



Journal homepage: www.sciencearchives.org

ISSN: 2582-6697



Review Article

<http://dx.doi.org/10.47587/SA.2020.1321>



Forensic entomology in the disclosure of the circumstances of criminal cases: a review

Mohammed Rafeq Ali, Ahmad M. Tariq* and Batool Abdul Jabbar Hussein

*Institute Medical Technical. Al-Mansur,
Middle Technical University, Baghdad, Iraq*

*Corresponding author: Ahmadtarek2001@gmail.com

Received: Nov 26, 2020 / Revised: Dec 26, 2020/ Accepted: Dec 29, 2020

Abstract

Forensic entomology is a branch of forensic science, which can utilize the information regarding insect life cycle and behavior for interpreting the criminal evidence in a legal context. The insects are important in the decomposition of corpses. The correlation between insects and corpses and the use of insects in medico criminal investigations was the main subject of forensic entomology. The aim of the present study was to review the historical background of this approach, important postmortem processes, and attempts to determine the time interval since death as well as to determine the criminal applications of entomology.

Keywords Forensic Entomology, Insects, Criminal Cases and Insect life cycle

Introduction

Murder is a heinous crime, one of the greatest sins that God Almighty has forbidden. "Whoever kills a person unlawfully kills all people." Unfortunately, crimes have spread in almost all human societies since Kanel killed his brother Habel, and it is still going on. Since human beings started killing each other, crime investigations were constantly evolving, but the battle of technology against crime is still limited, but recently, a team of pioneers has developed a new weapon that serves it. The existence of a group of more than thirty million insects is the largest in the world and is located in the British Museum of Natural History, which began to study insects, and quickly move the scientists of insects from the collection to observation, insects have revealed that it is the most systematic among many species of living creatures, and it is known that the beginning of many insects begins with the death of another animal, this relationship with death is expected, but it has ignored for a long time (Catts and Goff, 1992; Amendt et al., 2004). Human relations with death are unpredictable, and the investigation of the crimes has always required objective limits of knowledge. The science of crime

analysis has used all that science can provide to us, but this science has limits. In fact, there are fundamental factors in any crime, the science of the 21st century cannot penetrate and with all the available techniques, it is impossible for the forensic to determine the time of death for a body that died before more than seventy-two hours. For a corpse that has remained for many days, the best thing a forensic doctor can do is to estimate the death time. However, two sections of knowledge have met over the past 100 years, namely Entomology and Criminology and Crime analysis (LeBlanc et al., 2010). However, these two important sections did not make progress, unless they were effectively employed by criminal investigation agencies. The collection of forensic evidence is a major problem in criminal proceedings, and without such evidence, the crime will not be established. Without such evidence, the crime will not be established as well as will not be assigned to the accused and will not apply the penal code. Those who collect the evidence must adhere to the precautionary measures so as not to dispel the evidence, especially from the vestige of the offender or the victim or the

person who was taken from the scene of the crime. If the injured victim is still alive, he will not be sacrificed to preserve the vestiges, because the insects that were observed from the victim's body, and the scene of the crime became a sign of criminal reading or so-called criminal biology, which is a science that depends on the various insects as a basis for detecting the crime scene and after the crime, the life of these insects begins (Sukontason et al., 2007; LeBlanc et al. 2010).

Forensic entomology

Forensic entomology (also known as forensic biology), which relies on various insects as a basis for detecting the circumstances of the crime, especially violent crimes in general and murder in particular. Despite the development of science, the forensic doctor cannot determine the exact time of death, but with the use of criminal forensics, this can be determined and scientists always use pigs to carry out their experiments (Ashworth and Wall, 1994).

History of criminal entomology

Using insects in criminal investigations was done for the first time in China (1235) when the mystery of the case of a Chinese farmer killed by a deep calf strike was revealed. The village leader asked the farmers to bring their sickles and put them on the ground with no movement, and only minutes until the flies gathered on one of these sickles and revealed the killer because of the blood and flesh on his sickle that he used for the crime, and despite his efforts in cleaning it to hide his crime, the flies attracted the smell of blood even after washing the sickle. This incident was first published in China in 1247 in the book "The Washing Way of Life" written by the lawyer Sung Tzu, where he presented many of the human deaths that he dealt with and recorded his observations. Sung and the forensic doctor went into detail on how to study the bodies before and after the burial. He also explained the process that leads to understanding how to determine the probable cause of death. Thus, the precise details that he mentioned from his observations were considered one of the basic principles on which modern forensic scientists relied. The association between egg flies and Maggots, and the corps have not been detected (Goff et al., 1994).

Francisco Francesco L. Redi (1668) made a clear contribution to the science of insects, in which he refuted the theory of spontaneous reproduction of biogenesis. It was believed that flies spontaneously emerge from rotting meat under the appropriate conditions. He discovered that the exposed flesh was exposed to blue flies and noted that the flies turned into larvae and virgins and then turned into blue flies within 10 days, and the environmental factors can change this rule besides. This theory refutes the theory of spontaneous self-reproduction of insects. The first actual application of criminal insect science was made in 1855 by Dr. Bergeret D. Arbois "Bergerty" for a criminal case and was published as a case report where he collected insects from the body of an infant found in a house with a multitude of raised insects indicating a state of decomposition dating back several years, and therefore, the guilt was inflicted on the former inhabitants of

the house and not on those presents at the time of discovery of the body. Insects are one of the most important factors of biodegradation of corpses and often contain indicators of great value in criminal investigations and provide information regarding the time and place of the crime. Therefore, insects, their places of existence, and their basic environment should be studied (Tullis et al., 1987; Schoenly et al., 1987).

Forensic entomology has many uses in the field of forensic medicine. The most important was the estimate of the death time of the corpse through the type of insect located above it and through its life cycle figure (2). Additionally, the age of the insect was determined by its weight and length, and it can also determine the location of the body. There are insects present in the closed environment and the other exists in the open environment, and the absence of insects over the body may be due to keeping them in the refrigerator or a tightly sealed place. Scientists have confirmed that the insects invade the body with different stages, each stage has its insects, there are some insects invade the body at the beginning of the decomposition stage, and other insect attack the corpses after rotting while the beetles were found to invade the corpses after being dehydrated and decompose. Often insects choose open organs from the human body to lay eggs such as the nose, mouth, and ear as well as open wounds (Schoenly et al. 1987).

The first systematic study of criminal insect science was carried out in 1881 by the German physician H. Reinhad, and played a vital role in the history of criminal insect science through studying many corpses and demonstrated that the insect development can be associated with buried bodies Figure (3). His studies were the base for further research and subsequent studies. In France, Megnin published a series of articles on criminal insect science between 1883 and 1898 and after that, the researchers in the field of insect science, and the applications of its criminal branch were intensified until criminal forensic scientists became an integral part of criminal investigations in many countries of the world today (Davies, 1990).

Branches of entomology

1. Urban Entomology: Looking at insect cases that affect buildings constructed by humans and other aspects of the human environment.
2. Stored Products Entomology: It investigates cases of insects and pests of commodities stored as cereals and other products.
3. Medico criminal Entomology: Furthermore, called Medicolegal Entomology or Forensic Medico-legal Entomology investigates crimes of violence such as murder, suicide, rape, smuggling, suddenly death, the physical assault on children, aircraft crashes, and locating the crime.
4. Entomotoxicology: The use of insect samples to examine different types of toxins and drugs related to the body.

Science related to criminal insects

Insects are often considered to be factors of the biodegradation of bodies. Insect evidence Figure (1) often provides valuable information in criminal investigations in terms of the accuracy of time and space of the corpses, which cannot be provided in other ways in addition to the beneficial use from insect biology, also the criminal insect science benefits from basic concepts of other sciences included Insect Taxonomy, Ecology, Toxicology, Physiology, and Molecular Biology (Davies, 1990)

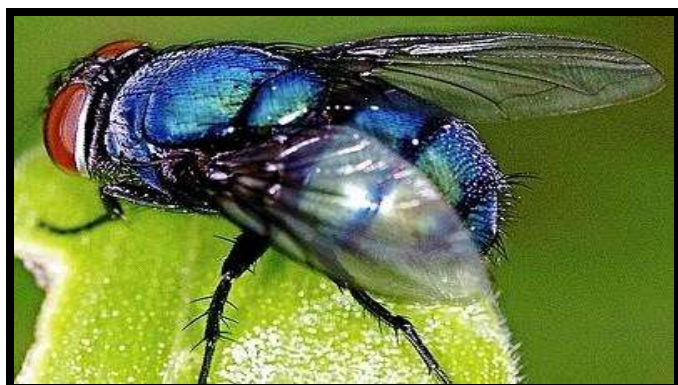


Fig. 1. Blue flies

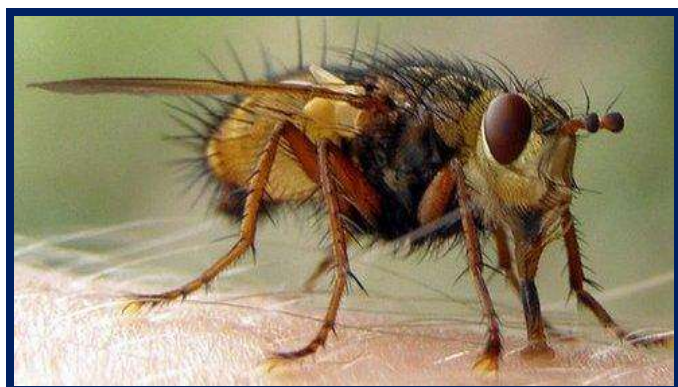


Fig. 2 Fly while feeding on human skin



Fig. 3 An enlarged and close-up image of the parts of the fly's mouth

Criminal applications of entomology

Determining the time of death in post mortem interval cases

The duration of death can be determined, often in the case of decomposing bodies Figure (4). It is also possible to determine whether the death occurred days, months, or even more precisely as it occurred at night or day Figure (5), and this plays a key role in condemning or acquitting any accused (Sukontason et al., 2007).



Fig. 4 Larvae reproduce within decayed tissues and skull of a cadaver

Determining the actual location of death

In cases where the location of the body is different from the actual place of death, this can be done by studying the geographical distribution of insects in different environments to determine the physical location of the body and, therefore, the location of the crime (Sukontason et al., 2007).

Defining the culprit in homicide murders

When an insect or part of it is stuck in the suspect's clothes or instruments. For example, a priest was convicted of killing his wife because the ant found in his shoe and its age three-days belonged to the same type of ants that were found near his wife's body just three days ago Figure (6) (Sukontason et al. 2007).

Suicide crimes

Sometimes the insect assembly of the developed or decomposed bodies may determine the location of the wound that caused the death/suicide, from which the type of suicide can be identified (Amendt et al., 2004).

Causes of sudden death

The possible causes of sudden death, whether due to toxicity or an overdose of narcotic or alcohol, are examined by examining the insect's food, where the same toxin is present in the larvae fed on the body (Amendt et al., 2004).

Blood spatter pattern analysis

As a result of the movement of insects on the remained blood at the scene of the crime, the insects changed some of the bloody effects on the surfaces through the limbs contaminated with blood, vomiting or stools, which may

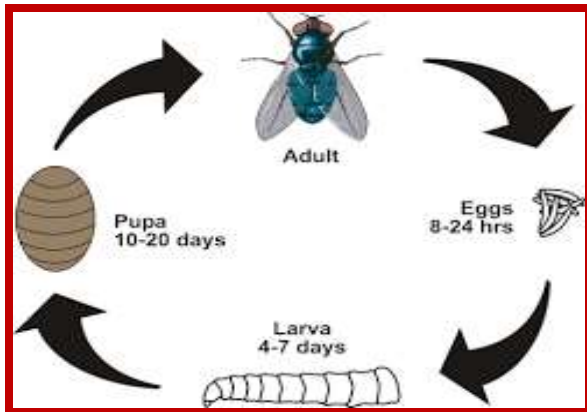
cause incorrect analyzes of the spread of blood at the scene of the crime (Amendt et al., 2004).

Elderly child & elderly neglect

This type of carelessness was investigated in the care homes when infections and wound sores are exacerbated to the point where flies multiply. It is possible to determine the time and extent of the physical harm suffered by the victims, although they are alive (Sukontason et al., 2007).



Fig. 5 A human body, and insect larvae proliferate



A



B

Fig. 6 (A&B) The life cycle of flies and the stages of decomposition of the human hand

Rape

When analyzing the human DNA that was fed by the insect, the identity of the body, as well as the perpetrator, can be inferred ((Amendt et al., 2004)

Trafficking contraband

The narcotics and the source of their smuggling can be identified by identifying the exporting country through the type of insecticide present ((Amendt et al., 2004)

Determine the location of the vehicle

It is possible to identify the areas where the vehicle was driven by insects or its parts attached to the glass or radiator, based on the diagnosis of the insect and compared to the diversity and geographical distribution of insects (LeBlanc et al., 2010)

How to use insects in criminal investigations

It is known how complicated the function of the forensic doctor, especially in the crimes of murder, the time of death, the tool of crime, and other usefulness of criminal research, and that the science of criminal insects is considered a breakthrough in the field of crime detection. The world of criminal insects usually works in three aspects: forensic, urban, and pollution of archived materials. Its work in this field is within forensic medicine in the case of rotting bodies and the types of insects that can be found. In other words, their work depends primarily on the phenomenon of tastiness and rotting of tissues. Therefore, it is so hard to be good at work in cold, frozen areas (LeBlanc et al., 2010)

How can the forensic scientist detect the time of death

Death time was associated with growth stages and the weight of larvae, which must be placed in boiled water for 10 seconds and then immersed in ethanol. Then enter the criminal insect world in a series of complex calculations to finally determine the exact time of death. In addition, there are those who paint the body of the dead with ointments to stop the growth of the larvae. There are some special techniques that are very useful, for example, some types of flies do not lay their eggs in closed places. If a corpse is found in the open and contains the eggs of these flies, this was evidence that the crime happened in a closed place, and then the body was transferred to the open place, and the body was transferred from the open to a closed place. Additionally, the corpse that was transferred after freezing was so easily exposed because the larvae do not grow and no insect eggs (Goff and Lord, 1994)

There is another point specific to this science related to trafficking accidents such as accidents that result from the entry of bees into the car, the world of criminal insects can detect the causes of this incident. Drugs can also be detected when cannabis or a pango is identified. The first use of this science in practice was in Scotland Yard (British police) in 1935 and thus, the science does not stop at any limits and

will remain dazzled with everything new in it. The development of criminal insect science makes it difficult for criminals to escape their crimes. Of course, most criminals and most people have not yet heard of criminal insects (Ashworth and Wall, 1994)

Recommendations

1. Definition of the Arab reader and the legal specialist of the importance of insect science and its role in evaluating the justice file with the correct evidence.
2. Encourage officials and those interested in investigating criminal cases to establish a laboratory of various types of insects of criminal nature and identify their environments for each of the regions of the same country, and equipped with a bank of information such as that used for DNA or DNA.
3. Modernize the scientific police equipment and equip them with laboratories for the purpose of identifying more of the criminal insect science, which facilitates their work tasks.
4. Legislation that accepts insects as criminal evidence.
5. Opening sections or people of criminal insect science in research centers and faculties of agriculture, science, and medicine.

Conclusion

Criminal insect science has evolved very rapidly over the past few years, and courts have begun to accept insects as a criminal guide. On the level of the Arab world, there is interest on the personal level of some forensic doctors, and through some seminars and conferences at the official level, it became clear that there is no laboratory specialized in the science of criminal insects in any of the Arab countries until the preparation of this booklet. In some Arab countries represented by the Ministry of Interior / General Directorate of Criminal Evidence, a subcommittee was formed on the project of application of criminal insects in the different environments of that country.

Conflict of Interest

The author hereby declares no conflict of interest.

Consent for publication

The author declares that the work has consent for publication.

Funding support

The author declares that they have no funding support for this study.

References

- Amendt, J., Krettek, R & Zehner, R. (2004). Forensic entomology. *Naturwissenschaften*, 91, 51–65.
- Ashworth, J.R. and Wall, R. (1994). Responses of the sheep blowflies *Lucilia sericata* and *Luxprina* to odour and the development of semiochemical baits. *Medical and Veterinary Entomology*, 8, 303–9.
- Catts, E.P. and Goff, M.L. (1992). Forensic entomology in criminal investigations. *Annual Review of Entomology*, 37, 253–72.
- Chen, W.Y., Hung, T.H. & Shiao, S.F. (2004). Molecular identification of forensically important blow fly species (Diptera: Calliphoridae) in Taiwan. *Journal of Medical Entomology*, 41, 47–57.
- Davies, L. (1990). Species composition and larval habitats of blowfly (Calliphoridae) populations in upland areas in England and Wales. *Medical and Veterinary Entomology*, 4, 61–8.
- Goff, M.L. & Lord, W.D. (1994). Entamotoxicology; a new area of forensic investigation. *The American Journal of Forensic Medicine and Pathology*, 15, 51–7.
- LeBlanc, H.N. & Logan, J.G. (2010). Exploiting Insect Olfaction in Forensic Entomology. In: Amendt, J., Goff, M.L., Campobasso, C.P., Grassberger, M., editors. *Current Concepts in Forensic Entomology*. Netherlands: Springer. pp. 205–21.
- Schoenly, K. & Reid, W. (1987). Dynamics of heterotrophic succession in carrion arthropod assemblages: discrete series or a continuum of change? *Oecologia* (Berlin), 73, 192–202.
- Sukontason, K., Narongchai, P., Kanchai, C., Vichairat, K., Sribanditmongkol, P. & Bhoopat, T. (2007). Forensic entomology cases in Thailand: a review of cases from 2000 to 2006. *Parasitology Research*, 101:1417–23.
- Tullis, K. and Goff, M.L. (1987). Arthropod succession in exposed carrion in a tropical rainforest on O'ahu Island, Hawaii. *Journal of Medical Entomology*, 24, 332–9.

This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).



How to cite this article:

Rafeq Ali, M., Tariq, A.M. & Hussein, B.A.J. (2020). Forensic Entomology in the disclosure of the circumstances of criminal cases: a review. *Science Archives*, Vol. 1 (3), 202-206. <http://dx.doi.org/10.47587/SA.2020.1321>