Forensics Lesson 8

Forensic Entomology

Quiz Date:

Vocabulary



**Insects as Evidence**

**What do they do?**

* **Forensic** **entomologists** apply their knowledge of entomology to provide information for criminal investigations.

**A forensic entomologist’s job may include:**

* Identification of insects at various stages of their life cycle, such as eggs, larva, and adults.
* Collection and preservation of insects as evidence.
* Determining an estimate for the postmortem interval or PMI (the time between death and the discovery of the body) using factors such as insect evidence, weather conditions, location and condition of the body, etc.
* Testifying in court to explain insect-related evidence found at
* Maggots can be used to test a corpse for the presence of poisons or drugs.
* Some drugs can speed up or slow down the insect’s development.
* Forensic entomologists use their knowledge of **insects** and their **life cycles** and **behaviors** to give them clues about a crime.
* Most insects used in investigations are in two major orders:

 1 – Flies (**Diptera**) and

 2 – Beetles (**Coleoptera**)

**Species succession** may also provide clues for investigators.

* Some species may to feed on a fresh corpse, while another species may prefer to feed on one that has been dead for two weeks.
* Investigators will also find other insect species that prey on the insects feeding on the corpse.
* **Weather** data is also an important tool in analyzing insect evidence from a corpse. Investigators will make note of the temperature of the **air**, **ground** surface, the **interface area** between the body and the ground, and the **soil** under the body as well as the temperature inside any **maggot masses**.
* They will also collect weather data related to daily **temperature** (highs/lows) and **precipitation** for a period of time before the body was discovered to the time the insect evidence was collected.

**Other factors that might affect their PMI estimates:**

1. Was the body enclosed in an area or wrapped in a material that would have prevented flies from finding the corpse and laying eggs?
2. Were other insect species present that may have affected the development of the collected species?
3. Were there drugs or other poisons in or on the body that might have affected the larvae’s development?

**Blow Fly Metamorphosis**

* Blow flies are attracted to dead bodies and often arrive within minutes of the death of an animal.
* They have a **complete** life cycle that consists of **egg**, **larva**, **pupa**, and **adult** stages.

1st – Adult flies lay **eggs** on the carcass especially at wound areas or around the openings in the body such as the nose, eyes, ears, anus, etc.

2nd – Eggs hatch into **larva** (maggots) in 12-24 hours.

3rd– Larvae continue to grow and **molt** (shed their exoskeletons) as they pass through the various instar stages.

 1st Instar - 5 mm long after 1.8 days

 2nd Instar - 10 mm long after 2.5 days

 3rd Instar – 14-16 mm long after 4-5 days

4th – The larvae (17 mm) develop into pupa after burrowing in surrounding soil.

5th – **Adult** flies emerge from pupa cases after 6-8days.

**Examples of Diptera (Flies)**

**Early Stage Decomposition**

* Blow & Greenbottle Flies (Calliphoridae)

Metallic thorax and abdomen

* Flesh Fly (Sarcophagidae)

Striped thorax

**Late Stage Decomposition**

* House Fly (Muscidae)
* Cheese Skipper (Piophilidae)

**Examples of Coleoptera (Beetles)**

**Early Stage Decomposition**

* Carrion Beetles (*Silphidae)*

Adults & larvae feed on fly larvae

**Early to Late Stage Decomposition**

* Rove Beetles (*Staphylinidae*)

Predator of fly eggs

* Clown Beetles (*Histeridae*)

Predator of fly eggs

**Late Stage Decomposition**

* Ham & Checkered Beetles (*Cleridae*)

Predator of flies & beetles

also feed on dead tissue

* Skin Beetles (*Dermestidae*)

Feed on dried skin & tissues

* Hide Beetles (*Scarabidae*)

Usually the last to arrive

**Flies**

* The progression of insect life follows a **pattern**, and the developmental rates of flies are relatively **predictable**.
* The rate of insect development is influenced by temperature because insects are **ectothermic** (“cold blooded”), which means their body temperatures are largely dictated by the outside temperature.
* Only when the outside temperature warms an insect’s internal body temperature to its critical level can the insect become active (and eat and grow).
* The **postmortem interval**—the time between death and discovery of the corpse – can be estimated using insect evidence and temperature data along with other factors, such as the presence of drugs in a corpse and conditions related to the corpse itself (wrapped in a material, in a closed room, exposed to outside conditions, etc.)
* Not all **fly species** are found everywhere, and this can provide important information also.
* For example, the skipper fly, *Piophila nigriceps (pie-oh-FEEL-ah NYE-greh-cehps),* is found only in **urban** settings. House flies, blow flies, and flesh flies can be found in both urban and **rural** settings.

**Metamorphosis**

* Flies, beetles, and many other insects have **complete** metamorphosis, which consists of four stages – **egg**, **larva**, **pupa**, and **adult**.
* After the adults mate, the females lay eggs onto corpses - usually near natural **body openings** or **wounds**.
* Feeding activity is usually seen in the **head** region first (mouth, nostrils, eyes, ears), followed by the **excretory** openings. The **trunk** of the body is invaded much later in the process.
* The length of the life cycle varies between different fly species and is dependent on **temperature**.

**Stages of Decay**

**1 - Fresh Stage**

* + Begins at the moment of death and lasts until the body becomes bloated.
	+ Blow flies and flesh flies are among the first to find the body.
	+ Predatory wasps and beetles may arrive later to feed on the maggots (but not the corpse).

**2 - Bloated Stage**

* + Begins when the body becomes inflated due to the production of gases from bacteria that begin to putrefy the body or cause it to decompose.
	+ House flies now join the other flies and their maggots form feeding masses that help to liquefy the tissues of the body.

**3 - Decay Stage**

* + Begins when the skin breaks and the gases escape.
	+ Maggot masses are large and very active as they grow older and larger.
	+ This is the stage of decomposition that smells bad.
	+ At the end of this stage, the maggots leave the corpse in search of a place to pupate in the soil.

**4 – Post-Decay Stage**

* + Most of the flesh is gone from the corpse, with only cartilage, bone, and skin remaining.
	+ This stage is devoid of flies. Some beetles continue to feed on the highly desiccated or dried remains.