STUDIES ON FORENSICALLY IMPORTANT ENTOMOLOGICAL SPECIMENS RECOVERED FROM MONKEY CARRION EXPOSED TO DIFFERENT ECOLOGICAL HABITATS

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ABSTRACT

Little information was available on the forensically important specimens collected from carcasses in indoor and different ecological habitats in Malaysia. This study was attempted to determine the arthropod succession on carcasses (1) placed in different ecological habitats, such as lowland forested area, coastal area and montane forested area; (2) placed in indoor and outdoor conditions; and (3) carcasses being incinerated, submerged in freshwater river, and treated with insecticide and its effect on post mortem interval (PMI) estimation.

Carcasses placed outdoor and indoor underwent 5 decomposition stages namely, fresh, bloating, decay, advanced decay and remains/dry. Decomposition duration on carcasses placed in indoor was prolonged, in comparison to outdoor in lowland forested and coastal areas by 1.67 to 2.73 folds, but not in montane forested area.

There were no activity and oviposition of forensically important flies during nocturnal period. Flies activity were observed to be active from about 30 minutes after sunrise throughout the day until 10 minutes after sunset.

There was no delay on flies oviposition on carcasses placed outdoor in all ecological habitats. However, there was at least a 1 day delay on PMI estimation on carcasses placed indoor in coastal area. It is interesting to note that there was a 3 days delay in PMI estimation on carcasses placed indoor in both lowland and montane forested areas. This study revealed the time required for blow flies to perceive the body and enter indoor to oviposit in three different ecological habitats. Our results established the time required to be added to estimate larval age to approach a realistic PMI estimation in this region.

Oviposition of flies on carcasses, besides being used for PMI estimation, can also serve as geographical indicator: (1) *Lucilia porphyrina* was exclusively found in montane forested area; (2) *Chrysomya nigripes* was a strictly outdoor species and only invaded carcasses in lowland forested area; and (3) *Chrysomya chani* was only found invading carcasses placed in outdoor and indoor in lowland forested area.

Study conducted on incinerated carcasses emphasizes that: (1) incineration effect does not deter the arrival and oviposition of flies; (2) incineration effect does not make any difference in the fauna succession pattern between incinerated and non-incinerated carcasses, with succession sequence from Calliphoridae, Sarcophagidae and Muscidae; and (3) decomposition rates on incinerated carcasses were faster than non-incinerated carcasses.

Study conducted on carcasses submerged in freshwater river emphasizes that: (1) PMI estimation on carcasses submerged in freshwater river was delayed by a minimum period of 2 days; (2) there was no difference in the fauna succession pattern between carcasses submerged in freshwater river and placed outdoor, with the succession sequence from Calliphoridae, Sarcophagidae and Muscidae; (3) *Chrysomya megacephala* was the dominant adult flies observed visiting the carcasses, but only *Ch. pinguis* and *Hemipyrelia* spp. were found to be dominant maggots colonizing the carcasses; and (4) decomposition rates of carcasses submerged in freshwater river were slower than carcasses placed outdoor.

Study conducted on carcasses treated with insecticide concluded that malathion repelled and delayed the insect invasions of the carcasses, especially flies for at least 7 days.

Ants (Order: Hymenoptera) were reported occurring in all decomposition stages, and were not significant indicator for carcasses succession or PMI estimation. Beetles (Order: Coleoptera) were observed visiting the monkey carcasses in lowland and montane forested areas, and their succession on different decomposition stages were determined. No beetles were observed visiting carcasses placed in coastal area. More species of beetles were found in indoor than outdoor. Ants and beetles were found on carcasses strictly specific in certain geographical regions, indicating that they can serve as an evidence in forensic cases occurred in similar ecological habitats.

ABSTRAK

Hanya sedikit maklumat mengenai spesimen-spesimen yang berkepentingan forensik yang diperolehi dari bangkai-bangkai yang berada di keadaan tertutup (dalam bangunan) dan ekologi habitat yang berlainan boleh didapati di Malaysia. Kajian ini dijalankan untuk menentukan turutan serangga di bangkai-bangkai (1) yang terletak di ekologi habitat yang berlainan, seperti kawasan hutan tanah rendah, kawasan pantai dan kawasan hutan gunung; (2) yang terletak di keadaan dalaman (dalam bangunan) dan luaran (luar bangunan); dan (3) yang telah dibakar, ditenggelamkan dalam air sungai, dan dirawat dengan racun serangga serta kesannya terhadap anggaran PMI.

Penguraian bangkai-bangkai yang terletak di keadaan dalaman dan luaran melalui 5 peringkat, iaitu segar (*fresh*), kembung (*bloating*), pereputan (*decay*), pereputan lanjut (*advanced decay*) dan kekal/kering (*remains/dry*). Tempoh penguraian bangkai-bangkai yang terletak di dalaman telah dipanjangkan sebanyak 1.67 hingga 2.73 kali, dibandingkan dengan bangkai-bangkai yang terletak di luaran di kawasan hutan tanah rendah dan pantai. Akan tetapi, kejadian ini tidak berlaku di kawasan hutan gunung.

Tiada aktiviti dan oviposisi oleh lalat berkepentingan forensik pada waktu malam. Aktiviti lalat hanya diperhatikan kira-kira 30 minit selepas matahari terbit dan aktif sepanjang waktu siang sehingga 10 minit selepas matahari terbenam.

Tiada penangguhan masa pada oviposisi lalat atas bangkai-bangkai yang terletak di keadaan luaran di semua ekologi habitat. Walau bagaimanapun, penangguhan masa sebanyak 1 hari telah berlaku pada bangkai-bangkai terletak di keadaan dalaman di kawasan pantai. Tambahan lagi, penangguhan masa sebanyak 3 hari telah berlaku pada bangkai-bangkai yang terletak di keadaan dalaman di kawasan hutan tanah rendah dan gunung. Kajian ini menunjukkan masa yang diperlukan untuk lalat mengesan lokasi bangkai dan oviposisi atas bangkai tersebut dalam tiga ekologi habitat yang berlainan. Keputusan kami memastikan masa yang diperlukan untuk ditambah ke atas anggaran umur larva demi menghasilkan anggaran PMI yang lebih realistik di rantau ini.

Oviposisi lalat di atas bangkai-bangkai bukan sahaja boleh digunakan dalam anggaran PMI, ia juga boleh bertindak sebagai penunjuk geografi: (1) *Lucilia porphyrina* hanya boleh didapati di kawasan hutan gunung; (2) *Chrysomya nigripes* merupakan species lalat yang terdapat di keadaan luaran dan hanya oviposisi di bangkai-bangkai yang terletak di kawasan hutan tanah rendah; dan (3) *Chrysomya chani* hanya oviposisi di bangkai-bangkai terletak di keadaan dalaman dan luaran di lawasan hutan tanah rendah.

Kajian yang dijalankan pada bangkai-bangkai yang dibakar menekankan: (1) kesan pembakaran tidak menghalang kedatangan dan oviposisi lalat; (2) kesan pembakaran tidak menyebabkan sebarang perbezaan atas corak turutan fauna di antara bangkai-bangkai yang dibakar dan tidak dibakar, dengan turutannya dari Calliphoridae, Sarcophagidae dan Muscidae; dan (3) kadar penguraian bangkai-bangkai yang dibakar adalah lebih cepat dibandingkan dengan bangkai-bangkai yang tidak dibakar.

Kajian yang dijalankan pada bangkai-bangkai yang ditenggelamkan dalam sungai menekankan: (1) anggaran PMI pada bangkai-bangkai yang ditenggelamkan dalam sungai telah ditangguhkan sekurang-kurangnya 2 hari; (2) tiada perbezaan atas corak turutan fauna di antara bangkai-bangkai yang ditenggelamkan dalam sungai dan terletak di keadaan luaran, dengan turutannya dari Calliphoridae, Sarcophagidae dan Muscidae; (3) *Chrysomya megacephala* merupakan lalat dewasa yang dominan mengunjungi bangkai-bangkai yang ditenggelamkan dalam sungai, akan tetapi hanya *Chrysomya pinguis* dan *Hemipyrelia* spp. yang dijumpai sebagai larva yang dominan membiak di atas bangkai-bangkai tersebut; dan (4) kadar penguraian bangkai-bangkai yang ditenggelamkan dalam sungai adalah lebih perlahan dibandingkan dengan bangkai-bangkai yang terletak di keadaan luaran.

Kajian yang dijalankan pada bangkai-bangkai yang dirawat dengan racun serangga menunjukkan malathion boleh menghalau dan menangguhkan pembiakan serangga pada bangkai-bangkai, terutamanya lalat sekurang-kurangnya 7 hari.

Semut (Order: Hymenoptera) dilaporkan wujud di semua peringkat penguraian dan tidak menunjukkan kepentingan dalam turutan fauna dan anggaran PMI atas bangkai-bangkai. Kumbang (Order: Coleoptera) telah diperhatikan mengunjungi bangkai-bangkai di kawasan hutan tanah rendah dan gunung, dan turutan species kumbang di peringkat penguraian yang berlainan pada bangkai-bangkai telah pun ditentukan. Tiada kumbang dijumpai pada bangkai-bangkai yang diletakkan di kawasan pantai. Spesies kumbang yang dijumpai di keadaan dalaman adalah lebih banyak dibandingkan dengan keadaan luaran. Semut dan kumbang yang dijumpai di atas bangkai-bangkai adalah berdasarkan rantau geografi, ini menunjukkan ia boleh dijadikan sebagai bukti dalam kes-kes forensik yang berlaku di ekologi habitat yang sama.

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~	about
&	and
°	degree
°C	degree Celsius
=	equal
<	less than
>	more than
≥	more or same
%	percent
ACUC	Animal Care and Use Committee
cm	centimeter
cm^2	centimeter squared
df	degree of freedom
Dr.	Doctor
E	East
e.g.	exempli gratia (“for example”)
et al.	et alia (“and others”)
h	hour
i.e.	id est (“that is”)
kg	kilogram
KKM	Kementerian Kesihatan Malaysia (Ministry of Health Malaysia)
km	kilometer
KOH	Potassium Oxide
L	liter

IMR	Institute for Medical Research
mm	millimeter
N	North
n	number
nd	second
P	possibility value
PERHILITAN	Department and Wildlife and National Park, Peninsular Malaysia
PMI	Post mortem interval
rd	third
SE	standard error
sp.	species (singular)
spp.	species (plural)
st	first
w/w	weight per weight