

## Research Note

### First report of the house fly larvae, *Musca domestica* (Linnaeus) (Diptera: Muscidae) associated with the monkey carcass in Malaysia

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**Abstract.** A study on insect succession of monkey carcass in a forested area in Ulu Gombak, Selangor, Malaysia was conducted from 9 May to 18 June 2007. The third instar of the housefly, *Musca domestica* (Linnaeus) (Diptera: Muscidae) were only found on dry stage of a decomposed (Day-33) monkey carcass (*Macaca fascicularis* Raffles). This observation revealed that *M. domestica* maggots were found together with other muscid fly maggots, *Hydrotaea* (= *Ophyra*) *spinigera* (Stein) (Diptera: Muscidae) on dry stage of a carcass. However, the role of *M. domestica* on forensic entomological study remains unknown. This study recorded the first finding of *M. domestica* maggots on primate carcass in Malaysia.

The house fly, *Musca domestica* (Linnaeus) (Diptera: Muscidae) is cosmopolitan in distribution and reported to exist wherever man has established himself (Omar *et al.*, 2003). Adults and maggots of this fly can be found in fisheries, slaughter houses, vegetable farms, market places, garbage disposal sites and poultry farms (Bohart & Gressitt, 1951; Byrd & Castner, 2001; Nazni *et al.*, 2003); while the oviposition of *M. domestica* on human corpses are rare (Greenberg, 1971; Smith, 1986).

In Malaysia, maggots of *M. domestica* were never reported from any entomological specimens from human corpses. However, this was in contrast to the finding of Lectercq (1969) in Europe where the first wave of fly larvae in cadavers were inclusive of *M. domestica*. Reviews on

forensic entomological cases of human corpse in Malaysia by Lee (1989, 1996), Hamid *et al.* (2003), Lee *et al.* (2004) and Salleh *et al.* (2007) showed that there were no evidence of infestation by *M. domestica* maggots on human cadavers so far. On the other hand, Vitta *et al.* (2007) and Heo *et al.* (2007, 2008a) reported that adults of *M. domestica* visited pig carcasses (*Sus scrofa* Linnaeus) in the early stages (fresh stage and bloating stage), but no maggots of *M. domestica* were recovered from their studies. Heo *et al.* (2008b) reported the occurrence of *M. domestica* eggs on pig carcass but no maggots were found from their study.

This paper reports the first record of *M. domestica* larvae recovered from a primate carcass in Malaysia.

A study on insect succession was conducted from 9 May to 18 June 2007 (rainy season) to determine successional fauna using monkey carcass in a forested area in Wildlife Research Centre, University of Malaya, 16<sup>th</sup> Mile of Gombak District (3°17'57.86"N, 101°47'00.78"E), Selangor, Malaysia. The study site was a secondary forested area with very low human populations and activities. The nearest human dwelling was approximate 300 meters from the study site.

The monkey carcass was used as a model for human decomposition since they are phylogenetically related to human. At the beginning of field study, a monkey (1 replicate, 3 year olds, 4.5 kg) was euthanized by a single shot to the forehead from a handgun at point blank. Euthanization was administered by personnel of the Department of Wildlife and National Parks (PERHILITAN), Peninsular Malaysia, Ministry of Natural Resources and Environment, Malaysia. The study protocol was approved by Institute for Medical Research's Unit of Animal Care and Use Committee [ACUC/KKM/02(2/2008)]. No faeces and urine of the carcass were observed after the monkey was euthanized. After death was confirmed, monkey carcass was immediately placed indoor on a cemented ground of a wooden hut [10 ft (length) x 10 ft (wide) x 10 ft (height), that had 4 windows on each side of the wall] in the forest. The windows of the wooden hut were open throughout the study period to allow flies access into the hut.

The carcass was monitored hourly for the first 3 days (10 minutes for each hour), and daily from day 4 onwards until no more larvae and bones were observed from the carcass. A representative sample of larvae infested on different parts of the monkey carcass was collected in order that the natural populations were not disturbed. Larvae were collected by using forceps and immediately placed and killed in glass vials containing 70% ethanol. One collection was done daily in the morning about 10 am. All the specimens were preserved in 70% ethanol and transported back to the Laboratory of Medical

Entomology Unit, IMR for mounting and identification.

About 50% (minimum of 5 specimens of each species) of the total daily collected larvae were mounted according to the method described by Lee *et al.* (1984). All adults and larvae were identified using the taxonomic keys of Kurahashi *et al.* (1997), Ishijima (1967) and Greenberg & Kunich (2002).

The species of maggots obtained from different decomposition stages of monkey carcass are showed in Figure 1. No flies' and larvae' activities were observed on the carcass for the first 3 days of post mortem. On Day-4 (bloating), adults of *Chrysomya villeneuvei* Patton and *Chrysomya chani* Kurahashi (less than 10 flies) were observed visiting the carcass, and egg mass was observed on the eyes and mouth regions of the carcass. However, no larvae were found on the Day-4. On Day-5 (bloating) and Day-6 (bloating), second instar of *Chrysomya pinguis* Walker, *Ch. villeneuvei* and *Ch. chani* were collected from the carcass, indicating these three species of blow flies were the early colonizers on carcass placed indoor in forested area. Pupae of *Ch. villeneuvei* and *Ch. chani* were found on and around the carcass from the Day-10 (advanced decay) onwards.

The third instar of *M. domestica* were only found on Day-33 (remains stage) of a decomposed monkey carcass. A total of 6 maggots of third instar *M. domestica* were collected from the monkey carcass. No first instar, second instar and puparia of *M. domestica* were recovered from the carcass. Our study shows that *M. domestica* maggots were found together with another muscid fly maggots, *Hydrotaea* (= *Ophyra*) *spinigera* Stein on dry stage of a carcass. *Musca domestica* maggots were not obtained after this. *Hydrotaea spinigera* maggots were the dominant colonizer in the dry stage, and the occurrence of *M. domestica* may cause interspecific competition between both species of maggots. However, no study has been conducted on interspecific competition between these two species.

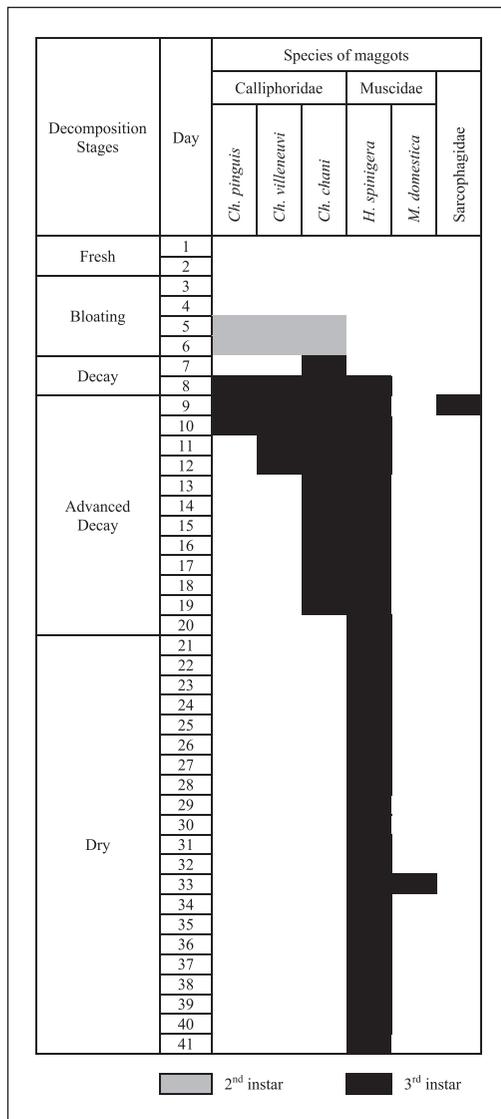


Figure 1. Maggots recovered from monkey carcass (*Macaca fascicularis* Raffles) placed in forested area in Ulu Gombak, Selangor (3°17'57.86"N, 101°47'00.78"E) from 9 May to 18 June 2007. One monkey carcass was used in this study

According to Smith (1986), *Hydrotaea* maggots are predaceous in the second and third instars, and frequently attack other maggots living in the same medium including *M. domestica* and other Muscidae. Only the occurrence of the third instar *M. domestica* observed in this study might be probably due to the predation by *H. spinigera*, thereby accounting for

the complete absence of the maggots thereafter.

The occurrence of *H. spinigera* maggots in the decomposition stage of corpse and/or carcass is varied. As in this study, this fly was found associated with monkey carcass in the decay to dry stage. Smith (1986) reported that *Hydrotaea* usually appears in human corpses during the period of ammoniacal fermentation (decay), and 4 – 8 months (dry) after death. Besides, Byrd & Castner (2001) also reported that other species of *Hydrotaea* (*H. aenescens* Wiedemann and *H. leucostoma* Wiedemann) maggots usually appear during the late or active decay stages on human cadavers. In Thailand, the third instar of *H. spinigera* was collected from a mummified human corpse, approximately 3 – 6 months of decomposition (Sukontason *et al.*, 2001a). On the other hand, Omar *et al.* (1994a) reported that *H. spinigera* was a major colonizer of monkey carcasses when the carcasses were already in decay stage, approximately 3 to 6 days after the carcasses were placed. Our finding was similar to previous works (Sukontason *et al.*, 2001b; Heo *et al.* 2008a) in that the third instar of *H. spinigera* were found on the carcass on decay and advanced decay stage (~ day 7 – 8<sup>th</sup>).

Heo *et al.* (2008b) reported the oviposition of *M. domestica* eggs on fresh pig carcass and concluded that this species maybe was an early visitor. This contrasted with our study in which the *M. domestica* maggots were only observed on remains stage. Thus, the occurrence and role of *M. domestica* in forensic entomological study remain unclear. More studies should be conducted to investigate the role of *M. domestica* as an indicator in forensic entomological study.

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#### REFERENCES

- Bohart, G.E. & Gressitt, J.L. (1951). *Filth-inhibiting flies of Guam*. Honolulu Star-Bulletin, Hawaii.
- Byrd, J.H. & Castner, J.L. (2001). *Forensic Entomology—The utility of arthropods in legal investigation*. CRC Press, USA.
- Greenberg, B. (1971). *Flies and disease*. Princeton University Press, Princeton, NJ.
- Greenberg, B. & Kunich, J.C. (2002). *Entomology And The Law: Flies As Forensic Indicators*. Cambridge University Press, UK.
- Hamid, N.A., Omar, B., Marwi, M.A., Salleh, A.F.M., Mansar, A.H., Siew, S.F. & Moktar, N. (2003). A review of forensic specimens sent to Forensic Entomology Laboratory Universiti Kebangsaan Malaysia for the year 2001. *Tropical Biomedicine* **20**(1): 27–31.
- Heo, C.C., Marwi, M.A., Salleh, A.F.M., Jeffery, J. & Omar, B. (2007). A preliminary study of insect succession on a pig carcass in a palm oil plantation in Malaysia. *Tropical Biomedicine* **24**(2): 23–27.
- Heo, C.C., Marwi, M.A., Salleh, A.F.M., Jeffery, J., Kurahashi, H. & Omar, B. (2008a). Study of insect succession and rate of decomposition on a partially burned pig carcass in an oil palm plantation in Malaysia. *Tropical Biomedicine* **25**(3): 202–208.
- Heo, C.C., Marwi, M.A., Jeffery, J., Kurahashi, H. & Omar, B. (2008b). On the occurrence of *Musca domestica* L. oviposition activity on pig carcass in peninsular Malaysia. *Tropical Biomedicine* **25**(3): 252–253.
- Ishijima, H. (1967). Revision of the third stage larvae of synanthropic flies of Japan (Diptera: Anthomyiidae, Muscidae, Calliphoridae and Sarcophagidae). *Japanese Journal of Sanitary Zoology* **18**(2–3): 47–100.
- Kurahashi, H., Benjaphong, N. & Omar, B. (1997). Blow flies (Insecta: Diptera: Calliphoridae) of Malaysia and Singapore. *Raffles Bulletin of Zoology* **5**: 1–88.
- Lectercq, M. (1969). *Entomological Parasitology: the Relations Between Entomology and Medical Science*. Pergamon, Oxford.
- Lee, H.L. (1989). Recovery of forensically important entomological specimens from human cadavers in Malaysia. *Malaysian Journal of Pathology* **11**: 33–36.
- Lee, H.L. (1996). Recovery of forensically important insect larvae from human cadavers in Malaysia. *Malaysian Journal of Pathology* **18**(2): 125–127.
- Lee, H.L., Abdullah, A.A. & Cheong, W.H. (1984). The use of fly larvae from human corpses in determining the time of death: A review and some technical considerations. *Journal of Medical and Health Laboratory Technology of Malaysia* **9**: 15–17.
- 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): 69–75.
- Nazni, W.A., Lee, H.L., Sofian-Azirun, M. & Sadiyah, I. (2003). Guidelines for fly control. *Tropical Biomedicine* **20**(1): 59–63.

- Omar, B., Mohd, A.M., Oothuman, P. & Othman, H.F. (1994a). Observation on the behaviour of immatures and adults of some Malaysian sarcosaprophagous flies. *Tropical Biomedicine* **11**(2): 149–153.
- Omar, B., Marwi, M.A., Mansar, A.H., Rahman, M.S. & Oothuman, P. (1994b). Maggots of *Synthesomyia nudiseta* (Wulp) (Diptera: Muscidae) as decomposers of corpses found indoors in Malaysia. *Tropical Biomedicine* **11**(2): 145–148.
- Omar, B., Marwi, M.A., Ahmad, A., Zuha, R.M. & Jeffery, J. (2003). Synanthropic index of flies (Diptera: Muscidae and Calliphoridae) collected at several locations in Kuala Lumpur and Gombak, Malaysia. *Tropical Biomedicine* **20**(1): 77–82.
- Salleh, A.F.M., Marwi, M.A., Jeffery, J., Hamid, N.A.A., Zuha, R.M. & Omar, B. (2007). Review of forensic entomology cases from Kuala Lumpur Hospital and Hospital Universiti Kebangsaan Malaysia, 2002. *Journal of Tropical Medicine and Parasitology* **30**: 51–54.
- Smith, K.G.V. (1986). *A Manual of Forensic Entomology*. Comstock Publishing Associates, New York. pp. 125.
- Sukontason, K., Sukontason, K., Vichairat, K., Piangjai, S., Lertthamnongtham, S., Vogtsberberg, R.C. & Olson, J.K. (2001a). The first documented forensic entomology case in Thailand. *Journal of Medical Entomology* **38**(5): 746–748.
- Sukontason, K., Vogtsberber, R.C., Sukontason, K., Olson, J.K., Lertthamnongtham, S. & Piangjai, S. (2001b). Surface ultrastructure of the third-instar larvae of *Hydrotaea spinigera* Stein (Diptera: Muscidae), a fly species of forensic importance. *Journal of Vector Ecology* **26**(2): 191–195.
- Vitta, A., Pumidonming, W., Tangchaisuriya, U., Poodendean, C. & Nateeworanart, S. (2007). A preliminary study on insects associated with pig (*Sus scrofa*) carcasses in Phitsanulok, northern Thailand. *Tropical Biomedicine* **24**(2): 1–5.