Determination of Death Time Duration of Dead Body Using Maggots

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Abstract: The use of maggots has provided to be an important factor in death time duration. Estimation of the postmortem interval (PMI) using faunal diversity, development and succession in human death investigations is based on a number of assumptions. In present study, maggots of House fly (*Musca domestica*) in case-I and maggots of Blow fly (*Calliphora vomitoria*) in case-II was sent in the Forensic Science laboratory, Madhuban, Karnal. For determination of death time duration of a dead body CRIME SOLVING METHOD (Smith, 1986) was followed. In both cases length of five number of maggots was measured with scale in millimeters. In case-I, it is varied from minimum 18mm (length of number 1 maggot) to maximum 26mm (length of number 4 maggot) with an average 22.60mm. It is examined average death time duration also varied from minimum 8 day (number 1 maggot) to maximum 10 day (number 4 maggot) with an average 9 day. Similarly, in case-II length of five number of maggots varied from minimum 28mm (length of number 1 maggot) to maximum 32mm (length of number 2 maggot) with an average 29.80mm. It is examined average death time duration also varied from minimum 10 day (number 1 and 4 maggot) to maximum 12 day (number 2 maggot) with an average 10.8 day.
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1. Introduction:

The four development stages through flies and many other insects passed is called complete metamorphosis. Here, the insect hatches from an egg into a white grub, called a larva or a maggot, which crawls like caterpillar and actively consumes food to grow quickly. The insect will pass through several stages during this process. Every time it completes a stage, it must shed a tough or hard exoskeleton and hus molt. Upon reaching larval maturity, the maggot will darken and turn into an immobile pupa. The pupa may look inactive, but many changes are occurring inside the casing. Soon, a winged adult fly emerges. The adults will then mate, and the females will lay more eggs onto corpses. The adult females often search out the natural body openings for this. This means that eggs and larvae begin feeding in the head region first (mouth, nostrils, eyes, ears), followed by the excretory and reproductive openings. The trunk of the body is invaded much later in the process.

Maggots or larva are warm like creatures are little more than fleshy, section less tubes with hooked mouth parts. The mature larva is 3 to 9 mm long, typical creamy whitish in color, cylindrical but tapering toward the head. The head contains one pair of dark hooks. The posterior spiracles are slightly raised and the spiracular openings are sinuous slits which are completely surrounded by an oval black border. The legless maggots emerge from the eggs in warm weather within eight to 20 hours, and they immediately feed on and develop in the material where the eggs were laid. The full-grown maggots have a greasy, cream-colored appearance and are 8 to 12 mm long. The larvae go through three instars. When the maggots are full-grown, they crawl up to 50 feet to a dried, cool place near breeding material and transform to the pupa stage. High manure moisture favors the survival of house fly larvae.

The major contribution made by a forensic entomologists in a homicide investigation is an estimate of the duration of the postmortem interval (PMI). Some added contributions include indication of movement of the corpse, and possibly the manner of death. Estimating the PMI involves the setting of the maximal and minimal probable time interval between death and corpse discovery

The use of maggots has provided to be an important factor in investigation of death time duration. In the suspected case maggots are collected from the recovered died body and send in the Forensic Science Laboratory for identification of time duration of dead body after death.

2. Materials and methods:

For determination the death time scene, two human body case was solved in Forensic Science

laboratory, Madhuban, Karnal-132001 (Haryana, India).

Case I

A dead body of male aged 40 years was recovered from the bank of swimming pool of a hotel and it is referred for postmortem nearby Chandigarh civil hospital. The death was in suspected. Parents of dead body explained that this is not a natural death but it is an incident. For identification time duration death of dead body, maggots (*Musca domestica*) recovered from the dead body and sent in Forensic Science Laboratory, Karnal (table 1).

Weather Report: Daytime temperatures have been average over the past three weeks, ranging from 80 to 93º F.

Case II

A dead body of male aged 22 years was recovered from the roadside and it is referred for postmortem nearby Yamuna nagar civil hospital. The death was also in suspected. For estimation time since death of dead body, maggots (*Calliphora vomitoria*) recovered and sent in the Forensic Science Laboratory, Karnal (table 2).

Weather Report: Daytime temperatures have been average over the past three weeks, ranging from 70 to 80º F. Temperatures in the woods would be approximately 5 degrees cooler due to the lack of sun in the shady environment.

Collection and preservation of maggots based on Kulshrestha & Chandra (1987). Among two methods pertinent in using the entomological evidence first is measurement of larvae, which provides very useful findings for forensic estimations. The development of body length (millimeters) of fly larvae over corresponding days has been recorded at different temperatures and humidity. On the basis of variation in the length of larvae, a scale relating to their maturation in prevailing environment can be drawn, which shall certainly be used as an aid in estimating the age of larval growth by studying the specimens. The second method adopted for study was the rearing of fly larvae in to adults, to calculate the 'Time Since Death' of infested body on the basis of total developmental time. Here for investigation of death time of a dead body CRIME SOLVING METHOD (Smith, 1986) was followed.

Table 1. Recovered maggots from the dead body of both cases.

	House fly (*Musca domestica*) (length)	Blow fly (*Calliphora vomitoria*) (length)
Case-I	16mm-22mm	-
Case-II	-	26mm-30mm

3. Results and Discussion:

The emphasis here will be on the early successional arthropods, primarily blow fly (Diptera: Calliphoridae). Blow fly are generally the most dominant, and conspicuous insects in the decomposition process, and their occurrence and biology are used most often in making a post mortem interval (PMI) estimate. At present PMI estimates are drawn from a few baseline studies (Kamal, 1958; Greenberg, 1991). Three patients died, one as a result of an accident, and two as a result of underlying disease (progression of cancer and a haematological disorder). The death time duration of a body determined by applying maggots. Initially, dead body of with the first three patients, maggots were put freely on the wound covered by a net, but after 3–4 days, when maggots grow up to 8–10 mm and these are examined that time duration (Steenvoorde and Jukema, 2004).

Nandy (2010) and Dixit (2007) reported peak level in between 36 to 48 hours after death, while Mukherjee (1994) noted the rising titre in the first two to three days after death by using maggots. Reddy (2010) reports 20 times death time duration in 48 hours after death by using maggots.

Smith (1986) studied the life cycle of house fly (*Musca domestica*) and blow fly (*Calliphora vomitoria*) on died body with temperature 70 to 80 º F. He examined in case of house fly (*Musca domestica*) maggots attain length 6mm (4 day after death), 12-16mm (7 day after death), 21-25mm (9 day after death), 26-29mm (12 day after death) and adult 30-32mm (18 day after death). He also examined blow fly (*Calliphora vomitoria*) maggots attain length 9-11mm (2 day after death), 17-20mm (6 day after death), 26-30mm (10 day after death), 31-35mm (13 to 20 day after death) and adult 36-38mm (21 day after death).

In present study, length maggots of House fly (*Musca domestica*) in case-I and Blow fly (*Calliphora vomitoria*) in case-II was measured in the Forensic Science laboratory, Madhuban, Karnal.

In case-I length of five number of maggots was measured with scale in millimeters. It is varied from minimum 18mm (length of number 1 maggot) to maximum 26mm (length of number 4 maggot) with an average 22.60mm. It is examined average death time duration also varied from minimum 8 day (number 1 maggot) to maximum 10 day (number 4 maggot) with an average 9 day.

Table 2 Average length (mm) of maggots with day after death in case-I.

House fly (*Musca domestica*)		
S.N.	Length (mm)	Day after death
1	18	8
2	21	9
3	24	9
4	26	10
5	24	9
Average	22.60	9

Similarly, in case-I length of five number of maggots of case-II varied from minimum 28mm (length of number 1 maggot) to maximum 32mm (length of number 2 maggot) with an average 29.80mm. It is examined average death time duration also varied from minimum 10 day (number 1 and 4 maggot) to maximum 12 day (number 2 maggot) with an average 10.8 day.

Table 2 Average length (mm) of maggots with day after death in case-II.

Blow fly (*Cilliphora vomitoria*)		
S.N.	Length (mm)	Day after death
1	28	10
2	32	12
3	30	11
4	29	10
5	30	11
Average	29.80	10.8

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