

# FORENSIC ENTOMOLOGY IN INDIA: A ROAD LESS TRAVELLED

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**Abstract:** *Arthropods are the most common species on the planet and play an important role in the decomposition of a corpse. Forensic Entomology relies on entomological examination of species typically associated with carrion to provide crucial insights into investigations. Entomological data has contributed to the resolution of various medico-criminal cases from the beginning of time. By analyzing either the species of arthropods present or their age and developmental stage, the post-mortem interval can be accurately determined. The present paper discusses the historical development and the utilization of forensic entomology in crime investigation, including the various uses of entomological evidence, information about crucial species of arthropods, as well as the techniques of determining the PMI using insect evidence. The paper also presents an argument about the need for congruence of the theory of forensic entomology and actual cases on the ground. The need to tackle ground level issues such as, law enforcement agencies being skeptical about the potential of this field and the collection of evidence being done in a careless manner have been discussed. Various international and national cases are presented as well, in order to depict the usage of this branch and the loopholes which need to be tackled for promoting this niche branch of forensic science.*

**Keywords:** *Forensic Entomology, Criminal investigation, Evidence, Law, Lacunae*

## I. INTRODUCTION

Insects can and have played a very important role in providing evidence in criminal cases. Forensic entomology is a branch of forensic science that deals with “the study of arthropods, particularly insects, which are linked to crime and other areas of the legal system. In most cases, forensic entomology entails identifying insects and other arthropods found in human remains in order to determine the time and place of death.”<sup>1</sup> Entomologists can utilize information about arthropods, including their life cycles for ascertaining information like the manner of death, location of death, placement of the body after death, identification of wounds etc. <sup>2</sup> Nevertheless, estimation of the post-mortem interval (PMI) or the time elapsed after death is the most important process where entomological data is used.

1. History- The connection between insects and carrion (human or animal) has been known for thousands of years. A prominent example of the

same is Homer’s Iliad, which dates back to 8th or 9th century B.C.E in which the character of Achilles is concerned about the corpse of his friend Patrokis, as he fears that the dead body will “breed worms” and make “the body foul.”<sup>3</sup> Around 3600 years ago, Har-ra-Hubulla, the oldest known book on zoology makes mention of blowflies<sup>4</sup>. Also, the Egyptians used to embalm dead bodies of individuals to prevent them from insects and decay some 2500 years ago. In addition to this, the Egyptians Book of the Dead also carries a mention of maggots. The first recorded use of forensic entomology can be found in a book authored by Sung Tzu, titled ‘The Washing Away of Wrongs,’ which dates back to 13<sup>th</sup> century China. In the said book, there is a case illustrated, wherein, to find the murderer of a farmer, all the suspects were asked to lay their sickles on the ground. Here, only one sickle attracted blow flies and this led to the confession of the murderer. It was in the 18<sup>th</sup> century France, where entomological

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<sup>1</sup> Isaac Joseph Et. al., *The use of insects in forensic investigations: An overview on the scope of forensic entomology*, 3(2) J FORENSIC DENT SCI. 89, 90-91 (2011), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3296382/>.

<sup>2</sup> Sanjay Kumar Meena, Et. al., *A Review on Forensic Entomology*, 1 NJESR 56, 59-60, (2020),

[https://www.researchgate.net/publication/352074129\\_A\\_Review\\_on\\_Forensic\\_Entomology](https://www.researchgate.net/publication/352074129_A_Review_on_Forensic_Entomology).

<sup>3</sup> Gail S. Anderson, *Forensic Entomology: The Use of Insects in Death Investigations*, <https://www.sfu.ca/~ganderso/forensicentomology.html> (last visited Mar. 5, 2022).

<sup>4</sup> Devinder Singh, Et. al., *Forensic Entomology: An Exhaustive Review*, 27 ANN ENTOMOL. 1, 1-3 (2009), [https://www.researchgate.net/publication/320288428\\_Forensic\\_Entomology\\_An\\_exhaustive\\_review](https://www.researchgate.net/publication/320288428_Forensic_Entomology_An_exhaustive_review).

evidence was used in a modern courtroom to exonerate inhabitants of a house where remains of a skeleton, belong to a child were discovered. Yovanovich and Megnin's evaluation of insect succession on dead bodies, published in the 18th century finally gave recognition to the science of forensic entomology<sup>5</sup>.

In the Indian context, the earliest study on the subject is believed to be conducted in 1889 by Mackenzie in Calcutta where he recorded his observations, on dead bodies regarding the time of appearance of eggs and maggots<sup>6</sup>.

## II. REVIEW OF LITERATURE

**Isaac Joseph**, in his work, *the use of insects in forensic investigations: An overview on the scope of forensic entomology (2011)* throws light on the important and fundamental aspects of forensic entomology including the history of development of the said branch along with elaborate discussion on association of arthropods with post-mortem changes in the human body. The paper also discusses in brief, entomo-toxicology and use of insect data for determination of the crime scene. **Manisha Sardar**, in *A Comprehensive Overview of Forensic Entomology* provides in-depth information about the various aspects of forensic entomology, starting from the historical background, the process of decomposition and role of insects in the same, methodology used in forensic entomology, its application and lastly limitations in the said field. **Manish Sharma, Devinder Singh, Forensic Entomology: An Indian Prospective**, discussed the application of forensic entomology especially in the Indian perspective. It highlights upon the needs and facilities required to develop this field and how India is leading to a stunted growth of this subject area of forensics. This paper has also provided a brief insight into works of certain scientists in the field of forensic entomology and how there can be better usage of expertise in the medico-legal arena. **H. S. Bhawara, Snehlata Singh**, in *Insect evidence in legal investigation* elaborates upon Insects playing a vital role in the biological decomposition of bodies and how they can be used as evidence in criminal investigations. The authors elaborate on the application of entomology in the legal investigation especially in determining the time

of death and when the post-mortem is delayed is considered as an effective method. Unfortunately, this subject of study has received bare-minimum attention in Indian forensic science laboratories. The article also discusses the many entomological study methodologies, involving the historical aspect and a procedural guide.

**Martin J. R. Hall** in *The Relationship between Research and Casework in Forensic Entomology* discusses on the importance of a close and positive interaction between research and casework in such a specialised area of forensic science as entomology. The author emphasises on how a forensic entomology involves collecting insects and analysing climatic conditions for producing a strong witness testimony based on examination of data. This field also includes challenges in this field which can include circumstances where samples, if they are gathered at all, are poorly preserved and do not represent the entire cadaver fauna. The paper presents the need for congruence of the theory of forensic entomology and the actual cases on the ground.

## III. FORENSIC ENTOMOLOGY IN INVESTIGATION OF CRIME

The close link between cadavers and insects and the use of arthropods during investigation of medico-criminal cases forms the subject matter of forensic entomology. Measurement of the body temperature, analysis of rigour or livor mortis are some medical techniques that can help in accurately determining the time of death only for the first two or three days. Therefore, in cases where more than 72 hours have passed, intervention of a forensic entomologist is required because in such cases, insect evidence is often the most meticulous and, sometimes, the only way to determine the time since death.

1. Additional uses of entomological evidence- As discussed above, entomological evidence can be aptly used to determine the time of death. In addition to determining the PMI, insect evidence can be used to determine the following:

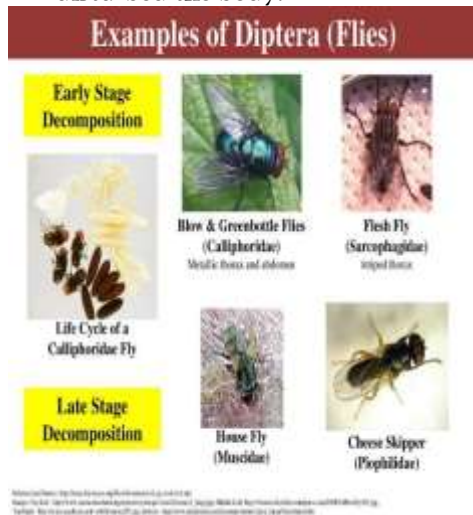
- i. Movement of the body after death: In cases where the dead body has been removed from the crime scene to a place of hiding, the insects found on the body

<sup>5</sup> Manisha A. Sardar, Et. al., *A Comprehensive Overview of Forensic Entomology*, 7 IJETV 19, 20-22, (2021), [https://www.researchgate.net/publication/353954977\\_A\\_Comprehensive\\_Overview\\_of\\_Forensic\\_Entomology](https://www.researchgate.net/publication/353954977_A_Comprehensive_Overview_of_Forensic_Entomology)

<sup>6</sup>A. Appala Raju, *Forensic Entomology- Insects Role in Criminal and Civil Laws*, 8(1)INT.J.CURR.MICROBIOL.APP.SCI 2479-2483 (2019), <https://www.ijcmas.com/8-1-2019/A.%20Appala%20Raju,%20et%20al.pdf>

on the body may be native to the first region but not the second. This will establish that the body was transported, and will also help in determining the region where the crime occurred.

- ii. Disturbance to the body after death: In some cases, the killer may return to the scene and disturb the dead body. This can disturb the insect cycle, which can be identified and utilised by the entomologist to determine the date of death as well as the date when the killer disturbed the body.



Presence and position of wounds: Insects have the tendency to colonize and lay their eggs in open wounds, before proceeding to other body parts. Therefore, if there is insect colonisation away from the natural cavities/orifices, then there is a high possibility that the site is of a wound. For example, if there is maggot activity in the palms of the corpse, then the same can be considered to be an indication of presence of defense wounds.

- iii. Entomo-toxicology: Insect evidence can also help to determine the presence as well as the type of drugs and other toxic substances. In cases of absence of adequate flesh on the cadaver, maggots can be examined as they bioaccumulate these toxins and can provide evidence of the drugs present.
- iv. Solving non-Homicidal/suicidal crime: In some cases, meticulous examination of the entomological evidence can help to solve crimes which do not involve homicide/suicide. For example, arthropod evidence involving taxa with distinct geographical ranges can help in determining origin of drug shipments,

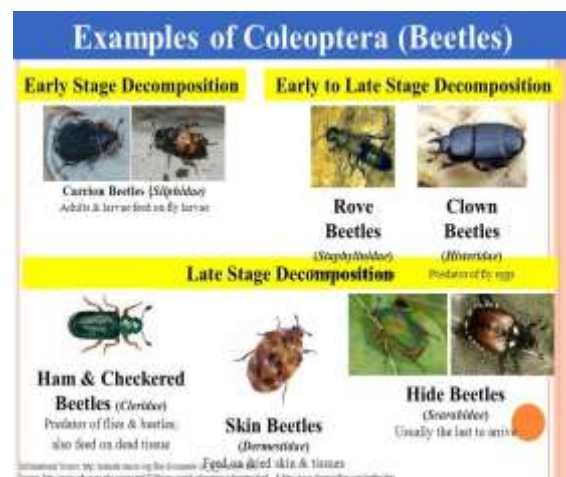
sources vehicles and other accessories used in a crime, etc.

- 2. Child abuse or abuse of the elderly: At times, insects may also invade an alive human's wounds or injuries or unsanitary regions and this is known as cutaneous myiasis. The person is still living, but is infested by maggots. This situation can aid forensic entomologist in deriving the date or the time period of the wound or maltreatment. An example can be that in a neglected child, the commencement of maggot infestation will provide a small time-interval since a diaper change last occurred for the child. This condition is common in young children and the elderly.

#### IV CLASSIFICATION OF ARTHROPODS

Generally, arthropods are classified into 4 categories namely:

1. Necrophagous species- These refer to arthropods that feed on the carrion (corpse)
2. Parasites/Predators- These include arthropods that feed on the necrophagous species. This group also includes what are termed *schizophagous* species, which primarily feed on the carrion but in later stages become predaceous.
3. Omnivorous species- These feed on both the carrion as well as other arthropods which may include ants, beetles, wasps etc.
4. Other species- These include spiders and springtails that utilise the corpse as an extension of their immediate environment.



**Fig. 1.** Insects falling in the category of Coleoptera (left) and insects in the category of Diptera (right)

It is important to note that the first two categories are of major importance for forensic entomology and they mainly belong to the species of the order *Diptera* (flies) and

*Coleoptera* (beetles). Diptera also called true flies are the most commonly exploited insects in forensic examinations.

In criminal cases involving violent death, the *Coleoptera* order is regarded as the second most important in terms of forensic relevance. *Silphidae*, also known as carrion beetles, hold special relevance among the forensic families due to their necrophagous behaviours in the immature stage and omnivorous diets as adults. The subfamilies *Nicrophorinae* and *Silphinae* are abundant in tropical locations, make up this group.

## V. TECHNIQUES USED FOR DETERMINING PMI

There are two major methods which can be utilised to determine post-mortem interval. First one is by using “**successional waves of insects**” and the second one is by “**using maggot age and development**.”<sup>7</sup>

The first method is based on the principle that any dead body, either human or otherwise supports a dynamically altering ecosystem, going from fresh state to dry bones in a period of weeks or months, depending on the geographical factors. Decomposition leads to various biological, physical and chemical changes and the different phases of decomposition attract different species of insects. Flesh Flies (*Sarcophagidae*) and Blowflies (*Calliphoridae*) usually arrive within a day depending on the geographical conditions followed by Cheese skippers (*Piophilidae*) that arrive later during the protein fermentation stage<sup>8</sup>. Therefore, using the information on regional insect ecology and connecting the same with the carrion colonisation timeframes, the time of death can be ascertained. This method is used in cases where the dead body is a few weeks or a year old<sup>9</sup>. The approach can also be used to figure out what season a person died in. The second method can be used to determine the PMI up to one month. Species identification is the first step in this method. After successful identification, the age of the larvae is

determined which is done by measuring the dry weight or length of the oldest larvae and comparing the same with the reference data<sup>10</sup>. It is important to note here that the rate of development of the larvae depends upon the temperature of the surrounding area. Each stage of growth has its own set of temperature requirements; and therefore, once the thermal history of the larvae is acquired, comparing the same with the temperature of the crime scene can help in estimating the PMI<sup>11</sup>.

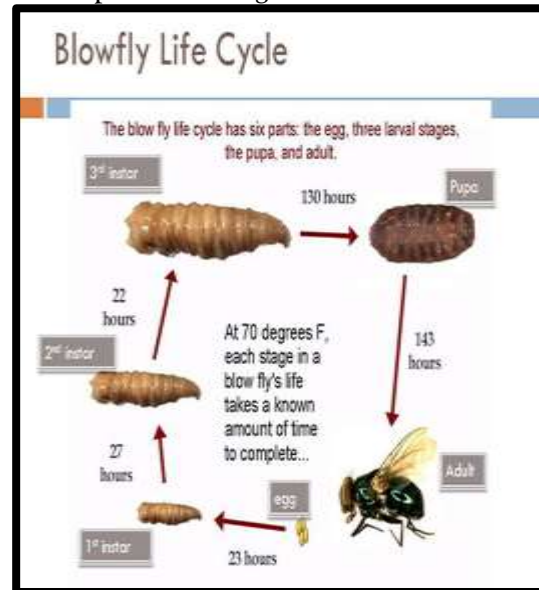


Fig. 2. Lifecycle of a Blowfly

## VI. FORENSIC ENTOMOLOGY: A LACUNAE IN THE INDIAN FORENSIC SCIENCE

Forensic Science in India has developed especially in the aspect of DNA profiling but the path of Forensic Entomology is still less travelled. Forensic entomology is gradually developing but most law enforcement agencies are still skeptical about the potential of this field<sup>12</sup>. In India it is still in a primitive stage and very less professionals are involved in researching and working in this arena. The infrastructure and the laboratories in India are not as well equipped to aid this branch of

<sup>7</sup> Pankaj Kulshrestha, *Synchronous Use of Maggots and Diatoms in Decomposed Bodies*, 26(3) JIAFM, 121-124 (2004).

<http://www.forensicindia.com/journals/jiafm/t04/i3/jalt04i3p121.pdf>

<sup>8</sup> Dorothy E. Gennard, *Forensic Entomology: An Introduction*, BICENTENNIAL (2007). [HTTPS://OLD.AMU.AC.IN/EMP/STUDYM/99995708.PDF](https://old.amu.ac.in/emp/studym/99995708.pdf)

<sup>9</sup> Lena Lutz, Et. al., It is all about the insects: a retrospective on 20 years of forensic entomology highlights the importance of insects in legal investigations, 135 INT. J. LEGAL MED. 2637, 2641-2643, (2021)

<https://link.springer.com/article/10.1007/s00414-021-02628-6>.

<sup>10</sup> Supra Note 4.

<sup>11</sup> Damien Charabidze, *Temperature: the weak point of forensic entomology*, 133(2) INT. JOURNAL OF LEGAL MED. 633-639 (2019).

<sup>12</sup> Sallawad SS, Sharma A, Pandey D, Ahirwar B, *Entomotoxicology-A Juvenile Branch of Forensic, Entomological Studies*, 11 RESEARCH J. PHARM. AND TECH, 65-72 (2018), <https://rjptonline.org/HTMLPaper.aspx?Journal=Research%20Journal%20of%20Pharmacy%20and%20Technology;PIID=2018-11-1-13>

forensic science<sup>13</sup>. Not many institutes within India provide courses on this aspect of forensic science therefore, its growth in our country has remained stunted.

The reason this branch of forensic entomology came up was to provide the medico legal aspect. Forensic entomology proposes to determine the time of death, known as post-mortem interval (PMI), which is derived from how long a carrion has been exposed in the environment<sup>14</sup>. Forensic entomology is chiefly related with death investigations and define the location, time and mode by analysing the insects collected from and around corpses<sup>15</sup>. It can be utilised majorly at the investigation stage of a crime where there can be application of the same. There are some forensic entomologists, though limited in number yet their expertise is not utilised to the utmost while determining a case. The presentation of characteristic morphology, numerous physical parameters involved, and the composition of arthropod species discovered on a body is required for the integration of forensic evidence in a medico-criminal investigation. Every instance has unique circumstances around the deceased body, which might substantially influence the final values determined from entomological data. As a result, specific standards and rules have been devised to ensure that entomological data gathered from a crime scene is credible, reproducible, and legitimate<sup>16</sup>. These standards and guidelines will enable quality assurance and accreditation of Forensic Entomological evidence in the courtroom. For aiding in this examination, the law enforcement agencies are responsible, they are involved in the collection of evidence and it is their duty that forensic investigation of those pieces of evidence are done in order to establish those facts which can be admissible in the court. The collection of evidence is done in such a careless manner and is majorly tampered and so it becomes difficult to investigate especially on lines of forensic entomology. In India, whenever a case of decomposed body is found, the matter is investigated by the police and only if they suspect a foul play then they will take the corpse

to the forensic expert for determining the time of death and therefore, this aspect of forensic science is rarely investigated. The maggots crawling over the dead bodies are usually considered to be a disgusting element of decay and are not collected at the time of autopsy<sup>17</sup>. The forensic entomology is a road less taken in India since the results by forensic entomologist are not immediate and it takes time to rear the insects<sup>18</sup>. Therefore, due to the unawareness, need for rapid results and negligence, this specialisation is used in a limited manner.

Even the court of law is ready to accept forensic entomological evidence if the samples were analysed with the requisite precautions. In the case of *M. Sakthivel v. The State by Inspector of Police, Yercaud Police Station, Salem District*<sup>19</sup> the court was submitted forensic entomological evidence to determine the time of death and court did find some force in the argument but stated that “though maggots were crawling all over the body, there was no attempt made by the investigating agency to collect the maggots by engaging the services of an entomologist to get precise opinion regarding the time of death”. Forensic evidence is not explicitly mentioned under any legislation but can be traced to section 45-51 of the Indian Evidence Act,<sup>20</sup> which addresses expert's opinion in evidence. Section 45<sup>21</sup> states that opinion of experts can be cited as evidence in the court. In cases the matter of the inquiry is in context to science or art and in which inexperienced persons are unlikely to form correct judgement, Section 45 of the Indian Evidence Act authorizes presentation of expert evidence. It permits an expert to testify in court about a specific fact and demonstrate to the court that his findings are unbiased and scientific. There is no overt mention of any kind of forensic examinations and so people usually prefer the faster methods in forensic science rather than waiting for the entomological deductions.

In the mortuaries of several Indian hospitals and medical institutes, there are no modern facilities. These will require post-mortem toolkits, photography and video graphic kits, as well as cold rooms/chambers for the storage of

<sup>13</sup> Supra note 5.

<sup>14</sup> Ibid.

<sup>15</sup> P K Sumodan, *Insect Detectives*, 7(8) RESONANCE, 51-58 (2002),

[https://www.researchgate.net/publication/320264807\\_Forensic\\_Entomology\\_An\\_Indian\\_Prospective](https://www.researchgate.net/publication/320264807_Forensic_Entomology_An_Indian_Prospective)

<sup>16</sup> Supra note 5.

<sup>17</sup> Messers Ruchi Sharma, Rakesh Kumar Garg and J.R.Gaur, *Various methods for the estimation of the post*

*mortem interval from Calliphoridae : A review*, 5(1) EGYPT. J. FORENSIC SCI., 1-12 (2015).

<sup>18</sup> H. S. Bhawara, Snehlata Sing, *Insect evidence in legal investigation*, 2(2) Indian J. Forensic Med. Toxicol., 17-19 (2008).

<sup>19</sup> (2016) 2 MLJ (Cr.) 666.

<sup>20</sup> Indian Evidence Act, 1872, No. 01, Acts of Parliament, 1872.

<sup>21</sup> Indian Evidence Act, 1872, § 45, No. 01, Acts of Parliament, 1872.

dead bodies brought in for post-mortem examinations. Air conditioning should be available throughout these post-mortem facilities. The mortuaries should have proper lighting with preserving and packing materials for all types of exhibits that are missing<sup>22</sup>. Due to the lack of infrastructure, the forensic entomological investigation is hindered and is rarely presented as evidence. Forensic Entomology is therefore, a road less travelled in India due to multiple issues and is a lacuna in the Indian forensics. Continuous efforts are being done by certain scientists who are experts in this field to promote it at least from the research point of view so that in future it can be incorporated as a common way of corroborating evidences in context to time of death in criminal investigations.

## VII. FAMOUS CASES UTILIZING FORENSIC ENTOMOLOGY

Forensic Entomology has been used in various cases, especially the ones related to murder for establishing the time of death due to the presence of maggots on or around the decomposing body. One of the earliest cases which used forensic entomological evidence was used in the UK and was called the "Ruxton" case of 1935<sup>23</sup>. In this case, Buck Ruxton, a physician, murdered his wife and her maid. He then mutilated their bodies and dispersed the parts in order to make it unidentifiable. This case was also called as the Jigsaw Murders. Certain Maggots were found on the bodies of the deceased and so were sent to Dr Mearns, an entomologist at the University of Edinburgh. The maggots were about 12-14 days old, which hinted at the time of death and the duration for which bodies had been in the ravine. The time frame matched with the disappearance of both the women and further helped in corroborating the evidence presented in the court.

The Paul Bernardo case<sup>24</sup>, also known as Ken and Barbie Murders, was another important case in Canada where forensic entomological evidence was used to establish guilt. Paul Bernardo and Karla Homolka were involved in rape and murder of a fourteen-year-old girl in the year 1991. The brutality which they committed was recorded by them on tape due to which the charges were framed against them.

They were arrested and put on trial. Forensic entomologist Dr. Neal Haskell helped in establishing a timeline for the victim's murder by utilizing his understanding of development cycle of insects. He narrowed a fifteen-day time period to four days for the victim's time of death, which was presented in the court of law. The *Richie v. Mullin*<sup>25</sup> is a case in USA of the year 1991. In the case *Mrs. Laura Launhardt* was abducted and was then taken to an abandoned house in a rural area. The accused bound her and tied a strap around her neck which was connected to the clothes rod in a closet. The decomposing body of Mrs. Launhardt was discovered by the police. At trial, Mr. Richie and an accomplice were taken up as suspects and the defence relied on 'entomological evidence' which included the size of the maggots on her decomposing body. The defence wanted to deny charges of murder and used the entomological evidence to prove that Mrs. Launhardt had not died until 48 hours of the abduction. Defence counsel tried establishing the time of Death using maggots and proved that 48 hours after she was left in the closet, she slipped or fainted and the strap around her neck secured to the clothes rod had pressure on the blood vessels in her neck and she died with the asphyxiation. The entomological evidence was appreciated by the judge yet the accused's attempt to save himself from the charges of murder failed since the cause of death was ultimately linked to the actions of the accused.

In India as well, in certain cases the forensic entomological evidence has been discussed by the court. In the case of *Kuttikunkan v. State of Kerala*<sup>26</sup> The defence relied on the entomological evidence and stated that the day the deceased received injuries due to the action of the accused was different from the day of this death. The life-cycle of a maggot helped in deriving the time of death in this case due to which the charges of murder on the accused could not be sustained by the court. In the case of *M. Sakthivel v. The State by Inspector of Police, Yercaud Police Station, Salem District*<sup>27</sup> as well the prosecution tried to rely on the entomological evidence but since it was not as carefully preserved and there were possibilities of flaws in the conclusion, therefore, court did not rely on it.

<sup>22</sup> Prachi Kathane, Anshu Singh, *The development, status and future of forensics in India*, 3 *Forensic Sci. Int.* (2021), <https://www.sciencedirect.com/science/article/pii/S2665910721000463>

<sup>23</sup> *Rex v. Ruxton* (1935).

<sup>24</sup> *R. v. Bernardo*, [1993] O.J. No. 2047

<sup>25</sup> (25.07.2005 - 10th Circuit): MANU/FETT/0161/2005

<sup>26</sup> CRL.A.No. 1232 of 2008

<sup>27</sup> (2016) 2 MLJ (Crl.) 666.

In India very few cases have a reference of forensic entomological evidence and that is due to lack of awareness and resources to aid this kind of examination. There are certain experts such as Dr. Pankaj Kulshrestha of Medico Legal Institute, Madhya Pradesh has published few papers in case studies of post mortem interval estimation based on flies infesting human corpses<sup>28</sup> and also Zoology department of Punjab University is working on this aspect. But there is still a need for congruence of the theory of forensic entomology and the actual cases on the ground. The research might be developing in this area yet there is a need to tackle ground level issues so that this aspect can be used to its full potential for presenting valid corroborative evidences in the court of law.

### VIII. CONCLUSION AND RECOMMENDATIONS

In recent years, forensic entomology has become a novel instrument for solving criminal activities, such as murders and suicides. In these cases, forensic entomology attempts to estimate the time of death, the location of the crime, and a variety of other legal issues. PMI is one of the most significant parts of crime detection, and it can be determined quite easily with the help of insects especially when more than 72 hours have elapsed since death. Its accuracy varies from a day or a range of days. It is essential that the insects and maggots are collected appropriately, as accuracy is dependent on suitable conditions for insects<sup>29</sup>. Insects differ by geographic region, so this type of data must be used to develop the species and timing of colonisation for all areas. However, many laboratories in our nation do not specialise in this field and do not have the requisite infrastructure. For a successful investigation,

factors such as insect activity, optimum temperature, rainfall, burial depth, presence of carnivores, and so on should be monitored as well.

Though forensic entomology plays a significant role in medico-criminal cases, at the same time, it cannot be refuted that analysis of entomological evidence has certain limitations due to situations surrounding the dead-body, drowning of the corpse or loss of morphology of maggots. Without any doubt, the current developments in molecular techniques and research done by scholars have aided in providing solutions to these issues, thereby expanding the ambit and generating curiosity in the field. There exists an immediate need to develop uniform entomological data references with specific attention to the various geographical regions in order to foster research across the globe. Emphasis should be laid on the inclusion of a forensic entomologist in the crime-scene investigation team to gain a reliable understanding of the complex interactions between the environment and the corpse and collection of specimens that could be perplexing for other forensic personnel. Along with this, special attention should be paid by the government to provide public hospitals and forensic institutions the latest equipment and elaborate infrastructure to ensure accurate and efficient services. The field of forensic entomology will only flourish when universities and colleges introduce it as a separate course in the curriculum of Masters in Forensic Science and in the medical courses as well. Overall, the discipline of Forensic Entomology requires extensive research and analysis to remove the impediments of the existing problems in the arena using advanced technology in order to establish international standards for forensic-entomological evidence.

<sup>28</sup> Supra note 5.

<sup>29</sup> Martin J. R. Hall, *The Relationship between Research and Casework in Forensic Entomology*, 12(2) *Insects MDPI*, 174 (2021), <https://www.mdpi.com/2075-4450/12/2/174>