**King Saud University**

**Forensic Medicine department**

**Form 321**

**Forensic Entomology (Forensic Entomology Application and Uses in Forensic Medicine)**

**Agenda:**

* **Definitions.**
* **History of Forensic Entomology.**
* **Importance and Application in Forensic Medicine.**
* **Insect types and Lifecycles in Relation to Forensic Entomology.**
* **Procedures and Protocols of Forensic Entomology.**
* **Case Example.**
* **References.**

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Entomology, one of the branches of Zoology, is the scientific study of insects. Insects are defined as invertebrate animals having an exoskeleton, a segmented body, and three jointed pairs of legs (1). It encompasses many different scientific fields including forensic entomology which is defined as the study and application of insects or arthropods into the legal system. Most commonly associated with death investigation (2).

Use of forensic entomology in death investigation is not exclusively a modern phenomenon. One of the earliest uses of entomology in the investigation of a crime was in the late 13th century, in china. *Song Ci*, a judicial intendant, wrote a book called “*Washing Away of Wrongs”*, in which he detailed methods of examining corpses and determining a probable cause of death. In one of the cases mentioned in the book, a farmer had been found dead near a rice field, killed by slash wounds to the head. The book goes on to describe how the investigator had all nearby workers assembled with their tools laid in front of them. After a period of time, the investigator noticed flies gathering around a certain sickle, and its owner was accused of the murder. The owner confessed, believing this to be a religious omen. Song Ci, however, had correctly deduced that the flies were attracted to the trace amounts of blood and tissue that remained on the sickle (3).

Unfortunately, it was not until the 1800's that forensic entomology was applied in a criminal investigation in Europe. At that time, scientists started looking into the order and succession of insects that inhabit the cadavers, and what their life cycles could reveal about a crime.(2)

Entomology has wide and important applications in forensics medicine. Which is shown through the following uses (2):

* Estimation of the time of death.
* Identification of the geographical area of the deceased.
* Identification of sites of trauma.
* Entomologic evidence as they can be used for toxicology.
* Identification of death caused by insects like anaphylactic shock.

One of the most important and recognizable applications of entomology in forensic medicine is the estimation of the Post-Mortem Interval (PMI). This is performed by collecting insects in various stages of their life cycles from the scene of the crime. This of course requires a comprehensive knowledge of both insect types and life cycle.

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| The phases that insects go through during their lifecycles are distinct. The implications of finding insects in certain phases on or around a dead body can explain a great deal of information related to the case being investigated. Eggs, larvae and pupa are considered the most important stages for forensic entomologists since their presence on a body means that they must have grown on the corpse, while an adult insect might have come from somewhere else. They are usually found in a wound or natural orifice, but may be found on clothing. The two main insect groups on bodies are flies (Diptera) and beetles (Coleoptera). | \* available at: http://xnet.rrc.mb.ca/davidb/entomology.html |

Flies are usually the first to colonize a body, as they prefer a moist corpse to feed their larvae. The most common type is the blow fly. Blowflies are attracted to the odor of corpses from large distances and can arrive at the site in a matter of hours, even minutes (4). Closely related species of blowflies have different developmental rates and growth periods, making blowflies the most important and most accurate indicators of PMI (5). Hister beetles feed on the larvae and pupae of other insects and are often found under the body, and in and under clothing. The adults lay their eggs in the corpse, inhabiting it in the later stages of decay (6) .The pattern of insects appearing on a cadaver is predictable and as such can be helpful in determining the time of death.

Forensic entomologists can also determine if a body has been moved through any special type of insects which is known to be found in particular area which may reveal any manipulation with the site of body. (2) In case the body was found to be in a badly decomposed state, forensic entomologists can identify the likely site of a wound by assessing the pattern of colonization by the insects found on the body. If the insects have colonized away from natural orifices, which is where they usually gather, then that would hint at the probable site of the wound. We can also determine the presence of drugs –or any toxins- by analyzing the insects present on the body. This is only used when we cannot use the victims own tissue.

Appropriate handling of insect evidence and extensive knowledge of insect lifecycles and types can help forensic entomologists learn many valuable facts about a dead body. However the effectiveness of forensic entomology might be compromised by circumstances surrounding the cadaver like Weather, temperature, moisture levels (7).

Since forensic entomology deals with death investigations, certain procedures and protocols must be followed, the most essential of which is the collection of insects present in the crime scene. While dealing with insect evidence, investigators are expected to collect the evidence with care and accuracy, to be knowledgeable about post-mortem changes in human beings, and of course, to have an extensive knowledge of insect behavior and habits. It would seem, based on these qualities, that the presence of a forensic entomologist is necessary. However, forensic entomologists cannot be at every crime scene, and so it is crucial that investigators be taught the basic skills of insect evidence collection, to avoid the evidence being tampered with or compromised and to ensure it reaches the forensic lab in the best condition possible.

After collection, insect evidence should still be dealt with carefully. It should be handled with gloves instead of forceps as some insects are extremely fragile. It should also be kept in separate containers according to the area it was collected from and when it was collected and can also be labeled according to the stage of insects ‘life cycle (7).

Forensic entomology has been used to great effect in recent investigations, in 2004, 33-year-old Jonathan Blackwell was reported missing. He was last seen leaving his job at a Virginia Goodyear tire shop and the last person who spoke to him was his mother. A week later, Blackwell’s car was found burned, but there was no sign of Blackwell himself. The State Bureau of Investigation received a tip after two years, and based on that tip, Police searched a field near Highway 29 in North Carolina. Jonathan’s body was found buried there and the suspect, truck driver Stacey Webster, was charged with murder shortly after.

What seems interesting in this case, is that upon exhuming Blackwell’s body, investigators had found blowfly larva on his remains. This was not expected because the body was uncovered in December of 2006, two years after Blackwell’s disappearance, and the larva was estimated to be seven days old. Based on this, it was safe to assume that the murderer had moved Blackwell’s body to a second grave for whatever reason, where Blackwell’s body had been found (8).

* **References:**

(1) *Sir Vincent B. Wigglesworth*. Insects. Britannica Online Encyclopedia. February 2012. Accessed February 18, 2012.Available at: <http://www.britannica.com/EBchecked/topic/289001/insect>.

(2) *Jason H. Byrd and Stephen J. Cina* (editor). Forensic Entomology. Medscape Reference. 2011. Accessed February 18, 2012 Available at: <http://emedicine.medscape.com/article/1780557-overview>.

(3) Greenberg B. and J. C. Kunich. Entomology and the Law: Flies as Forensic Indicators. Cambridge University Press; 2002. Page 332.

(4) *Madison Lee Goff*. A fly for the prosecution. Chapter 2: "The bugs on the body". Harvard University Press; 2001. Page 22.

(5) *Zaidi F, Wei SJ, Shi M, Chen XX*. Utility of multi-gene loci for forensic species diagnosis of blowflies. Journal of Insect Science. 2011. Volume: 11. Article: 59. Accessed February 18, 2012. An online copy of the article is available at: <http://www.insectscience.org/11.59/i1536-2442-11-59.pdf>.

(6) *Dorothy E. Gennard*. Forensic entomology: an introduction. Chapter 3: "Identifying beetles that are important in forensic entomology". Published by John Wiley and Sons; 2007. Page 63.

(7) *Dr. Gail S. Anderson*. Forensic entomology: the use of insects in death investigations. Accessed February 18, 2012. An online copy of the article is available at: <http://www.sfu.ca/~ganderso/forensicentomology.htm>

(8) *Wynne Parry*. Bugs of Death May Help Solve Murder Cases. Live science. November 2011. Accessed February 18, 2012. An online article is available at: http://www.livescience.com/16987-blow-flies-csi-forensics.html