



Forensic Entomology

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ABSTRACT

The close relationship between insects and corpses and the use of insects in medicocriminal investigations comes under forensic entomology. The paper reviews the scientific basis underlying attempts to determine the time interval since death. By using medical method like measurement of body temperature or analyzing liver and rigor mortise, time since death can only be accurately measured for the first two or three days after death. By calculating the age of insects which are feeding on the dead body. The entomological method can be hampered in species identification but it can be overcome by modern DNA techniques. Right from early stages insects are attracted to the decomposing body and lay eggs in it. Postmortem index can be estimated by studying stages of insects population.

KEYWORDS : insects, medicocriminal, postmortem index, measurement, DNA technique

1. INTRODUCTION

Study of insects and arthropods in criminal investigations is called forensic entomology. Insects are more attracted towards decomposed, dead decaying matters. To estimate postmortem index, forensic scientist by studying insects development and their larval stages. It is very useful in solving the criminal cases.

Forensic entomology studies insects and arthropods in criminal cases. The colonies of insects are used to determine the time of death, time of interval between death and corpse discovery, cause of death and suspects at the death scene. The morphology of insects, colonies, their larval stages are studied to solve the criminal cases.

"The washing away of wrongs" a book written by sung tzu's in which there is description of very first case of use of insects in criminal investigations. A former was found dead in the crop field with sickle and all

suspected individuals were told to put their sickle on ground, only one sickle was attracted by blow flies to trace amount of blood which was not seen by naked eyes.

In 18th century, first application of forensic entomology was presented in court. Autolysis of cells start as soon as death occurs (degrading of cells). The bacteria of gastrointestinal tract start decomposing and produces various gases like hydrogen sulphide, carbon dioxide, methane, ammonia, sulphur dioxide. Researchers use these gases to study different stages of dead body. These gases and volatile liquid attract flies for decomposition.

ROLE OF FORENSIC ENTOMOLOGISTS

- Identification of insects at various stages of life cycle.
- collection and preservation of insects as evidence

- Determining and estimate for post- mortem interval or PMI (the time between death and discovery of body using factors such as insects evidence, weather conditions etc.
- testifying in the court to explain insects related evidence found at a crime scene.

The forensic entomologists can use a number of different techniques including species succession, larval weight ,larval length and a more technical method accumulated degree hour technique which can be very precise, if the necessary data is available.

By looking at the insects that are feeding on and around the dead body relevant information can be determined

Flies – flies are the first one to get attracted towards the dead bodies. Carron flies includes *Calliphoridae* (blow flies), *Sarcophagidae*(flesh flies) and *Muscidae*(house flies) belong to order – diptera. Usually three types of flies lay eggs; common house flies(*Musca domestica*), green bottle flies(*Lucile Sericata*) and blue bottle fly(*calliphoravomitioria*). These are most wide spread and accurate insects for determining time of death.

Beetles–these are often found on old cadavers, or in dry conditions. Beetles includes silphidae(Rove beetles) and Dermestids (carpet beetles) belong to order Coleoptera.

Ants–these are generally consume smaller cadavers and belong to order Hymenoptera. All these insects belong to class insecta of phylum Arthropoda

Blow fly life cycle stages

- firstadult flies lay eggs on the carcass especially at wound areas or around the openings in the body such as nose, eyes, ears, anus etc.
- second –eggs hatch into larva(maggot) in 12 – 24 hrs
- third – Larvae continues to grow by feeding on corpse and molt (shed their exoskeleton) as they pass through the various instar stages.

◦ 1st instar stage – is 5mm long after 1.8 days

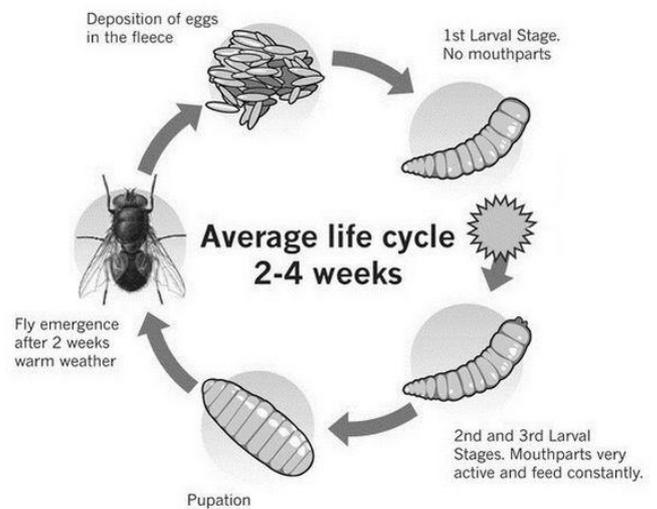
◦ 2nd instar stage – is 10mm long after 2.5 days

◦ 3rd instar stage – is 14 – 16 mm long after 4- 5 days

◦ 4th instar stage – the larvae (17mm) once it gets satiated develop into pupae after burrowing in surroundings soil.

◦ 5thinstar stage – adult flies emerge from pupae after 6 – 8 days

Life Cycle of Blowfly



Pic source- pinterest.com

Bodies grow through five general stages of decomposition and this information can aid investigation in estimating the PMI

1. Fresh stage:- (Day 1-2) It begins at the moment of death and ends when the bloating of the carcass is observed. In this autolysis occurs but morphological changes do not occur at this point. Insect were seen attracted within the first 10 min of death. Cellular breakdown occurs during this stage without morphologic alterations .
2. Bloated stage:- (Day 2-7) Putrefaction begins at this stage. Gases produced by the metabolic activities of anaerobic bacteria cause an inflation of the abdomen and the carcass forming a balloon like appearance during the later part of adult Diptera were attracted to the carcass during this stage.
3. Decay stage:- (Day 5-13)Abdominal wall is penetrated, resulting in the deflation of the carcass and ending the Bloated stage. The internal temperature rises to 14 degrees above the ambient temperature, Followed by a drop signifying the end of the decay stage. There is conversion of carcass Biomass to dipteran larval Biomass. The larvae subsequently depart from the carcass to pupate.
4. Post- decay stage:- (Day 10-23) In this most of the Diptera larvae the carcass , leaving behind bones,

cartilage, hair, small portions of tissue and a large amount of wet, viscous material known as byproducts of decay (BOD).

5. **Remains stage:-** (Day 18-19) This stage is characterized by bones with little cartilage remaining and the BOD has dried up the transition from post decay to remains stage is gradual with declining adult and larval Diptera population.

Factors that affects growth rate of insects

1. **Temperature:-** higher the temperature, faster the insect will grow and develop into an adult
2. **Food quality:-** eating rich, nutritious food help larvae grow faster.
3. **Oxygen level:-** increasing oxygen concentration increases growth rate of insects.
4. **Day length/ season:-** many insects co- coordinate their developmental cycles with the seasons

Current perspective of forensic entomology

1. **Time of death(larval development)**
 - the first approach in estimation of time since death is the estimation of maggot developing in the body
 - for this purpose, the knowledge of life histories of flies of families Calliphoridae (blowfly), Sarcophagidae(flesh flies) and houseflies has an important application forensic medicine.
 - **Blow fly metamorphosis:-** blow flies are the gold standard forensic indicators. These are most useful in estimating of time of death. These are the ones that comes in first immediately after the body is dead and start to decompose. They have an incredible sense of smell. They have a complete life cycle which consists of egg, larva, pupa and adult stages known as complete metamorphosis.
2. **Time since death (faunal succession)**
 - faunal succession is the term used to describe the transition of colonizing species from one insect species to another, through different stages of decay.
 - flies arrive within minutes or hours of death as the body begins to give off. The odours of decomposition. Carrion beetles arrive within few days and dig underneath the body and begin feeding. Carpet beetles arrive once the corpse is

dried out sufficiently and begin to consume skin and hairs.

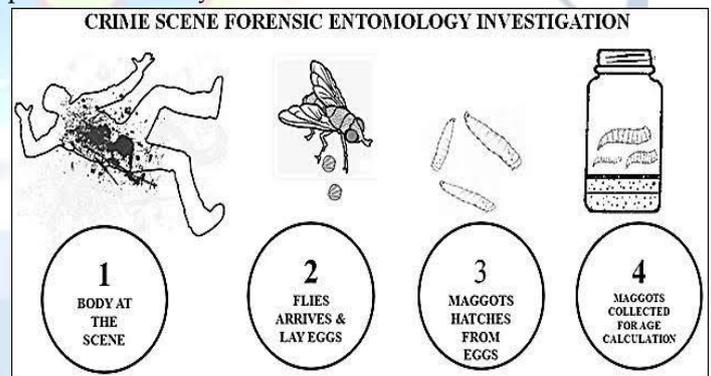
- succession is less precise science than PMI relying to some extent on the forensic entomologists prior knowledge of species over a wide range of families and is also reliant on knowledge of local fauna to asses the significance of the presence or absence of a particular species
- the faunal succession can vary significantly between individual cadavers and the arrival times of certain species are influenced by local factors.

3. Place of death

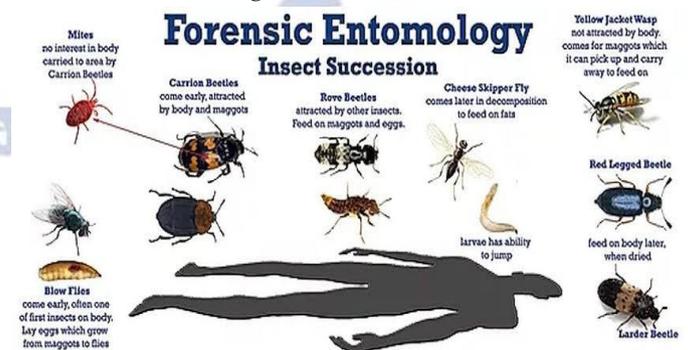
Since some of the species appear in a particular geographic area or a particular locality from the examination of insects, the particular geographic and ecological place can be known .

4.Manner of death

- Actual event that led to death is especially important in advanced purified bodies.
- if purified body has wounds infested with insects, it could be Homicide
- In cases of death due to suspected poisoning, by using arthropods in a corpse or at a crime scene, investigators can determine whether toxins were present in a body at the time of death.



Pic source:- researchgate.com



Pic source:- Quora.co

CONCLUSION

As the crime is increasing day by day like murders, suicides so ,the FORENSIC entomology emerge as a new innovative tool for solving criminal cases. Postmortem index is one of the important aspects in crime detection. Postmortem index can be estimated only within first 72 hrs of death by observing eggs ,1st,2nd ,3rd instar larvaepurpariaand adult flies. The proper interpretation of visiting insects on carrion can provide information in criminal case. The present work is an attempt to prepare the pioneer data on calliphoridaeand sarcophagidae visiting on carrion because these dipterans flies are most possible crime detectors.

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