INSTITUTE FOR MEDICAL RESEARCH

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HIGHLIGHT

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IMPROVED CRIME SCENE INVESTIGATION (iCSI)

Using IMR-Developed Forensic Entomology Kits

Determination of the age of insects found on human cadavers is used to assess the minimum post-mortem interval (mPMI) or time elapsed since death. This information is used to deduce the age of the corpse and is admissible in courts of law worldwide. An important pre-requisite for determining mPMI is the proper recovery and processing of forensically important insects from human cadavers. However, there are neither standardised methods nor kits available in the country for the collection, preservation, processing and identification of the insects. Pathologists, medical officers and police officers often rely on individual methods to collect the specimens, often not in accordance to Standard Operating Procedures (SOP).

Key**Message**

1. Forensic investigation on insect species colonising a dead body is used to determine the time elapsed since death or the minimum post-mortem interval (mPMI).
2. PMI is established by analysing:
   - Colonisation patterns of insect species in succession over time.
   - The life cycle of forensically important flies.
3. The IMR-developed Forensic Entomology kits enable standardized collections, preservation, processing and identification of insect specimens found on cadavers.

Research finding to improve mPMI :

Succession of Insect Colonisation

The cadaver is a very rich but ephemeral (short-lived) resource for insect colonisation.

There are five (5) main stages of body decomposition upon death, namely:

> Fresh Stage (Day 1-2)
> Bloated Stage (Day 2-6)
> Decay Stage (Day 5-11)
> Post-Decay Stage (Day 10-25)
> Skeletonise Stage (Day 25)

There is intense competition amongst organisms to colonise the body especially in the early stages of decomposition.

Insect colonisation of cadavers occurs in a fairly predictable sequence, that is, different species, especially of flies, and other insects arrive to colonise corpses at their various stages of decomposition (Tables 1 & 2).

There is biodiversity of distribution of forensic flies at different altitudes (Figure 1) that assist CSI on location and during removal of cadavers.

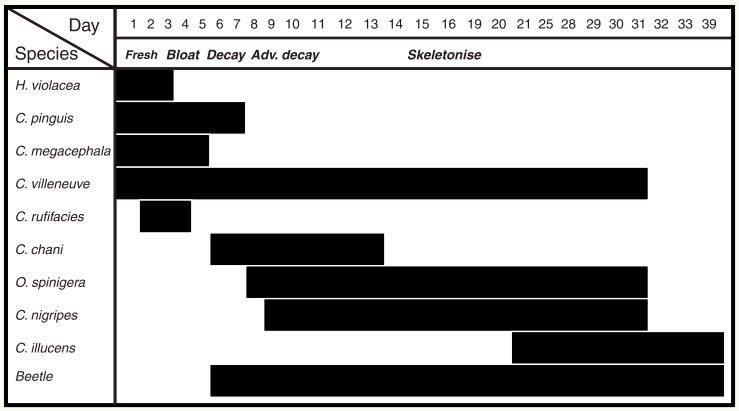


Table 1 : *Decomposition stage and Insect succession on monkey carcass in an outdoor forested site in Ulu Gombak, Selangor*

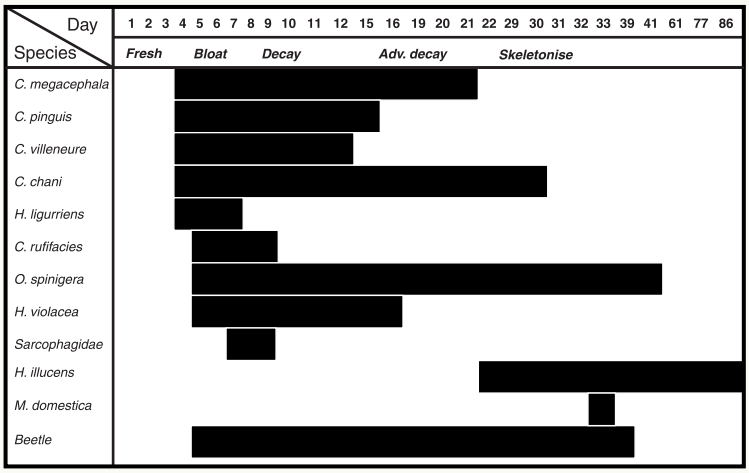
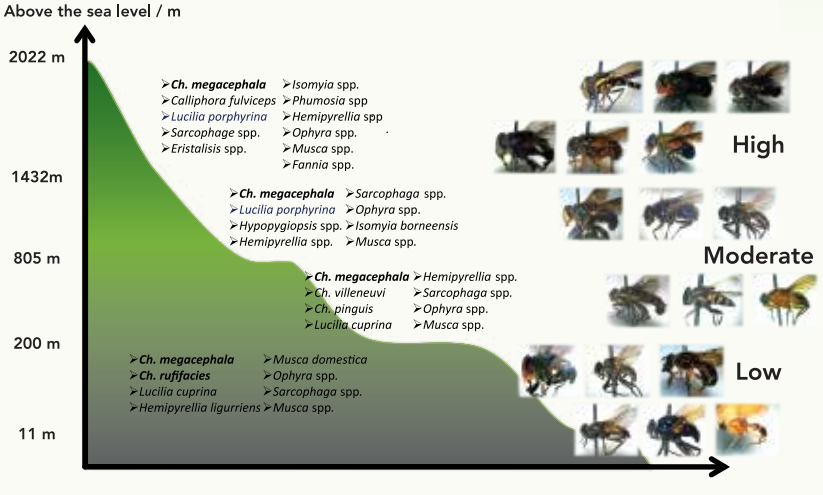


Table 2 : *Decomposition stage and Insect succession on monkey carcass in an indoor forested site in Ulu Gombak, Selangor*



background

- Forensic Entomology is an area of applied science that is used to assist the medico-legal judiciary system in crime scene investigation.
- It is the science and study of insects colonising a dead body almost immediately after death.
- The development of insect species dynamics over time can be used to determine time elapsed since death or the minimum post-mortem interval (mPMI).
- After 72 hours, entomological evidence is the most accurate method to determine the elapsed time since death or the minimum post-mortem interval (mPMI).

What To Do At A Crime Scene And Before Autopsy?

(Recommendations for sampling at a Crime Scene)

1. Standard checks on the cadavers and the surroundings for entomological evidence.
2. Collect meteorological data at the crime scene.
3. Standardisation of sample collection procedures at different parts of the cadavers by collecting the evidence into different labeled containers.
4. Standard collection procedures for the most mature insect specimens that have developed on the cadavers (adults, pupae, post-feeding and feeding larvae, eggs) and remnants such as empty fly pupa, beetle exuviate, etc.
5. Surrounding environment for sampling should be within a radius of ±10m and vertically ±1.5m.
6. Collect maggots from different maggot masses.
7. It is compulsory to document the date and time of sample collection.
8. Specimens will be used for morphological and molecular identification. ONLY 70-95% alcohol is used to preserve the specimens. Water, normal saline, phenol, formalin or formaldehyde must NOT be used for preservation.
9. Standard killing procedures are recommended for all sample specimens.
10. Standard rearing procedures are used for living insect samples under known temperature and relative humidity.
11. Each sample must be sealed to guarantee the chain of custody.

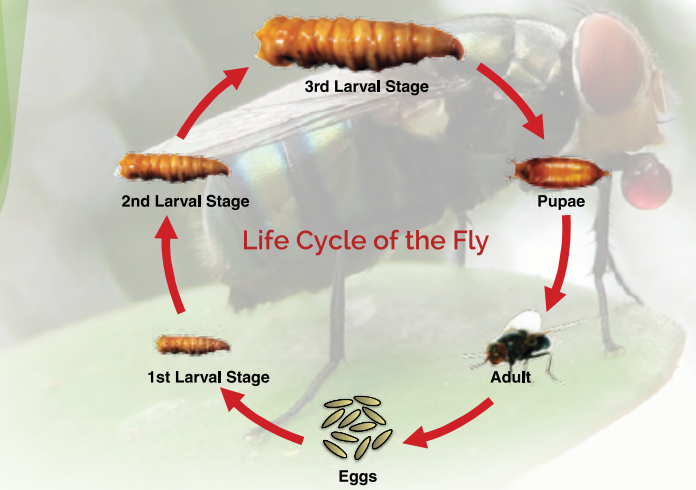
"...important pre-requisite for determining mPMI is the proper recovery and processing of forensically important insects from human cadavers."

Documentation & Chain of Custody In The Laboratory

- Document the name of the instructing authority, principal contact, the time when the specimens are received and name of the person(s) who deliver(s) the specimen.
- Ensure that the specimens are sealed upon receiving.
- Specify the reference code/identification for the case clearly.
- Chain of custody must be practiced by all involved in handling the evidentiary samples.
- Store all specimens in a cabinet under lock and key in a secured room.

The blow fly life cycle has six development stages:

the egg, three larval stages, the pupa and adult



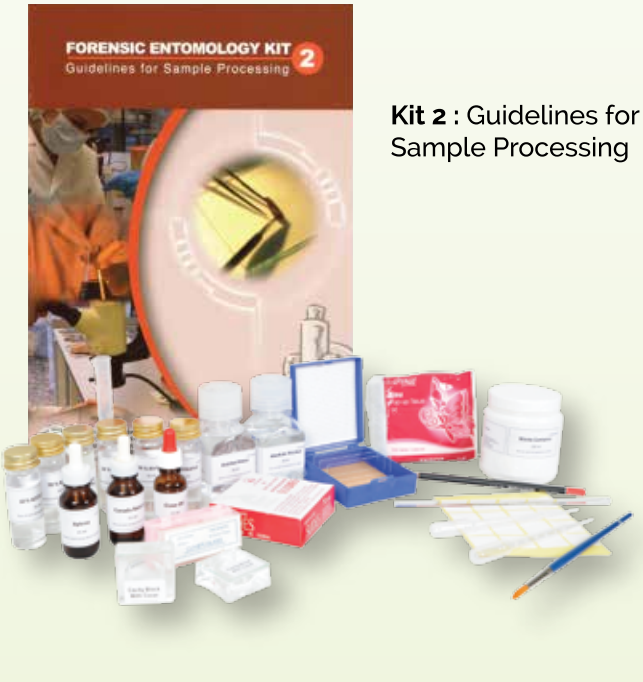
The Way Forward: Translating Research To Best Practices And Standardisation

Research | Sampling | Preservation | Taxonomy | Documentation | Development of Forensic Kit

Advantages of the Kits

- Collection of forensic specimens is much simplified and standardised.
- Specimens are preserved in the proper manner using the correct preservative solution.
- Forensic laboratory workers are able to process the specimens in a more efficient and proper manner by using the chemical solutions provided in the kits.
- Processed specimens may be mounted for study on life stages and species, thus allowing quicker reporting which may provide clues to the investigator in a more timely manner.

Kit 1 : Guidelines for Sample Collection



Kit 2 : Guidelines for Sample Processing

Conclusion

Forensic investigation using fly maggots is an important tool in determining minimum time elapsed since death or the PMI. The pre-requisites for conducting a proper and precise age-determination are:

- Documentation of the decomposition stage of a corpse and the ecosystem
- Mode of corpse disposal
- Collection of representative samples from the crime scene
- Proper preservation of evidentiary entomological samples
- Careful mounting of the specimens

Acknowledgement

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References

Baharudin, O., Marwi, M.A., Mansar, A.H., Rahman, M.S. & Pakeer, O. (1994). Maggots of *Synthesiomyia nudiseta* (Wulp) (Diptera: Muscidae) as decomposers of corpses found indoors in Malaysia. *Tropical Biomedicine*. 11: 145-148.

Byrd, J.H. & Castner, J.L. (2001). Insects of forensic importance. *Forensic Legal Investigations. CRC Press LLC* pp 1-418.

Lee, H.L., Krishnasamy, M., Abdullah, A.G. & Jeffery, J. (2004). Review of forensically important entomological specimens in the period of 1972-2002. *Tropical Biomedicine Supplement* 2: 69-75.

Nazni, W.A., Lee, H.L., Chen, C.D., Heo, C.C., Abdullah, A.G., Wan-Norjuliana, W.M., Chew, W.K., John, J., Rosli, H. & Sofian, M.A. (2011). Comparative insect fauna succession on indoor and outdoor monkey carrions in semi-forest areas in Malaysia. *J Asian Pacific Journal of Tropical Biomedicine* S232-S2238.

Nazni, W.A., Jeffery, J., Heo, C.C., Chew, W.K. & Lee, H.L. (2011). Illustrated keys to adult flies of forensic importance in Malaysia. *IMR Bulletin No. 25*. Institute for Medical Research pp 1-118.

Amendt, J., Campobasso, C. P., Gaudry, E., Reiter, C., LeBlanc, H. N., & Hall, M. J. R. (2007). Best practice in forensic entomology – standards and guidelines. *International Journal of Legal Medicine*.121 (2): 90-104.

Animal Use Approvals

ACUC - The study protocol was approved by the Animal Care and Use Committee, Ministry of Health Malaysia [Permit No. ACUC/KKM/02(2/2008)].

Prior to commencement of the project, approval was obtained from the Department of Wildlife and National Parks (PERHILITAN) of Malaysia to euthanize the monkeys. All euthanisation was administered by the experts from the Department of Wildlife and National Parks (PERHILITAN) of Peninsular Malaysia.

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