



IMPORTANCE FORENSIC ENTOMOLOGY

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Abstract: Forensic Entomology is

The study of predicting the death time of a corpse and indicating the position of the crime through knowing the kinds of insects found on it is called "Forensic Entomology". The current investigation studied certain variables such as conduct of insects, their life cycle, how they are dispersed, and several factors surrounding them to recognize the evidence for identify the crime circumstances.

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INTRODUCTION

"Entomology" is a term refers to the investigation of insects, which is derived from Greek; "Entomon" (i.e., "insect") and "logos" (i.e., "word, reason"). Entomology is considered as an old decipline of forensic sciences. Over time, its employment was increased for establishing the postmortem period to identify the death season, place, transportation or storage of remains, and other elements. According to the development of Entomotoxicology, the role of Forensic Entomology has grown and reinforced. Thus, employing DNA for species identification has taken the discipline to a whole new level (Rudra gouda,2022).

Forensic Entomology plays a fundamental role in various investigations so it is necessary to be familiar with different kinds of insects with forensicsignificance, determining the death

time and the stages of decomposition of the corpse, understanding the proper methods for collecting and preserving data, knowing the updated techniques of Forensic Entomology in solving murder cases.

The insect community of forensic importance consists mainly of three insect orders: Diptera, Coleoptera, and Hymenoptera. Diptera is the dominant order in the insect community, and the families include Sarcophagidae, Calliphoridae and Muscidae of Diptera order, and beetles of Coleoptera order, these insects are of great importance in feeding on corpses (Bharti and Singh, 2023).

Entomology Forensic fields

This science was divided into three main fields of application, which many scholars later considered as fields of this science (London and Stevenson, 1986):

1-Urban Entomology

It investigates legal incidents involving insects and related animals affecting constructed buildings, industrial installations, and the human environment.

2-Stored Products Entomology

It investigates incidents involving insects that infect staple commodities of stored food products such as grains and other food products and cause contamination or spoilage of food. This branch is an important part of Forensic Entomology.

3-Medicocriminal Entomology, Medicolegal Entomology, or Medicolegal Forensic Entomology (Haskell and Williams, 2008)..

Pieces of insects that can be present during the stages of decomposition of the corpse:

There are four sequential stages that the corpse goes through:

1-Fresh stage

The first stage begins with death and continues until the first signs of bloating appear. During this stage, autolysis begins and the body temperature decreases and equals the temperature of the surrounding air. In this stage, there are no morphological changes or the appearance of smell (Byrd and Castner, 2010). Insects of these families Sarcophagidae, Calliphoridae and Muscidae begin to be attracted to the corpse (Singh and Bharti, 2001).

2-Bloated stage

At this stage, protein-digesting enzymes begin to break down complex proteins into their monomeric form, and gases are produced from this process that corrode the body, and the stage of corpse bloating begins, which can be seen through mild swelling of the abdomen caused by putrefaction (Payne, 1965). Then the skin of the abdomen and around the joints of the extremities shrinks, giving the corpse the appearance of a taut balloon. The corpse is characterized by hair loss and the appearance of the smell of putrefaction, as body fluids leak

out from the natural openings. The body temperature increases at the end of this stage as a result of putrefaction and the activity of larvae. Many groups of the beetle family are attracted to this stage to feed on the corpse (Grassberger and Frank, 2004).

3-Decay stage

This stage begins with the release of Ammonia, Methane, Carbon dioxide, and Hydrogen sulfide (putrefaction gases) (Anderson and Laerhoven, 1996). Then the skin of the corpse begins to crack in many regions of the body due to the activity of the larvae of order Diptera, and as a result of this cracking, it leads to the entry of air, which causes the acceleration of the decomposition of the aerobic body proteins, and the temperature of the corpse and the temperature of the environment rises, and the value of this rise reaches from 10-15 degrees C°. (Singh and Bharti, 2001), and the smell of putrefaction of the corpse is very strong, and at this stage the biodiversity of insects appears, and the larvae devour 90% of the biomass of the corpse (Bharti and Singh, 2003).

4-Dry stage

It is the last stage of decomposition, which is characterized by dryness of the skin, bones and cartilage, it is characterized by the appearance of smell, and the temperature is close to the corpse and the surrounding environment, and due to the length of this stage and the absence of important events to distinguish it, the end of this stage is not clear, and its peak may be reached as a result of presence of insects of forensic importance on the corpse, including beetles and pupae of order Diptera, which may indicate a desiccation stage (Tomberlin et al., 2010).

Forensic entomology applications :-

Insects an important role in crime scene investigations on land and water (Hobischak and Anderson, 2002; Moretti et al., 2011). Medicolegal forensic entomology uses insect evidence to solve criminal cases (Villet, 2010).

Amendt et al., (2010) indicated that the most common applications of forensic entomology were :

1-Post Mortem Interval (PMI) :

It means determining the period of time that has elapsed since the time of death, and this is often in cases of decomposing corpses. This is done by estimating the duration of the longest-lived larvae and its relationship to the date of hatching of eggs of flies, and using the chart of the growth of the larvae of this type of flies under temperatures corresponding to the temperature at the crime scene, which is useful in calculating the date of hatching of eggs. This method is highly accurate if done. It is implemented during the first three days of death, and the time of death can also be determined by adopting the pupa stage, which is calculated according to the succession of different insect species on the corpse (Paling, 2005; Cruz, 2006).

2-Location of Death:

Determining location of death is used in cases of changing the location of the corpse, and this is done by studying the geographical distribution of insects in different environments and from incidents that support the role of insects in changing the location of the crime in order to mislead justice (2010 et al., Amendt).

3- The homicide:

This is done through the presence of the insect or part of it stuck to the clothes or tools of the accused (2007, Gennard).

4-Suicide crimes

This is done by watching the gathering of insects in advanced decomposition or unclear corpses, which is the cause of determining the location of the wound responsible for death or suicide, and from it the type of suicide can be known (Gruner 2004).

5- Sudden death:

It means researching the possible causes of sudden death, such as poisoning when using an overdose of a narcotic or alcoholic substance.

This is done by examining the insect's food, in which the same poison is present when larvae feeds on a corpse (Rasmi and Jisrha, 2015).

6- Blood spot distribution pattern

This is done by monitoring the movement of insects on traces of blood at the crime scene, which leads to changing some of the blood traces on the surfaces by means of their blood-contaminated legs, vomit, or excrement, which may cause false analyzes of the spread of blood at the crime scene (Paling, 2005; Cruz, 2006).

7- Child and oldage neglecting:

This type of negligence is investigated in care homes when infections and suppurations of wounds that have exacerbated due to the multiplication of flies in them can be determined, and through it, the extent of the physical harm that befell the victims, even if they were alive (Amendt et al., 2010).

8-Rape crimes

This is done by analyzing the human DNA on which the insect fed, and thus the identity of the corpse and the perpetrator can be inferred. Research results have shown that when the corpse of a sexually raped female is in an advanced state of decomposition, it is difficult to obtain samples of semen mixed with the corpse to determine the DNA's genetic fingerprint. By the rapist, but the presence of fly larvae in the genital area of the raped woman can be evidence to know that the female has been sexually raped before she was killed. At the same time the fly larvae can retain the genetic fingerprint of the rapist in her gut, because the genetic fingerprint of the offender is transmitted to the larvae of flies that feed on the body of the raped female regardless. Regardless of the semen present in the sexual area of the raped women (Amendt et al., 2010)..

9-Trafficking Contraband

Drugs and the source of their smuggling can be detected by classifying the species of insects accompanying them, and this helps to provide evidence that this substance is smuggled, and

thus the original home of these drugs can be determined because the species of insects differ in their geographical distribution (Gruner, 2004).

10-Car and Traffic Accidentes

Insects may be a direct cause of some road accidents, such as wasps and bees, by stinging car and truck drivers while they are driving, by confusing them, and the stinging pain caused by these insects (Rasmi and Jisrha, 2015).

11-Detecting terrorist operations and war crimes

Detection is made through chemical analysis of the contents of the intrails of fly larvae found on the bodies of the victims of explosives, as it was found that the fly larvae retain the remains of the explosive materials that were used in the terrorist incident. The quality of these explosives can also be known by comparing the results of the chemical analysis of the type of explosives with those used in previous incidents, and when they match, they provide evidence that a terrorist cell carried out the incident (Rasmi and its bridge, 2015).

The effect of environmental factors on the presence of forensic insects:

The decomposition of corpses is affected by many environmental factors, including the difference in temperature, amounts of rain, wind, and direct sunlight that affect the insects present, this is done by influencing their activity, but the factors of temperature and humidity are among the most important factors influencing the behavior and life of insects. Below are listed among the most important factors influencing insects' counting of corpses:- :

Effect of temperature and humidity:

Temperatures are among the most important factors that affect the rate of growth and laying of eggs by carnivorous insects, as cold weather prevents the activity of flies in light of the relationship between the growth rate of flies and temperatures Reiter (1984) observed the larvae can reach their maximum at room

temperature, but it decreases if the temperature increases to a higher level and it is also found that the larvae progress at constant temperatures and higher than 30 °C and they were unable to pupae because it leads to their death and therefore there is a variation in the tolerance of insects to temperatures, and it ranges between 15-30 °C ° and a maximum of 60 ° C (Knipling and Sullivan, 1957).

Temperature and humidity change according to the change of the season, the geographical area, and the organisms present at the site of the corpse. Therefore, the forensic entomologist is interested in the daily range of temperatures and within different seasons at the crime site because it affects the growth rate of the stages of insects, as Deonier (1940) noted that the maximum temperatures of activity species of metal flies range between 4-14 °C.

Therefore, the forensic entomologist must measure the temperature of the corpse and the surrounding atmosphere, but in practice this procedure may not take place most of the time due to its late arrival after the corpse was transported from the site in which it was found to the laboratory for the purpose of examination and the autopsy, therefore, relying on the temperature and humidity recorded at the nearest meteorologist will be inaccurate and, accordingly, requires the entomologist to estimate the temperature around the corpse to be used in estimating the time that has passed since death, while being careful when estimating (Nuorteva, 1972). At the same time, the temperature and humidity plays a very important and effective role in analyzing corpses, and Payne (1965) found that decomposition is slower in cold and cloudy days, and on warm days the effectiveness of insects increases, as high temperatures cause a slow decrease in the mass of corpses, and this reflects the effectiveness of attracted insects, which leads to a change in the timing of the arrival of insects to the surface This in turn affects the rate of putrefaction.

Studies have shown that there is a direct relationship between the rate of decomposition

of the corpse and the temperature, as the high temperature increases the stage of decomposition of the corpses and vice versa. High levels of humidity and rainfall can reduce the development of larvae and the activity of insects (Anderson and VanLaerhoven, 1996), in addition to their effect on the activity of microbes inside corpses (Gill, 2005), while low temperature, humidity and heavy rain (Smith, 1986) effect on the effectiveness of blue flies and their delayed arrival to corpses, However, Greenberg (1990) proved that insects of the family of Muscidae do not fly in rainy weather, while insects of the Sarcophagidae family are not affected by rain (2000, Erzinclioglu), and therefore these insects are the primary groups that colonize corpses if the period of rain increases. It was found that changing climatic factors, especially temperature, humidity and rainfall, affects the rate of decomposition of corpses (Shi et al., 2009).

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