases, the remains were found in the decomposing stage and had third instar fly and empty puparia on them. Five fly species were found to be attracted to the corpses: *Chrysomya megacephala, Ch. rufifacies, Sarcophagidae, Hermetia illucens,* and *Eristalis tenax*. *Ch. megacephala* was found in all cases, followed by *Ch. ruffifacies* (4/8), with *Sarcophagid, H. illucens*, and *E. tenax* in one case each.

Post-mortem interval

A. Cases from KLH

Post-mortem intervals were 4 days (cases #1 and #2)

B. Cases from HUKM

Post-mortem intervals were 4 days **(**cases #5 and #6), 5 days (cases #1 and #4) and > 30 days (cases #2 and #3).

Discussion

In this study, most of the forensic specimens sent were third instar larvae, which is similar to the finding of [2] and [6]. Third instar maggots are usually found during the active stage of decomposition, which is the most foul-smelling stage, thereby instantly alerting people to its presence.

Dipterans, especially *Chrysomya* spp, are usually the first group of flies found in corpses undergoing early decomposition. The dominant role of *Chrysomya* spp as major decomposers has been widely reported in previous studies [2,11].

We also found a black soldier fly, *H. illucens*, in one case. The corpse, which was found in an empty house, lacked soft tissues and was partially skeletonized. *H. illucens* (Diptera: Stratiomyidae) is a cosmopolitan species establishing itself wherever climatic conditions are favorable [12]. Adult *H. illucens* appear to initiate oviposition at 20-30 days post-mortem, and development is very slow [13]. However, in Malaysia, Siniah *et al* have reported *H. illucens* larvae from a corpse dead for not more than 5-7 days [14]. In our study, *H. illucens* was found in a highly decomposed body and is known to be present in corpses for longer than any other fly.

Larvae of the drone fly, *E. tenax*, were found in the body found in a river. In nature, larvae of drone flies feed on decaying organic materials in

Table 1 Species of flies collected and post-mortem intervals for the cases.

A. Kuala Lumpur Hospital

Cases No.	Larval stage received	Species collected	PMI (days)
1	Third instar	i *Ch. megacephala* ii *Ch. rufifacies*	4
2	Third instar	i *Ch. megacephala* ii *Eristalis tenax*	4

B. Hospital Universiti Kebangsaan Malaysia

Cases No.	Larval stage received	Species collected	PMI (days)
1	Third instar	i *Ch. megacephala* ii *Ch. rufifacies* iii *Sarcophaga* spp	5
2	Third instar Empty puparium	i *Hermetia illucens* ii *Ch. megacephala* iii *Ch. rufifacies*	30
3	Empty puparium	i *Ch.megacephala*	30
4	Third instar	ii *Ch. megacephala* iii *Ch. rufifacies*	5
5	Third instar	i *Ch. megacephala*	4
6	Third instar	ii *Ch. megacephala*	4

the stagnant water of small ponds, ditches, and drains [15]. *E. tenax* should be expected whenever a decomposing body is found in an aquatic environment.

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References

1. Lord WD, Stevenson JR. Directory of forensic entomologists, 2nd ed. Washington DC: Walter Reed Army Medical Center; 1986.
2. Lee HL. Recovery of forensically important entomological specimens from human cadavers in Malaysia. Malaysia J Pathol. 1989;11:33-6.
3. Omar B, Marwi MA. Arthropod ecological succession as forensic indicator. Pascasidang Kolokium Perubatan ke. 1992;3:40-4.
4. Lee HL, Marzuki. Preliminary observation of arthropods on carrion and it application to forensic entomology in Malaysia. Trop Biomed. 1993;10:5-8.
5. Omar B. Diptera succession in monkey carrion at a rubber tree plantation in Malaysia. Trop Biomed. 1994a;11:77-82.
6. Afandy H, Omar B, Marwi MA, Ahmad MS, Halim M, Feng SS, *et al.* A review of forensic specimens sent to Forensic Entomology Laboratory Universiti Kebangsaan Malaysia for the year 2001. Trop Biomed. 2003;20:27-31.
7. Smith KGV. A manual of forensic entomology. New York: Cornell University Press; 1986.
8. Catts EP, Haskell NH. Entomology and death: a procedural guide. South Carolina: Joyce's Print Shop Inc.; 1990.
9. Ishijima H. Revision of the third stage larva of synanthropic flies of Japan (Diptera: Anthomyiidae, Muscidae, Calliphoridae and Sarcophagidae). Jpn J San Zool. 1967; 18:47-87.
10. Kurahashi H, Benjaphong N, Omar B. Blowflies (Insecta: Diptera: Calliphoridae) of Malaysia and Singapore. Raffles Bull Zool. 1997;5:1-88.
11. Omar B, Marwi MA, Mansar AH, Rahman MS, Oothuman P. Maggots of *Synthesiomyia nudiseta* (Wulp) (Diptera: Muscidae) as decomposer of corpses found indoor in Malaysia. Trop Biomed. 1994b;11:145-8.
12. Lerlercq M. Entomological parasitology: the relations between entomological and medical sciences. Oxford: Pergamon Press; 1969.
13. Lord WD, Goff ML, Adkins TR, Haskell NH. The black soldier fly *Hermetia illucens* (Diptera: Stratiomyidae) as a potential measure of human postmortem interval: observation and case histories. J Forensic Sci. 1994;39:215-22.
14. Sinniah B, Ramakrishnan K, Lim EJ. *Hermitia Illucens* and *Chrysomya megacephala* isolated from human cadaver. Trop Biomed. 1994;11:7-9.
15. Garcia LS, Bruckner DA. Medically important arthropods. In: Garcia LS, Bruckner DA, editors. Diagnostic medical parasitology. 3rd ed. Washington DC: ASM Press; 1997. p. 523-63.