

FORENSIC ENTOMOLOGY - A GUIDE TO POST-MORTEM INTERVAL

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ABSTRACT

Since many insects are associated with the human body after death, they are always a potential source of evidence in case of murders or suspicious deaths. They are also potentially useful as evidence in situations other than murder cases. Despite this great potential, however, the field of forensic entomology remains obscure in our country, largely because of lack of awareness of the benefits that may accrue from its application and hesitation on the part of others to do a proper post-mortem examination in cases infested with maggots. Some questions that may be answered using forensic entomological techniques include time, place, and cause of death; when burial occurred; how long a body remained submerged under water; and when the body was placed in a certain given spot. This study involves the application of forensic entomology for crime scene investigations based on the use of insect evidence in determining post-mortem interval. This study involves examination of the insects involved in the decay of corpses, the collection of insect evidence and its use in predicting the post-mortem interval. In this ongoing study more than twenty cases have been studied so far. Interesting and valuable findings of this study are being presented in this paper.

Keywords : Forensic entomology, Post-mortem interval, Entomology, Maggots, Larvae, Insects, Flies.

INTRODUCTION

The examination of entomological evidence or insect infestation on human corpses/remains can provide estimates of the time of death or post-mortem interval. Forensic entomology is receiving increasing interest of investigators, forensic specialists, coroners, medical examiners, and pathologists. They focus on the criminal component of the legal system and dealing with the necrophagous, feeding insects. Insects can be of significant importance in cases of badly decomposed and unidentified remains and with an

undetermined time of death. [1]

Forensic entomology is the name given to any aspect of the study of insects and their arthropod counterparts that interacts with legal matters. This branch of science is also called as medico-legal entomology, sometimes termed "forensic medical entomology," and in reality "medico-criminal entomology" (because of its focus on violent crime), relates primarily to determination of time (post-mortem interval) or site of human death and possible criminal misuse of insects [2].

Maggots and corpses go together. For many

years, the "worms" crawling in the eyes, nose, and other orifices and wounds on dead bodies were considered just another disgusting element of decay, something to be rinsed away as soon as the corpse was placed on the table for autopsy. While ballistics, firearm examination, bite marks, gunpowder residue chemistry, blood analysis, and other elements of scientific criminology were studied and refined, the insects associated with death scenes were largely ignored. [3]

The potential for contributions of entomology to legal investigations has been known for at least 700 years, but only within the last decade or so has entomology been defined as a discrete field of forensic science. [3]

Forensic Entomology, as defined by University of Florida entomologist Jason Byrd, is "the use of the insects, and their arthropod relatives that inhabit decomposing remains to aid legal investigations." [4] Said in the words by the American Board of Forensic Entomology, "it's using insect evidence to uncover circumstances of interest to the law." [5]

Insect life cycles act as precise clocks which begin within minutes of death. They can be used to closely determine the time of death, especially useful when other methods are useless. They can also show if a body has been moved after death. The time of death, can usually be determined using insect evidence gathered from and around a corpse, if the evidence is properly collected, preserved and analysed by an appropriately experienced forensic entomologist. [6]

One of the first groups of insects that arrive on a dead body is the blowflies (Diptera: *Calliphoridae*). Usually the females lay eggs within hours after death. The blowfly goes through the following stages during its life history: egg, 3 instars larvae, pre-pupae, pupae within puparium, imago. If we know how long it takes to reach the different

stages in an insect's life, we can calculate the time since the egg was laid. This calculation of the age of the insects can be considered as an estimate of the minimum time of death. But even if the estimate of the insect age is correct, the death of the victim (usually) occurred before the eggs were laid. This period is quite variable and depends on temperature, time of day the death occurred, time in year the death occurred, whether the corpse is exposed or buried in soil or immersed in water. As a general rule insects will lay eggs on a corpse within few hours after the corpse is available for insects. Insects can also be of help in establishing whether the corpse has been moved after death, by comparing local fauna around the body, and the fauna on the body. [7, 8] However, after three days, insect evidence is often the most accurate and sometimes the only method of determining elapsed time since death. [9]

MATERIAL & METHODS

The material for the ongoing study comprised of 20 cases, where the dead bodies had evidence of presence of the insects or their immature stages on them. The study included the dead bodies brought to the mortuary of the Govt. Medical College & Rajindra Hospital, Patiala in the year 2003.

Collection of specific material evidence in the form of the insects, maggots, pupae and related material was done from various parts of the body. Both dead and live insects at all stages of development were collected for study. The samples were preserved in 70% alcohol. The live samples were kept with food and air in separate containers.

Method of the study comprised detailed particulars and circumstantial evidence of the deceased from the police inquest papers and from the relatives and other persons accompanying the dead body. Other important data related to the climate and geography of the site was collected.

Post-mortem examination was done to know the cause, manner and mode of death, and time since death as determined from other findings. The insect evidence collected was studied to calculate and determine the time since death. All the data and findings were recorded in the standard proforma and the data so collected was analysed.

OBSERVATIONS & RESULTS

The data collected in respect of 20 cases showed that 8 cases were of unknown persons and in 12 cases identity was known. Of these 3 were females and 17 were males. The ages were 10-20 years in 3 cases, 20-30 years in 5 cases, 30-40 years in 7 cases, 40-50 years in 1 case, 50-60 years in 3 cases and 1 case was more than 60 years of age.

Of the 20 cases clothing was partial in 13 cases, complete in 5 cases and no clothes were

present on 2 bodies.

The areas where the bodies were found were urban open areas in 2 cases, urban closed buildings in 4 cases, flowing water or irrigation canals in 5 cases, stagnant water in 1 case and rural open areas in 8 cases.

According to stage of decomposition 3 cases showed skeletonisation and 12 cases showed bloating and active decomposition, while 5 cases were dead bodies 1-2 days old.

No cases were reported in January, 2 cases were reported in February, none in March, 3 in April, 1 in May, none in June, 3 in July, 4 in August, 4 in September, 3 in October and no cases were reported in November and December.

Injuries were present in 12 cases and more infestation of maggots was found in these areas of the body and also the dark moist areas and orifices



Fig. 1



Fig. 2

Oldest Stage of life-cycle	Approx. Size (mm)	PMI from Entomology (minimum) as per diff. studies	Days since last seen alive	PMI from other decomposition changes
Eggs	2	12-36 hrs	2 1/2 - 2 -	1-2 days (bloating, distal rigor mortis RM) 1/2-1 day (rigor mortis all over) ~2 days (marbling. bloating, skin peeling) ~2 days (marbling. bloating, skin peeling) ~1 day (rigor mortis all over except eyelids)
Larva 1st	5	1-2 days	- - 2	1-2 days (marbling. bloating, RM absent) 1-2 days (marbling. bloating, RM absent) 1-2 days (marbling. bloating, RM absent)
Larva 2nd	10	2-3 days	- - 5	3-7 days (teeth & skull sutures loose) 3-7 days (teeth & skull sutures loose) 3-7 days (teeth & skull sutures loose)
Larva 3rd	20	3-7 days	8 8 7	~1 week 3-5 days ~1 week teeth & skull sutures loose liquefaction started
Puparium	10	8-18 days	- 15 16	2-3 weeks (all viscera liquefied) 1-2 weeks (liquefaction present) 1-2 weeks (liquefaction present)
All stages		18-24 days	50 150 -	3 wk-3mth (skeletonisation) ~1 month (skeletonisation) ~1 month (skeletonisation)

of the body like nostrils, eyes, genitals and hairy areas.

The earliest deposition of eggs by the flies was found to be at 12 hours after death in a case of hospital death shifted to the mortuary. The eggs were found to be deposited earliest in the eyes and nostrils in this case. The infestation was found to be earliest in the moist orifices and folds of the body and importantly, in the wounds.

The PMI determined from entomological evidence was found to be useful in giving the probable time since death in the post-mortem report. It was found to be a specially useful between 2-18 days after death. The range determined was found to be more appropriate. Out of the 20 cases studied the PMI given in reports would have been more accurate in 14 cases if the insect evidence had been correlated.

The later stages had to be co-related to the stage of decomposition and post-mortem interval estimated from the other findings.

The insects found were mostly flies (blue-flies and green-flies) and in some cases beetles and cockroaches were also found.

CONCLUSIONS

Forensic entomologists are being increasingly called upon to apply their knowledge and expertise in criminal and civil proceedings and to become part of forensic laboratories and medico-legal investigation teams. Insect evidence collected from and around the body of a victim of untimely death when properly collected, preserved, and analysed by an experienced and appropriately trained forensic entomologist, can provide an accurate estimate of the victim's time of death and other valuable information.

Insects can be a valuable tool in investigations of homicide, suicide, untimely death, and other violent crimes.

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