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RECOVERY OF FORENSICALLY IMPORTANT ENTOMOLOGICAL.SPECIMENS FROM HUMAN CADAVERS IN MALAYSIA – AN UPDATE

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Summary

A total of 101 entomological specimens recovered from human cadavers were processed and studied. Analysis of the data indicated that about 95% of the these specimens were maggots of flies. Maggots of the blowfly *Chrysomya* (Family: Calliphoridae) especially *Ch. rufifacis* and *Ch. megacephala* were predominantly found in 77 cases (76.2%) while larvae of several other flies of the genera *Sarcophaga, Calliphora, Lucilia* and *Hermetia* were also recovered. It was notable that *Musca domestica* or other related flies were not found in all these specimens. The age of these larvae was useful in the determination of the minimum time lapsed after death. However, more biological studies on animal carcases should be conducted for more accurate determinations. Methods of collection, preservation and despatching of specimens were also discussed.

Key words: Forensic, entomology.

INTRODUCTION

The recovery of entomological fauna from human corpses is one of the important features of forensic investtigations. These fauna may include a great variety of arthropods such as fly maggots (larvae), beetles, certain species of Hymenoptera, mites and other arachnids. Useful information and data can usually be derived by careful studies of the biology and bionomics of these arthropods, but by far, most studies focused on the potential use of fly larvae, which occur frequently in corpses, for the determination of minimum time of death. In forensic medicine, several methods such as changes in body temperature, development and loss of rigor mortis, chemical changes and forensic entomology are often employed to enable the pathologist to determine the time elapsed after death. Of these techniques, the use of entomological specimens (especially fly larvae which are frequently associated with corpses) is perhaps the simplest as well as being a fairly precise one. Usually, the time of death can be obtained by studying the species, stage of growth and life cycle of the fly recovered from corpses. Such a technique has been used extensively since the publication of Megnin's pioneering works in 1894.' This subject has also been extensively reviewed by several workers. [2,3,4] Nevertheless, these works were mostly conducted in Europe and North America where conditions are vastly different from the tropics such as countries like Malaysia. Unfortunately, similar work on this subject is extremely scarce in this part of the world. In Malaysia, Lee *er al*[5] has reported several observations pertaining to this aspect. In view of the fact that many more specimens are received in the past 5 years, it becomes necessary to update previous observations as reported by Lee *et al.*5

MATERIALS AND METHODS

A total of 101 samples were received from clinicians from various hospitals in Peninsular Malaysia as well as Sabah and Sarawak from January 1973 to August 1988. In all cases, the entomological speciniens when received were processed immediately by the following procedures.[5] The larvae were first cleared by soaking in 10% KOH solution in a covered glass-block for 4 – 24 hours depending on the types of specimen. The larvae were then rinsed thoroughly with distilled water and transferred carefully to 10% acetic acid for 30 minutes to neutralise the alkaline solution. They were later soaked in a small dish of distilled water and during this tune. a small incision was cut transversely at the last segment to remove all larval internal organs in order to facilitate taxonomic studies. The last segment of fly larvae which contains the posterior spiracles – an important taxonomic feature – was cut off completely so that it could be mounted separately for more detailed microsccpic studies. The larva and the detached segment were then dehydrated by soaking in ascending series of ethanol for 30 minutes in each concentration. After complete dehydration, these speciniens were then cleared in clove oil for 30 minutes, rinsed briefly with xylene and then mounted on a glass slide using Canada balsam. The slides were dried in an oven at 30°C for 24 hours. Identification of the larvae were accomplished by studying the anterior and posterior spiracles. the cephalopharyngeal skeleton and other

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TABLE 1

OCCURRENCE OF VARIOUS INSECTS IN HUMAN CADAVERS IN MALAYSIA

	Identification	Total No. Cases (%)
1.	*Chrysomya* only	56 (55.4)
2.	*Chrysomya* + other fly larvae	24 (23.8)
3.	*Sarcophaga* only	2 (1.98)
4.	*Sarcophaga* + other fly larvae	2 (1.98)
5.	*Calliphora* only	4 (3.96)
6.	*Lucilla* only	3 (2.97)
7.	*Hermetia* only	5 (4.95)
8.	Phoridae (Hump-backed fly)	1 (0.99)
9.	Coleoptera (Beetles)	2 (1.98)
10.	No larvae seen.	2 (1.98)
	Total :	101

taxonomic features using standard identification charts and keys.

RESULTS

Identification of entomological specimens recovered from corpses indicated that about 95% of these were fly maggots belong to different families of the order Diptera (Table 1). Of these, the blow-fly larvae of the genus *Chrysomya* (Family: Caliiphoridae) were the most common, being found in 76.2% of all cases studies so far (Table 2). Two species, namely *Ch. rufifacis* and *Ch. megacephala* were commonly found either as single colonies or mixed infestations in human corpses. Other blow-flies including *Calliphora* and *Lucilia* were also found in sporadic cases, while maggots of the flesh-fly *Sarcophaga* (Family: Sarcophagidae) and the soldier-fly *Hermetia* (Family: Stratiomyiadae) were also seen (Tables 3 & 4). From our experience, the latter was often recovered in large number from highly decomposed and old corpses, It was notable that no larvae of *Musca domestica* (common housefly) or other related flies were seen. Posterior spiracles of several flies are shown in Figs. 1, 2 and 3.

TABLE 2

TYPES OF *CHRYSOMYA* MAGGOTS COLLECTED FROM HUMAN CORPSES IN MALAYSIA

	Identification	No. cases (%)
1.	*Chrysomya rufifacis*	14 (13.9)
2.	*Chrysomya megacephala*	28 (27.7)
3.	*Ch. rufifacis* + *Ch. Megacephala*	21 (20.8)
4.	*Ch. bezziana*	1 (0.99)
5.	*Chrysomya* sp.	13 (12.9)
	Total :	77 (76.2)

TABLE 3

OCCURRENCE OF *CHRYSOMYA* WITH OTHER FLY MAGGOTS IN HUMAN CORPSES.

	Identification	No. cases (%)
1.	*Chrysomya megacephala* + *Sarcophaga* sp.	1 (0.99)
2.	*Chrysomya* sp. + *Hermetia* sp.	1 (0.99)
3.	*Ch. megacephala* + *Lucilia* sp.	1 (0.99)
	Total :	3 (2.97)

TABLE 4

OTHER FLY MAGGOTS RECOVERED FROM HUMAN CORPSES

	Identification	No. cases (%)
1.	*Sarcophaga* sp. + *Lucilia* sp.	2 (19.8)
2.	*Sarcophaga* sp.	2 (19.8)
3.	*Calliphora* sp. + *Calliphora* vicina	2 (19.8)
4.	*Calliphora* sp.	2 (19.8)
5.	*Hermetia* sp.	5 (4.95)
6.	*Lucilia* sp.	3 (2.97)
7.	Phoridae (Hump-backed fly)	1 (0.99)
8.	Coleoptera (Beetles)	2 (19.8)
9.	No larvae seen	2 (19.8)
	Total :	21 (20.8)

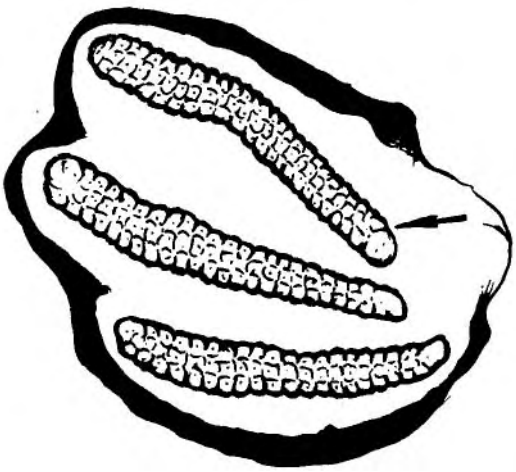

FIG. 1: Larval posterior spiracle of ***Sarcophaga.*** Note the long and slender spiracular slits (arrow). 400X

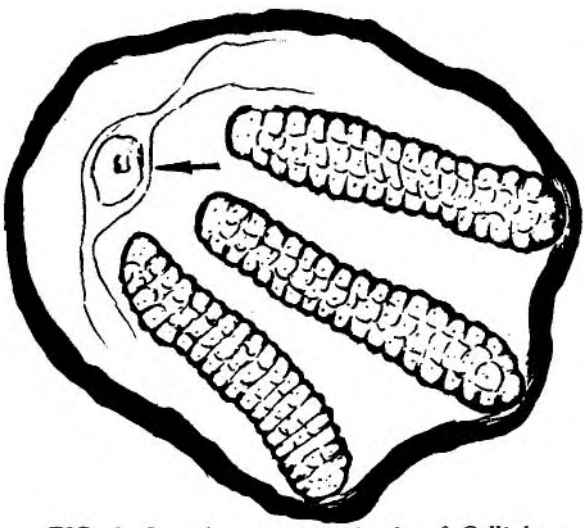

FIG. 2: Larval posterior spiracle of *Calliphora.* The position of the "button" is shown (arrow). 400X

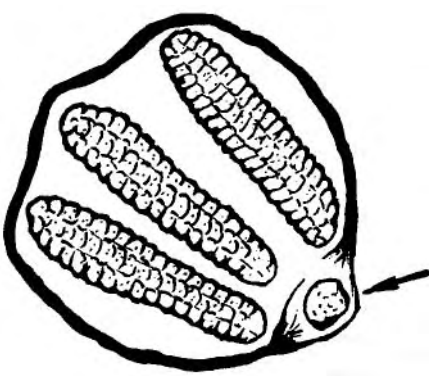

FIG. 3: Larval posterior spiracle of *Lucilia.* Note the position of the button (arrow). 400X

DISCUSSION

Although analysis of the data revealed that about 95% of the forensically important entomological specimens were fly larvae, in view of the rapid rate of decomposition of corpses under tropical conditions, it is highly probable that many other arthropods associated with corpses are present. These arthropods, which include beetles, body lice *(Pediculus humanus),* head lice ***(P, capitis),*** crab lice ***(Pthirus pubis),*** acarids such as the hair follicle mites, ***Demodex*** *folliculorum* and ***D. brevis*** are all host-specific to man and may have certain forensic significance.[4] With the exception of beetles, the importance of these arthropods has always been underestimated by forensic investigators mainly because of their extremely inconspicuous sizes compared with other entomological fauna in the corpses. More attention should be paid to these tiny arthropods for more detailed analysis.

The single case of *Chrysomya bezziana* was of special interest since larvae of this fly habitually breed in live human or vertebrate tissues causing a pathogenic condition known as "myiasis".[6] The presence of this fly indicated either a fresh corpse or the deceased may have been infestated with wound myiasis prior to death. It was also noteworthy that no larvae of ***Musca domestica*** were seen in contrast to the findings of Lectercq[2] in Europe where the first wave of fly larvae in cadavers were inclusive of ***Musca*** *domestica,* ***M.*** *corvina* and related flies.

Since the calliphorine flies of *Chrysomya* were found in 76.2% of all cases, the biology of these flies are therefore clearly important. The detail life-cycles of ***Ch.*** *rufifacis* and ***Ch.*** *megacephala* have been well-studied in our laboratory in rearing experiments, in which hour-to-hour development was observed and recorded carefully (Lee. unpublished). Both flies developed very fast in meat medium. One generation time for *Ch. rufifacis* is ***9*** days while ***Ch.*** *megacephala* takes as short as 7.15 days to complete 1 cycle at 30 ± 2°C and relative humidity of 85 ± 5%. The biology of other flies such as *Sarcophaga* was also well-studied in our laboratory (Lee, unpublished). This information undoubtedly is extremely useful for the estimation of the age of larvae and hence the determination of the minimum time lapse after death. However, certain other information is still lacking. This includes data on the succession of these fauna in corpses and biological studies of other insects such as beetles. These studies, though unsuitable to be conducted on human corpses

due to ethical reasons, should be carried out in carcases of large animals such as sheep, pigs or dogs, as have been done in Australia.'

Certain guidelines may be proposed here so that optimum information can be derived from these studies. It is suggested that the investigator should collect immediately at the scene of death at least a representative sample of 20 – 30 larvae randomly from various parts of the corpse using blunt-end forceps. Collection should be done as soon as possible since the corpse may be infested with a new wave of maggots or other arthropods when moved to the mortuary. Half of these collected larvae should be killed immediately in warm water of about 60°C. Boiling water must be avoided at all cost as this may char and blacken the larvae thus masking many taxonomic features and rendering detailed identification difficult. These dead larvae are then preserved directly in 70% ethanol in a small bottle (such as universal bottle), capped and sealed securely and properly labelled. All other solutions such as formaldehyde and saline should be avoided. The remaining larvae should then be transferred into a small capped bottle in which a piece of meat is added as food. Air holes should be made on the cap. These bottles are then packed carefully in a small box (with air holes) and despatched to the entomology laboratory concerned. On receipt, the preserved larvae will be processed immediately, while the live larvae can be reared to adults to confirm identification as well as used in rearing experiments for further studies. The presence of pupae in the corpse should be examined for in preferred places such as the soil beneath the corpse or in the immediate vicinity. The collected pupae should not be killed but should be kept in an airholed and capped bottle and despatched immediately. In all cases, duly filled forms with useful information such as the date and time of collection, and nature of specimen should accompany each specimen.

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