Journal of Forensic Sciences And Criminal Investigation
ISSN: 2476-1311

Juniper Publishers key to the Researchers

Case Report
Volume - 7 Issue - 5 February 2018
DOI: 10.19080/JFSCI.2018.07.555721

J Forensic Sci & Criminal Inves

Five Case Studies Associated with Forensically Important Entomofauna Recovered from Human Corpses from Punjab, India

Anika Sharma, Madhu Bala* and Neha Singh

Department of Zoology and Environmental Sciences, Punjabi University, India

Submission: February 08, 2018; **Published:** February 19, 2018

***Corresponding author:** Madhu Bala, Department of Zoology and Environmental Sciences, Punjabi University, Patiala, India, Tel: 91 9872129846; Email: madhubaladhakane@gmail.com

Abstract

The analysis of the insect community present on a decomposing corpse can often provide valuable forensic insights, especially the estimation of the time of death, or postmortem interval (PMI). Life cycle of insect act as precise clocks which starts within few minutes or hours after death. When other methods are notable to provide appropriate information, life cycle of insects plays an immense role in Postmortem interval estimation. The present results highlight the particularities of local insect fauna from human corpses from Northern India (Punjab) and its dynamics on human corpses. The insects were collected from human corpses during autopsy procedure. Out of the 5 human case studies, 4 were males and 1female; their ages ranged from 26 years to 52 years. The cause of death was either homicide or suicide. The main objective of this study was to collect necrophagous insects colonizing the human corpses as well as to gather information about their potential role in crime investigation.

Keywords : Forensic entomology; *Chrysomya megacephala*; Diptera; Coleoptera; Maggots; Postmortem interval

Introduction

Forensic entomology is now-a-days considered an important branch of forensic science, in which the biology and ecology of insects are studied, particularly to determine the postmortem interval (PMI) [1]. The difficulties that forensic medical specialists have faced is regarding the determination of time since death during investigations if deceased is being killed for more than three days [2]. Postmortem interval can be calculated using developmental data of certain species of insects and also through analysis of the arthropod community composition and its succession on the corpse [1]. The succession based method requires knowledge of insect fauna in that particular geographical region where the corpse is found, since species and their times of colonization vary among bio-geographic regions [3-5]. Hence, composition of local carrion fauna, its seasonal variations and patterns of succession, as well as the periods of time each life stage spends on a cadaver, comprise crucial information to be used in forensic cases of a particular region [3,4,6].

It is estimated that Diptera and Coleoptera account for 60% of the fauna associated with decomposing carcasses and, because of that, they are indeed very important in forensic science [7]. Generally Diptera is associated with the early stages of decomposition while beetles are tend to be associated with the advanced stages of decomposition [8]. The arthropods comprise a major element of the carrion community [9-11]. Of the different groups of arthropod that have been categorized based on their attraction to the corpse in different stages of decomposition, four basic arthropods corpse relationships have generally been accepted: Necrophages e.g. blowflies, which feed and breed on the decomposing tissue of the carrion; Necrophiles e.g. beetles, which are predators and parasites of necrophagous fauna, feeding on other arthropods; Omnivores e.g. wasps and ants, which feed on the carrion and its colonizers and Opportunists e.g. spiders, which are found in and around the carrion but only use it as an extension of their own environment [11-13].

Insects and humans are said to be most successful creature on earth. Firstly Blowflies visit corpse, followed by beetles and other insects. Knowing which insects are present, and which life stage they are in can determine how long ago a death took place. The use of insects in estimation of PMI requires information on their biology, phenology and habitat preferences. The main objective of insect succession studies is to examine the colonization patterns of insects in a particular area, often with the goal of obtaining data that can be applied to forensic

investigations involving insects in the event that a death occurs in a similar environment [11].

Why use Insects?

Insects have roamed the earth for 250 million years [14]. During this enormous period insects have attain a wide diversity in both form and behavior because of their hard exoskeleton, high reproductive rate and their capacity to survive in broad range of environment. Presently, there are about 700,000 described species and it is estimated there may be more than 10 million species of insects on earth [15]. Insect evidence can be useful if the information they provide is appropriately collected. Careful observation with knowledgeable expertise of faunal succession at a crime scene, added to known insect life cycle data, can lead the investigator to interpret how long the victim has been available to insect activity. Insects can helps us to understand what happened in criminal case because they are found everywhere, with the exception of sea, where only few species occur. On land and in freshwater, insects are most abundant of animals, forming 85% of world's known species.

Insects Silently Give us Valuable Information about a Crime:

The experts at the American Board of Forensic Entomology say we should be listening to insects through the evidence they provide us. But it is not only the time of death estimation that insects can help in criminal investigation. They can also helps us to discover the site of crime and how it was committed. They can shed light on crimes involving the smuggling of drugs; they can lead us to home town of a murder victim. Curiously, the use of insect in crime investigation is relatively new subject. It began to take shape during the second half of the 19th century, but even today, very few people, including some police officers, know that it exists at all.

Material and Methods

All the dead bodies discussed below were brought to mortuary of Rajindra medical college and hospital, Patiala from crime scene. Adult insects and their immature stages were collected from all human corpse at mortuary of Rajindra medical college, Patiala before autopsy. Some of them were stored in 70% ethanol while some of dipteran larvae were brought and reared in laboratory of department of Zoology and Environmental Science, Punjabi University, Patiala, India for identification. Larvae were provided with 500g chicken meat as food in 1L wide mouth glass rearing jar having 0.5L rice husk and covered with cotton gauge to prevent escape of larvae but allow air flow. Once adult eclosed identification was done with the help of keys and literature.

Case 1: Corpse Found from Residential Area

On March 30th, 2015, the body of 40 years old male, in the bloated stage of decomposition was recovered from a residential area of distt. Ludhiana, Punjab (India). The body of the deceased was discolored, facial features were hardly recognizable and genitals were fully decomposed as the genitals were chopped off. Forensic examination found incised wounds 8×1cm deep on the left side of the neck and another wound 15×12cm present between the legs. The death was attributed to murder by multiple stabbing. Entomofauna found on the body were maggots and pupae of *Chrysomya megacephala* (Figure 1).

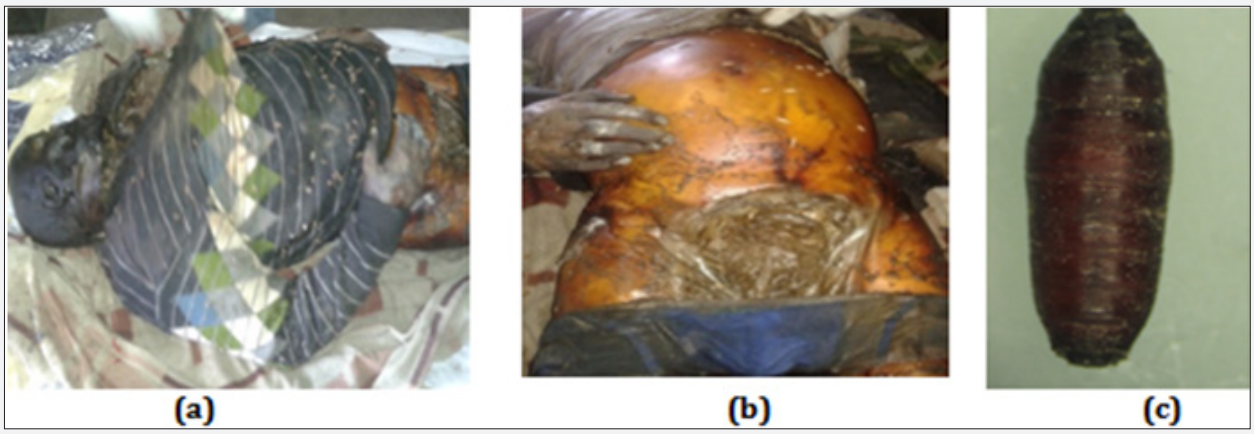

Figure 1: (a) corpse of 40 years old male (b)mutilated corpse (c) Pupae of *Chrysomya megacephala*.

Case 2: Diptera and Coleoptera on Skeletonized Body

A partially mummified body of a 26 years old male was found from his residence at Patiala, Punjab (India) on 22nd April, 2015. Body was in livor mortis stage. In this stage blood appears on the skin as purplish-red discoloration (like a bruise) and can give indication of position of the body at the time of death. The body was partially skeletonized in the neck region and upper chest where underlying bones were fully exposed. Facial features were unidentifiable, soft tissue including the skin is missing from the right side of face, head, neck and upper part of chest. Cause of death was unknown. Entomofauna found on the corpse consists of different instars of larvae of *Chrysomya rufifacies* and beetles belonging to family Dermestidae and Cleridae i.e *Dermestes maculatus* and *Necrobia rufipes* (Figure 2).

How to cite this article: Anika Sharma, Madhu Bala, Neha Singh. Five Case Studies Associated with Forensically Important Entomofauna Recovered from Human Corpses from Punjab, India. J Forensic Sci & Criminal Invest. 2018; 7(5): 555721. DOI: 10.19080/JFSCI.2018.07.555721

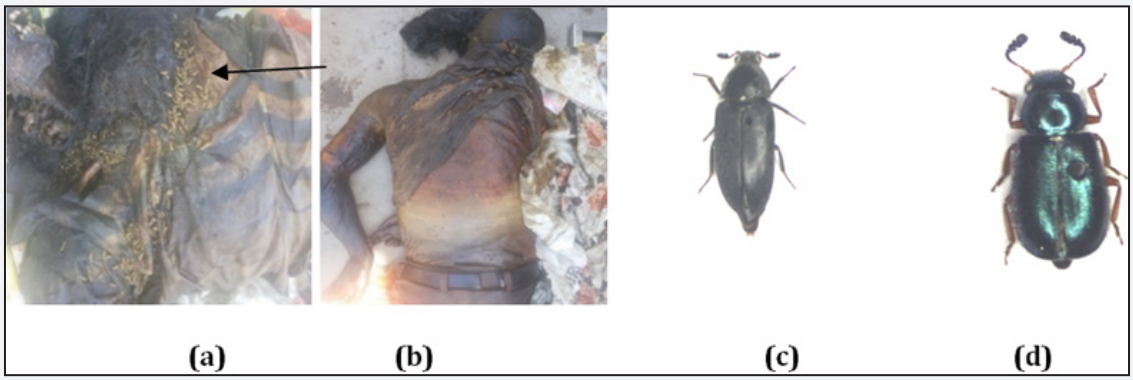

Figure 2 : (a) Abundance of *C. rufifacies* on the chest region (b) Corpse showing signs of livor mortis (c) *Dermestes maculatus* (d) *Necrobia rufipes*.

Case 3: Drowning Case

A dead body of about 52 years old female was recovered from Bhakra canal, Patiala, Punjab (India) on 22nd April, 2015. The body was in bloating stage of decomposition with partially identifiable facial features. Body was emitting foul smell. Whole body was inflated with water, as muddy water was present in larynx, trachea and stomach which was reported during post-mortem examination. Peeling of skin was reported on abdomen and limbs. Egg batches and adults of *Chrysomya megacephala* were present all over the body. Beetles belonging to family Histeridae were reported on corpse. Later egg batches were transferred to rearing jar provided with a piece of goat meat as rearing medium. Rearing helps in identification of fly as well as calculation of PMI (Figure 3C).

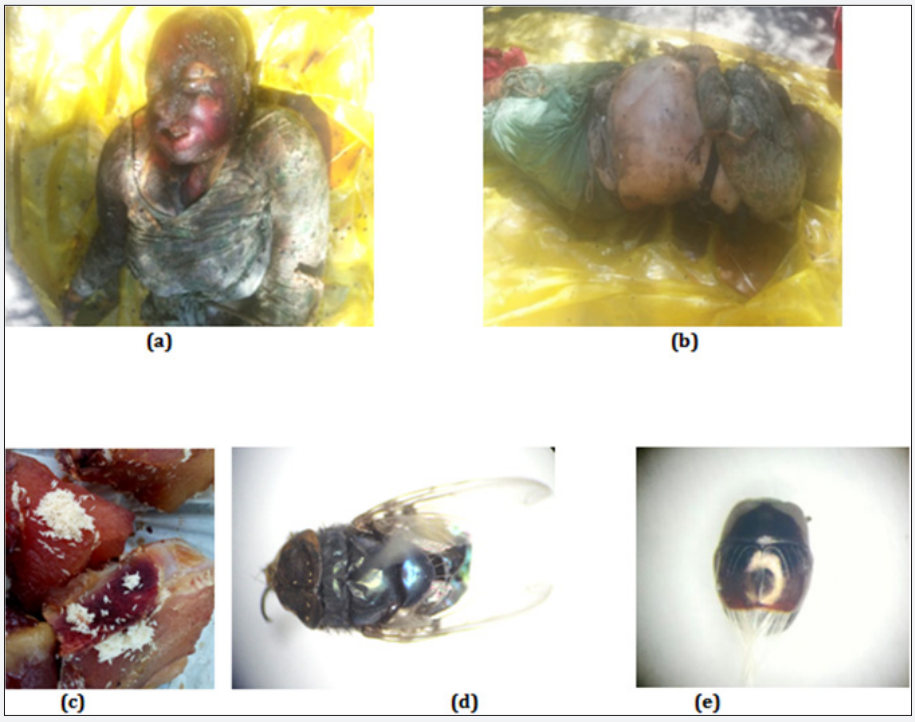

Figure 3 : (a &b) Corpse of a drowned female (c) Egg batches of blow flies (d) adult of *Chrysomya megacephala* (e) Histerid beetle recovered from the dead body.

Case 4: Skeletonized Corpse

A decomposed body of 32 years old unknown male was found in drain Dholanwala bridge, Bhatthalan, Punjab (India) on 6th July, 2015. Fracture of sternum was reported in post-mortem examination along with multiple rib fractures on both sides with infiltration of blood. The reason for deceased death was chest injury with multiple rib fractures. The insect fauna found on the body are Dipteran flies *Chrysomya megacephala*, C*hrysomya rufifacies, Phormia regina* and maggots of *Chrysomya albiceps.* An unidentified wasp was also collected.

How to cite this article: Anika Sharma, Madhu Bala, Neha Singh. Five Case Studies Associated with Forensically Important Entomofauna Recovered from Human Corpses from Punjab, India. J Forensic Sci & Criminal Invest. 2018; 7(5): 555721. DOI: 10.19080/JFSCI.2018.07.555721

Figure 4 : (a & b) Decomposed body of 32 years old male.

Case 5: Abundance of *Chrysomya Albiceps* on Corpse

A body of about 50 years old male was recovered from paddy field in Pathanmajra (Punjab)on 5thjuly 2015. Body was in bloated stage of decomposition as body fluids were oozing out. There was foul smell, discoloration and peeling of skin. The reason of death was unknown. Different instars of larvae of *Chrysomya albiceps* were present all over the body (Figure 5).

Figure 5 : (a & b) Maggots of *Chrysomya albiceps* were present all over the body (c) 3rd instar of *Chrysomya albiceps*.

Discussion

The rate of insect development and their pattern of succession on the carrion differ from country to country and even from area to area within the same country, mainly because of the variation in the topography and climate or weather. Thus, it is not possible to use the data available in one country and apply it to the medico-legal cases in another country. Collection of information about the composition and dynamics of the local communities of necrophagous arthropods in the area where the crime took place is essential to use entomology effectively in legal investigations.

Insects collected in above mentioned cases tend to be "nature's intelligence agents"; they arrive on decomposing corpses in a relatively predictable sequence and in turn provide valuable scientific information. This is termed "ecological succession" and consists of a series of blending waves of different arthropods. Differences in the cast of carrion-frequenting insects (flies, beetles, spiders, ants, etc.) can be used to describe incidents surrounding the death. Blowflies are the first to invade a corpse, while others such as dermestid beetles arrive later, removing the final bits of soft tissue. The time sequence in which carrion insects arrive, provides investigators data to estimate the time of death, reveal movement of the body from one location to another (deception), or time of return of murderer. These forensic determinations are possible, but only if entomological evidence is recognized, properly collected, and sent to a professional entomological laboratory for analysis by a qualified forensic entomologist.

There were more than 60 insect families which play an important role in carrion ecology [12]. However, Dipteran families i.e. Calliphoridae, Sarcophagidae and Muscidae and Coleopteran families i.e Silphidae, Staphylinidae, Cleridae and Dermestidae are the most important to be used in forensic entomology [16,5]. Decomposition of the carrion and insect succession patterns are influenced by many factors e.g. geographic location, habitat, season, temperature, humidity, insect abundance and carrion accessibility. Furthermore, many of these factors are inter-related and even the decomposition rate and insect succession are inter-dependent. It has been found that decomposition of the carrion is accelerated when the insects, particularly necrophagous flies, are present [9,17].

The two approaches for estimating the PMI are complementary i.e. developmental data and the successional data of the insects found on the corpse [18]. However, the

How to cite this article: Anika Sharma, Madhu Bala, Neha Singh. Five Case Studies Associated with Forensically Important Entomofauna Recovered from Human Corpses from Punjab, India. J Forensic Sci & Criminal Invest. 2018; 7(5): 555721. DOI: 10.19080/JFSCI.2018.07.555721

investigator must decide which model is suitable to be used. The use of development data is most applicable during early phase of decomposition when the immature stages of the first colonizers of family Calliphoridae, Sarcophagidae and Muscidae are present. Whereas succession data is utilized when early colonizers are no longer present and the remains are occupied by predators of fly maggots such as beetles [12,19] (Table 1).

Table 1: Showing the details and Entomofauna found on the deceased.

Case	Gender	Age	Cause of death	Stage of decomposition	Insect fauna collected
1	Male	40	Homicide	Bloated	Immature stages of *Chrysomya megacephala*
2	Male	26	Unknown	Partially skeletonized	Maggots of *Chrysomya rufifacies. Dermestesmaculatus, Necrobiarufipes*
3	Female	52	Drowning	Bloated	Eggs and adults of *Chrysomya megacephala*
4	Male	32	Chest injury	Skeletonized	*Chrysomya megacephala, Chrysomya rufifacies, Phormiaregina and Chrysomya albiceps*
5	Male	50	Unknown	Bloated	Maggots of *Chrysomya albiceps*

Acknowledgement

Authors are thankful to Rajindra medical college and hospital, Patiala and Department of Zoology and Environmental Sciences, Patiala. India for providing facilities for this work.

References

1. Amendt J, Campobasso CP, Gaudry E, Reiter C, LeBlanc HN, et al. (2007) Best practice in forensic entomology - standards and guidelines. Int J Legal Med 121(2): 90-104.
2. Prieto JL, Magana C, Ubelaker DH (2004) Interpretation of postmortem change in cadavers in Spain. J Forensic Sci 49(5): 918-923.
3. Anderson GS (1995) The use of insects in death investigations: an analysis of cases in British Columbia over a five year period. Can Soc Forensic Sci J 28(4): 277-292.
4. Anderson GS (2010) Factors that influence insect succession on carrion. Forensic Entomology: The utility of arthropods in legal investigations. In: Byrd JH & Castner JL (eds.) CRC Press, Boca Raton, Florida. pp: 201-250.
5. Anderson GS, VanLaerhoven SL (1996) Initial studies on insect succession on carrion in southwestern British Columbia. Journal of Forensic Sciences 41(4): 617-625.
6. Matuszewski S, Bajerlein D, Konwerski S, Szpila K (2010) Insect succession and carrion decomposition in selected forests of Central Europe. Part 2: Composition and residency patterns of carrion fauna. Forensic Sci Int 195(1-3): 42- 51.
7. Moretti TC, Ribeiro OB, Thyssen PJ, Solis DR (2008) Insects on decomposing carcasses of small rodents in a secondary forest in Southeastern Brazil. Eur J Entomol 105(4): 691-696.
8. Zhuang Q, Cai J, Zhang M, Feng H, Guo Y, et al. (2011) Molecular identification of forensically significant beetles (Coleoptera) in China based on COI gene. Revista Colombiana de Entomología 37(1): 95-102.
9. Payne JA (1965) A summer carrion study of the baby pig Susscrofa Linnaeus. Ecological Society of America 46: 592-602.
10. Anderson GS (2009) Factors that influence insect succession on carrion. In: Byrd JH, CastnerJL (eds.) Forensic entomology: The utility of arthropods in legal investigations, (2nd edn). Boca Raton, FL: CRC Press, USA, pp. 201-250.
11. Kreitlow KLT (2009) Insect succession in a natural environment, In: Byrd JH, Castner JL (eds.), Forensic entomology: The utility of arthropods in legal investigations, (2nd edn). Boca Rotan, FL: CRC Press, USA, pp. 251-269.
12. Smith KGV (1986) A manual of forensic entomology. The British Museum London, UK.
13. (Natural History) and Cornell University Press.
14. Goff ML (1993) Estimation of postmortem interval using arthropod development and successional patterns. Forensic Sci Rev 5(2): 81-94.
15. James L Castner (2004) Ultimate Guide to Forensic Entomology: A Review of Forensic Identification Cards.
16. Starkeby (2004) Ultimate Guide to Forensic Entomology: Introduction to Forensic Entomology'.
17. Aspoas BR (1994) Afrotropical Sarcophagidae in a carrion fly community. Med Vet Entomol 8(3): 292-294.
18. Abell DH, Wasti SS, Hartmann GC (1982) Saprophagous arthropod fauna associated with turtle carrion. Applied Entomology and Zoology 17: 301-307.
19. Tabor KL, Brewster CC, Fell RD (2004) Analysis of the successional patterns of insects on carrion in southwest Virginia. J Med Entomol 41(4): 785-795.
20. Schoenly K, Reid W (1987) Dynamics of heterotrophic succession in carrion arthropod assemblages: Discrete seres or a continuum of change? Oecologia 73: 192-202.

How to cite this article: Anika Sharma, Madhu Bala, Neha Singh. Five Case Studies Associated with Forensically Important Entomofauna Recovered from Human Corpses from Punjab, India. J Forensic Sci & Criminal Invest. 2018; 7(5): 555721. DOI: 10.19080/JFSCI.2018.07.555721

DOI : 10.19080/JFSCI.2018.07.555721

How to cite this article: Anika Sharma, Madhu Bala, Neha Singh. Five Case Studies Associated with Forensically Important Entomofauna Recovered from Human Corpses from Punjab, India. J Forensic Sci & Criminal Invest. 2018; 7(5): 555721. DOI: 10.19080/JFSCI.2018.07.555721