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(REVIEW ARTICLE)

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Importance of entomofauna found in cadavers for Forensic Entomology

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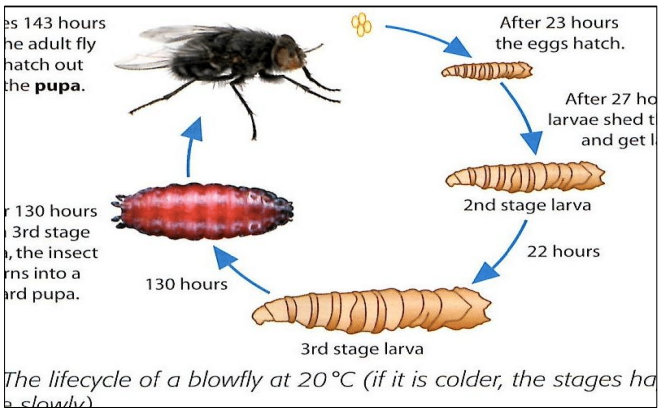
Abstract

The purpose of this paper is to investigate the entomofauna found in cadavers for Forensic Entomology in the following aspects (a) Forensic Entomology in addition to criminal investigation, Medico-Legal Entomology, the entomofauna found in the corpse can provide (b) the identity of the deceased, cause of death, movement body, use of toxins or drugs, in addition to the crime scene, stored products, drug trafficking, ill-treatment, but how Entomology can help to reach the after-death interval. A literature search was carried out containing articles published from 1993 to 2021. The mini review was prepared in Goiânia, Goiás, from September to October 2021, through the. The mini-review was prepared in Goiânia, Goiás, from September to October 2021, through the Online Scientific Library (Scielo), internet, ResearchGate, Academia.edu, Frontiers, Publons, Qeios, Portal of Scientific Journals in Health Sciences, Pubmed, Online Scientific Library (Scielo), internet, ResearchGate, Academia.edu, Frontiers, Biological Abstract, Publons, Qeios, Portal of Scientific Journals in Health Sciences, and Pubmed, Dialnet, World, Wide Science, Springer, RefSeek, Microsoft Academic, Science, ERIC, Science Research.com, SEEK education, Periódicos CAPES, Google Academic, Bioline International, VADLO, Scopus, and Web of Science.

Keywords: Criminal investigation; Medico-Legal Entomology; Entomofauna; After-death interval (IPM)

1. Introduction

Forensic Entomology is a branch of biology that can be defined as the application of the study of insects and other arthropods, in association with expert procedures.



The lifecycle of a blowfly at 20 °C (if it is colder, the stages ha

(Source: https://higheducationhere.com/forensic-entomology/)

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Figure 1 Forensic Entomologist: Job Description, Duties and Requirements;

Its purpose is to discover information relevant to a criminal investigation. This science is gaining importance and, when properly applied, becomes an important part of police investigations (Figure 1) [1,2,3,4,5].

The first documented case of forensic entomology is reported in a 13th century Chinese Forensic Medicine textbook. It was a murder case in which a farmer was found beheaded by a scythe. To resolve the case, all farmers in the region were forced to lay their scythes on the ground, in the open air. The flies landed on just one of them, attracted by the remnants of blood that still clung to the blade. The conclusion was that this was the killer's scythe. However, this science became known worldwide after 1894, with the publication in France of Mégnin's book "La Faune des cadavers". Where the author includes theoretical foundation, descriptions of insects and reports of real cases studied by him and collaborators (Figures 2 and 3) [1,2,3,4, 5,6].

Figure 2 It's Forensic Entomology at The Body Farm; (Source: https://www.sciencefriday.com/educational-resources/forensic-entomology-body-farm/)

Figure 3 Flies on a porcupine corpse; (Source: Paul venter, via Wikimedia Commons / CC BY-SA 3.0)

However, in Brazil, entomology gained prominence in 1908, with the pioneering works of Edgard Roquette Pinto and Oscar Freire. In the States of Rio de Janeiro and Bahia, respectively. Based on case studies in humans and animals carried out in the first decade of the 20th century, these authors recorded the diversity of the necrophagous insect fauna in regions of the Atlantic Forest, which were still quite preserved at that time. And they drew attention for their critical stance and their effort to develop methods suited to local conditions in Brazil (Table 1) [1,2,3,4,5,6,7].

Table 1 The necrophagous and coptophagus insect fauna in regions of the Atlantic Forest

Assemblage ecological measures	Necrophagous		Coprophagous	
	Area +P	Area −P	Area +P	Area −P
Richness	8	6	8	6
Abundance	185	200	380	445
Total biomass	71.4	76.9	95.6	101.8
Richness estimators				
ACE	8.0	6.0	8,0	8.2
Chao1	8.0	6.0	8,0	7.0

Source: https://www.researchgate.net/figure/Ecological-attributes-of-necrophagous-and-coprophagous-dung-beetle-assemblages-in-two_tbl1_316975202

1.1. Forensic Entomology Beyond Criminal Investigation

Forensic entomology is a branch of biology that can be defined as the application of the study of insects and other arthropods, in association with expert procedures. Its purpose is to discover information relevant to a criminal investigation. This science is gaining importance and, when properly applied, becomes an important part of police investigations (Figure 4) [8].

Figure 4 Um crime dinner; (Source: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fwww.effinghamschools)

1.2. The first application of Forensic Entomology

The first documented case of forensic entomology is reported in a 13th century Chinese Forensic Medicine textbook. It was a murder case in which a farmer was found beheaded by a scythe. To resolve the case, all farmers in the region were forced to lay their scythes on the ground, in the open air. The flies landed on just one of them, attracted by the remnants of blood that still clung to the blade. The conclusion was that this was the killer's scythe (Figures 5 and 6) [9].

However, this science became known worldwide after 1894, with the publication in France of Mégnin's book “La Faune des cadavers”. Where the author includes theoretical foundation, descriptions of insects and reports of real cases studied by him and collaborators [10].

However, in Brazil, entomology gained prominence in 1908, with the pioneering works of Edgard Roquette Pinto and Oscar Freire. In the States of Rio de Janeiro and Bahia, respectively. Based on case studies in humans and animals carried out in the first decade of the 20th century, these authors recorded the diversity of the necrophagous insect fauna in

regions of the Atlantic Forest, which were still quite preserved at that time. And they drew attention for their critical stance and their effort to develop methods suited to local conditions in Brazil [10,11].

Figure 5 Bugs don't lie: Student researchers explore Forensic Entomology; (Source: https://www.curry.edu/about-us/news-and-events/news/bugs-dont-lie-student-researchers-explore-forensic-entomology-)

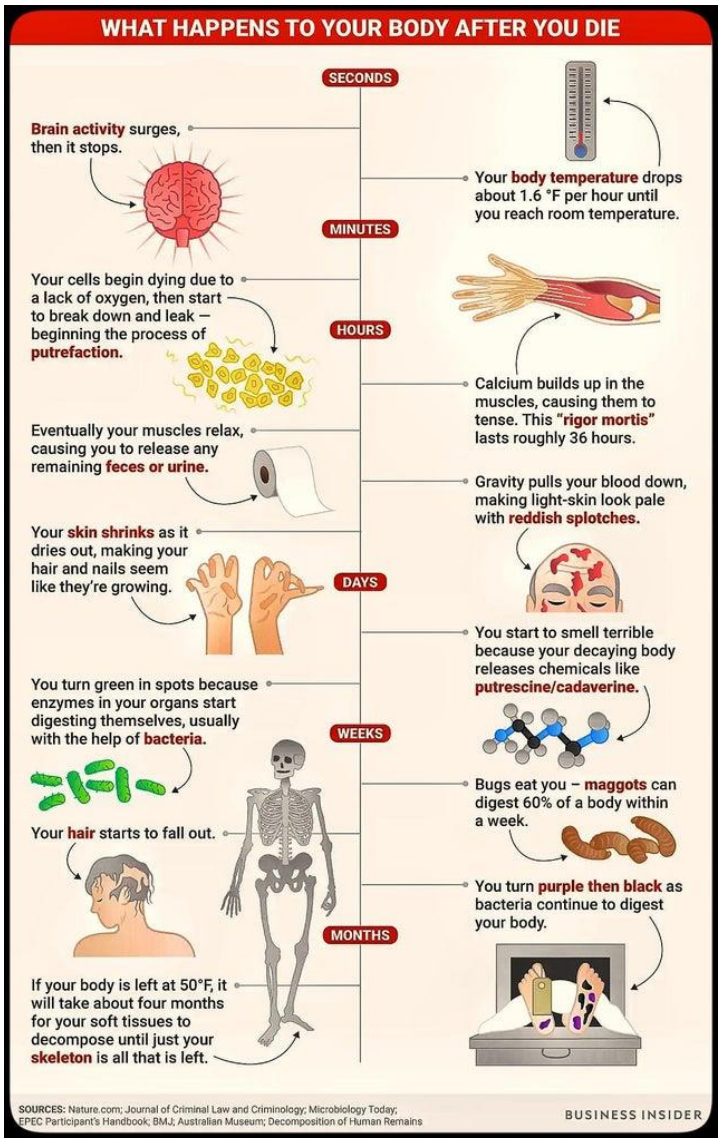


Figure 6 A morbid guide to human body decomposition; (Source: https://www.reddit.com/r/coolguides/comments/jdtivy/a_morbid_guide_to_human_body_decomposition/)

1.3. Medical-legal Entomology

Forensic or medico-legal entomology is more commonly known as medico-criminal Entomology due to the emphasis placed on the usefulness of arthropods in solving crimes that often involve violence. In short, it is science that deals with the application of the study of the behavior of insects and other arthropods associated with a human cadaver. In this sense, through this science it is possible to determine the date of death (time between death and the date the corpse was found), the so-called post-death interval (IPM). If the body was moved to a second location and if it was manipulated and possibly deduce the circumstances surrounding the event before or after the event. For example, dipterans of the Calliphoridae family are found in urban centers, and their association with bodies found in rural areas suggests that the victim was not killed at the point where he was found (Figure 7) [12,13].

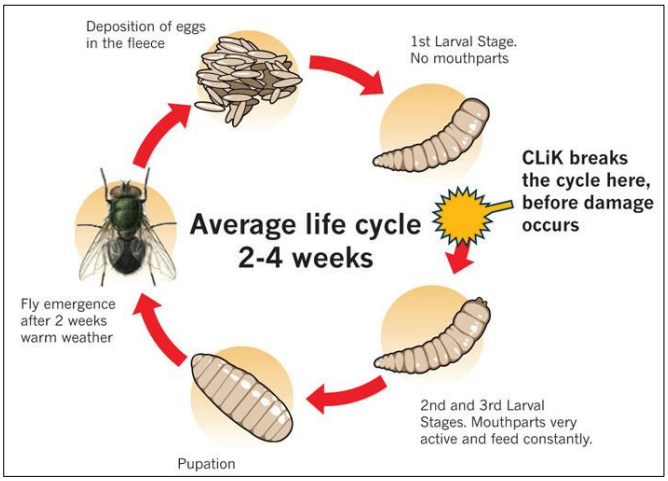


Figure 7 Calliphoridae family; (Source: https://twitter.com/entomologyorni1/status/1254062249662005250)

The ability of insects to pick up odors that humans cannot smell makes them the first to arrive at a crime scene or where there is a dead organism. However, the odors given off by the corpse are modified during decomposition. So, this change becomes more or less attractive to the species. Therefore, there are four categories that divide the ecological function of cadaveric fauna and are considered in an investigation: categories that divide the ecological function of cadaveric fauna (Figure 8) [14;15].

Figure 8 Insects of forensic importance associated to cadaveric decomposition in a rural area of the Andean Amazon; (Source: https://www.scielo.br/j/aa/a/gNmSRNCF6LqRNC7CQFkVqYH/?lang=en)

1.4. The entomofauna found in the corpse can provide some important information about

1.4.1. Dead person's identity

It can be done by obtaining blood and tissue from the cadaver inside the insects and later analyzing DNA for identification [14,15].

1.4.2. Cause of death

As the speed of decomposition is influenced by some factors such as where the person died, it can be found out if the person was killed by drowning, carbonization, poisoning, among other things (Figure 9) [14,15].

Figure 9 Cause of death; (Source: https://www.theguardian.com/science/2010/sep/23/flies-murder-natural-history-museum)

1.4.3. Body movement

As the diversity of scavenger insects is great even within the same region, it can be deduced if the body was moved [14,15].

1.4.4. Use of toxins or drugs

Toxins or drugs that are present in the decaying body cause developmental changes in the life stages of insects that feed on organic matter. And these substances can also be identified in the insect's body. Each moment of cadaveric putrefaction has its own conditions and characteristics. This means that each step attracts different groups of insects. In this way they succeed each other differently during the different stages of decomposition (Figure 10) [14,15].

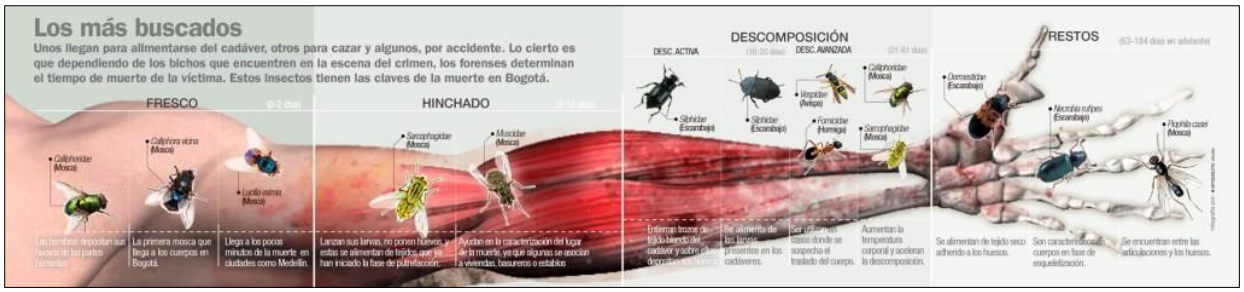


Figure 10 Cadaver decomposition phases: a-fresh, b-putrefaction, c-Dark putrefaction, d.fermentation and e.dry. Each moment of cadaveric putrefaction has its own conditions and characteristics; (Source: https://pontobiologia.com.br/csi-da-vida-real-entomologia-forense/)

1.4.5. Beyond the crime scene

In addition, entomology can be used in the investigation of other cases in the judicial sphere, such as: drug trafficking, mistreatment and contamination of materials and stored products [14,15].

1.4.6. Stored Products Entomology

They occur primarily in the civil area, and insects are usually the problem. It is the contamination to a large extent of stored commercial products, such as agricultural products after harvest and their derivatives when stored. The focus of control involves technologies aimed at eliminating or reducing the population of pests, to allow their safe use by consumers [14,15].

1.4.7. Drug Trafficking

It is possible to determine the origin of marijuana packages, for example, based on the identification of the insects that were retained now of pressing and tracing the traffic route through the geographic distribution of these insects [14,15].

1.4.8. Mistreatment

It is possible to specify the number of days during which a baby was deprived of hygiene care, based on the age of the fly larvae found in the swaddling and bedding [14,15].

1.5. But how can Entomology help to reach the post-death interval?

Knowledge about the decomposition process of cadavers is essential to estimate the post-mortem interval, but some factors influence the decomposition process. The IMP estimate, considering the entomology, can occur in two ways: observing the substrate where oviposition was made soon after death and making the determination of the age of those insects, predicting the sequence in the fauna succession. Other study models consist of separating the phases of death into: a-fresh, b-putrefaction, c-Dark putrefaction, d.fermentation and e.dry. Each moment of cadaveric putrefaction has its own conditions and characteristics (Figure 11) [14,15].

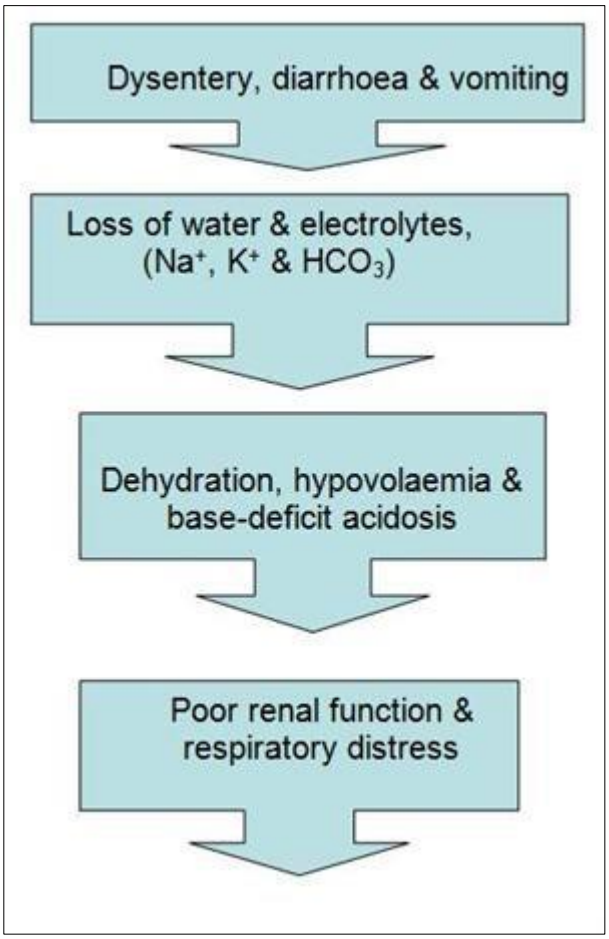


Figure 11 Does respiratory alkalosis cause hypokalemia | respiratory alkalosis symptoms - Health writings - Professional health; (Source: https://br.pinterest.com/pin/400750066812883089/)

1.6. This means that each step attracts different groups of insects.

Study of this succession and the recognition of the species involved in this process can help in estimating the IPM of a cadaver. Of the insects, beetles represent the most numerous species described (Figure 12).

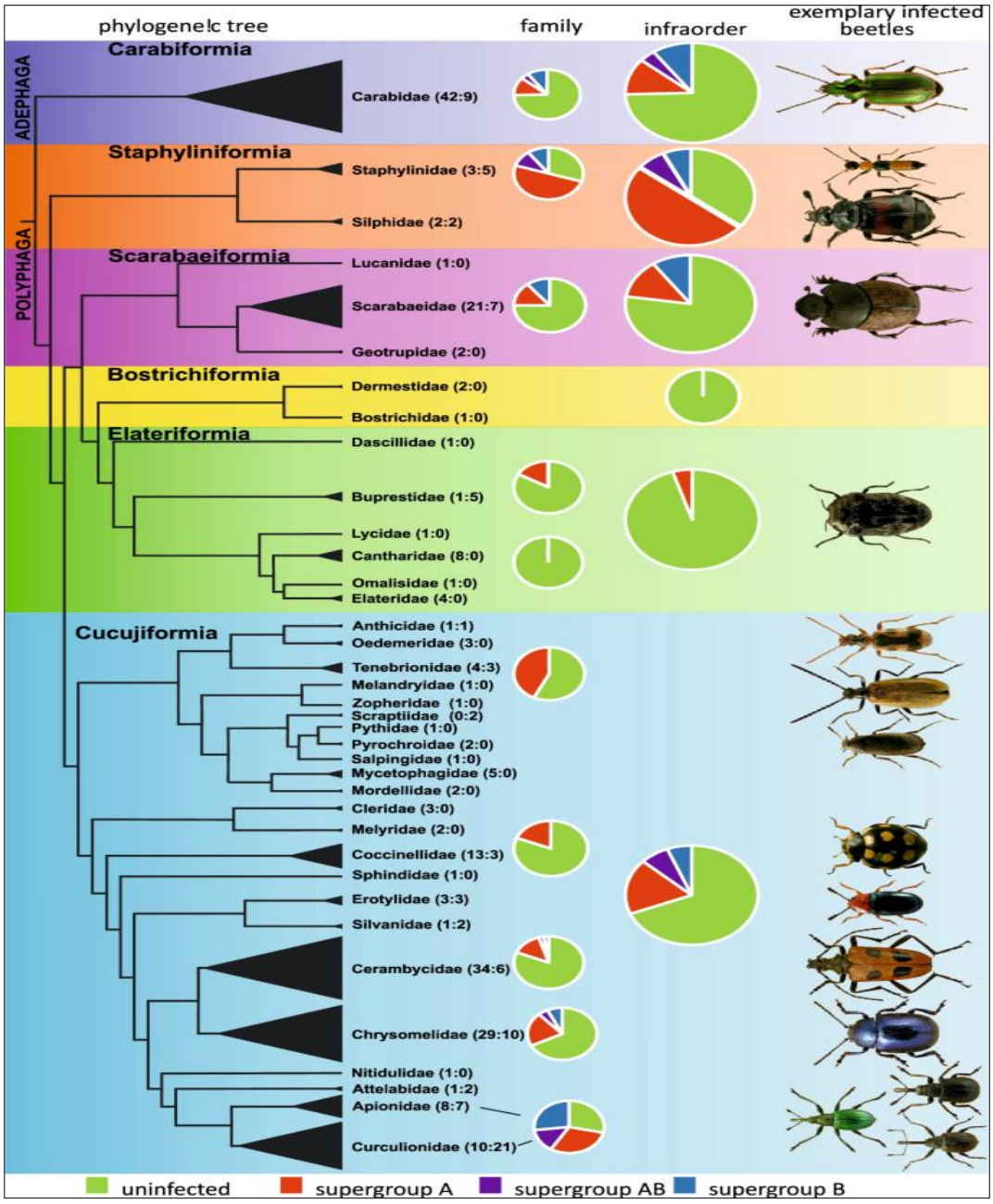


Figure 12 Approximate prevalence of *Wolbachia* infection in selected families and infraorders of beetles. Presented are shares of uninfected species (green), infected species by only supergroup (A) (red), only supergroup (B) (blue) and by both supergroups (violet). *Wolbachia* prevalence is presented on the background of simplified phylogenetic tree of beetle families considered in the study (reconstructed on the basis of mitochondrial trees topologies from Bocak *et al.*71 and McKenna *et al.*72). Exemplary infected beetle hosts presented to the right (photographs are reprinted from Iconographia Coleopterorum Poloniae under a CC BY license, with permission (© Copyright by Prof. Lech Borowiec, Wrocław 2007–2018, Department of Biodiversity and Evolutionary Taxonomy, University of Wrocław, Poland); (Source: https://www.nature.com/articles/s41598-018-38155-5)

These insects have gained importance in the forensic area as they are abundantly found associated with decaying material. To have an estimate of the IPM, scavenger species are needed. This use decaying organic matter as a source of protein and for egg laying (Table 2) [14,15].

Table 2 Initial studies in forensic entomology in Saskatchewan: decomposition and insect succession on pig carrion in the prairie ecozone

		Stages of Decomposition (days postmortem)			
Insect Family	**Common Name**	**Fresh** (0-4)	**Bloated** (5-7)	**Decay** (8-13)	**Dry** (14-26)
Calliphoridae	blowflies				
Muscidae	muscid flies				
Silphidae	carrion beetles				
Sarcophagidae	flesh flies				
Histeridae	clown beetles				
Staphylinidae	rove beetles				
Nitidulidae	sap beetles				
Cleridae	checkered beetles				
Dermestidae	dermestid beetles				
Scarabaeidae	scarab beetles				

Source: ps://www.semanticscholar.org/paper/Initial-studies-in-forensic-entomology-in-%3A-and-on-Sharanowski/9fb91c65928bcd8d509684f4be8880e4a9df0a86

This accelerates the putrefaction and disintegration of the body, which facilitates the study of the case, as each phase of putrefaction attracts a certain group.

1.7. Why are insects important to an investigation?

The use of Forensic Entomology depends on a lot of Biology. Knowledge about taxonomy, biology, life cycle, succession and ecology of the studied insects is essential.

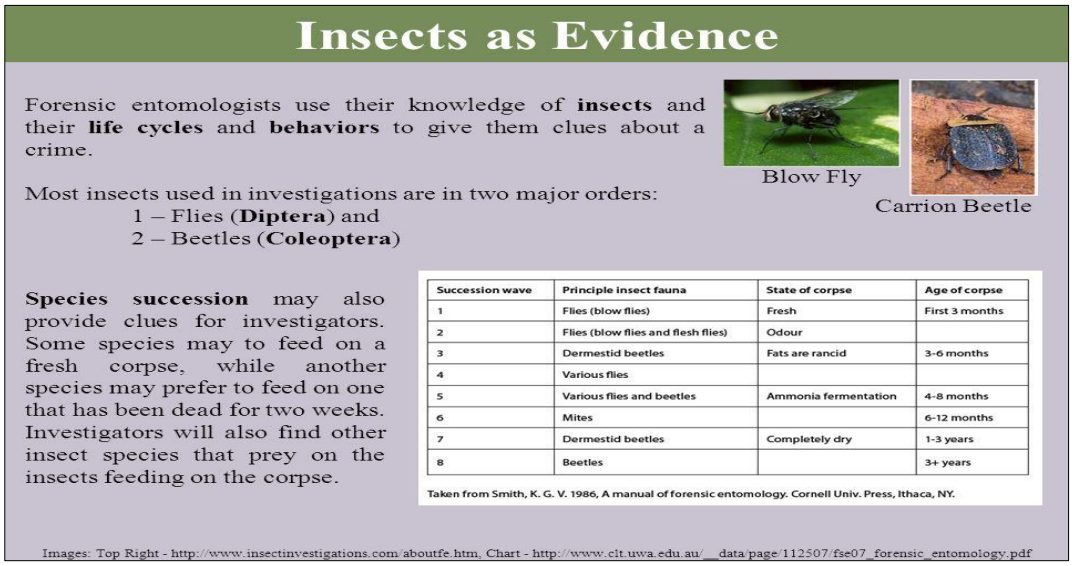


Figure 13 The presence of necrophagous insects on the corpse can provide important clues about what happened at the place of death, such as the chronology; (Source: https://slideplayer.com/slide/10613227/)

The ability of insects to smell odors that humans cannot smell makes them the first to arrive at a crime scene. Or where you have a dead organism, even if the decomposition is mainly done by microorganisms such as bacteria. The odors given off by the corpse are modified during decomposition. This change in odor becomes attractive to the species. The presence of necrophagous insects on the corpse can provide important clues about what happened at the place of death, such as the chronology (Figure 13) [16].

There are four categories that divide the ecological function of cadaveric fauna and are considered in an investigation: The entomofauna found in the corpse, if analyzed, can provide some important information about: a) Identity of the decreased It can be done by obtaining blood and tissue from the cadaver inside the insects and later analyzing DNA for identification (Figure 14) [16,17,18,19].

Figure 14 Real Life CSI: Meet Forensic Entomology; (Source: https://pontobiologia.com.br/csi-da-vida-real-entomologia-forense/)

1.8. But what types of insects and arthropods are used in forensic analysis?

Among the various species of insects that are involved in the decomposition of the body, we can mention those that possibly already inhabited the body before death, such as fleas and lice.

The order Diptera is the one that receives the most relevance in most cases, since flies are the first to find the body, so they are always related to the initial stage of decomposition. The Diptera families of importance in forensic entomology in Brazil are: Coleoptera, on the other hand, are the main entomological evidence for determining the MPI, especially when they are found in skeletons, in the dry phase of decomposition. The main families of beetles are: Other orders that are of lesser importance to Forensic Entomology, such as some that are found in the more advanced stages of decomposition [16,17,18,19].

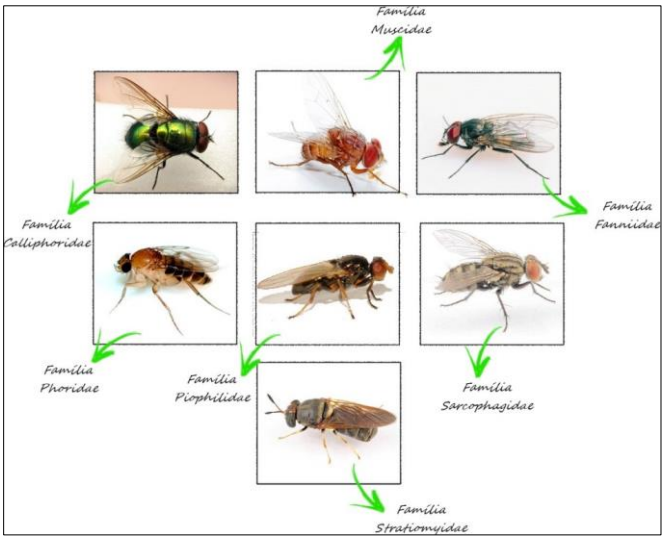


Figure 15 The Diptera families of importance in forensic entomology in Brazil are: Calliphoridae, Muscidae, Phoridae, Stratiomyiidae, Sarcophagidae, Fanniidae, Piophilidae; (Source: kasvi.com.br/entomologia-forense-ainvestigacao-criminal)

Such as Lepidoptera, which include butterflies and moths, and Hymenoptera, which include bees, wasps, and ants. Other insects that are found in bones and are associated with the end of the decomposition of cartilage and ligaments are of the order Blattodea, which is represented by cockroaches, the hemiptera which are the stink bugs and the isoptera which are the termites. It is also reported a last group of nocturnal habits that are generally saprophagous, the dermapteros, which are the "lacrainhas" [16,17,18,19].

It also investigates the effect of these substances on the development of arthropods to increase accuracy in estimating death. The larvae found in the decomposed body can identify the types of substances present, such as antidepressants, stimulants, and others (Figures 15 and 16) [17,18,19].

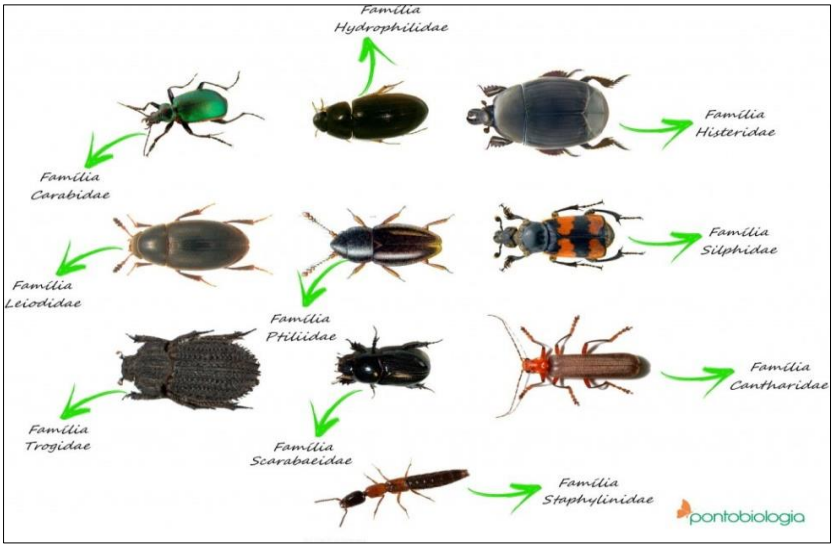


Figure 16 The main families of beetles are: Carabidae, Trogidae, Scarabaeidae, Staphylinidae, Canacidae, Silphidae, Hydroptilidae Histeridae and Leiodidae; (Source: kasvi.com.br/entomologia-forense-ainvestigacao-criminal)

1.9. But why use insects?

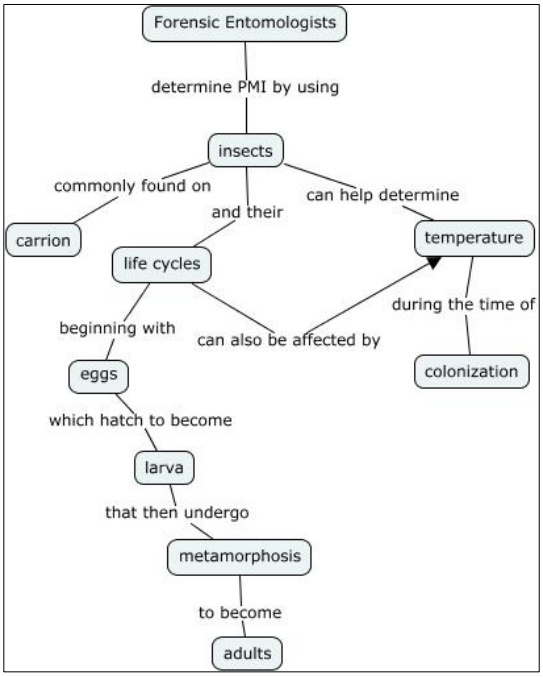


Figure 17 Forensic Entomology; (Source: https://cmapspublic.ihmc.us/rid=1RT7WZYGW-1Q04281-2XXN/Forensic%20Entomology.cmap)

For a toxicological analysis it is more advantageous to use larvae than tissue from a cadaver. Flies and beetles use intoxicated human tissues as food, thus introducing drugs and toxins into their metabolism. Another important factor when referring to the application of forensic entomology is how the death occurred, as depending on the substances present in the body, they can accelerate or delay (Figure 17) [17,18,19].

Objectives

The purpose of this paper is to investigate the entomofauna found in cadavers for Forensic Entomology in the following aspects (a) Forensic Entomology in addition to criminal investigation, Medico-Legal Entomology, the entomofauna found in the corpse can provide (b) the identity of the deceased, cause of death, movement body, use of toxins or drugs, in addition to the crime scene, stored products, drug trafficking, ill-treatment, but how Entomology can help to reach the after-death interval.

2. Methods

A literature search was carried out containing articles published from 1965 to 2021. The mini review was prepared in Goiânia, Goiás, from September to October 2021, through the. The mini-review was prepared in Goiânia, Goiás, from September to October 2021, through the Online Scientific Library (Scielo), internet, ResearchGate, Academia.edu, Frontiers, Publons, Qeios, Portal of Scientific Journals in Health Sciences, Pubmed, Online Scientific Library (Scielo), internet, ResearchGate, Academia.edu, Frontiers, Biological Abstract, Publons, Qeios, Portal of Scientific Journals in Health Sciences, and Pubmed, Dialnet, World, Wide Science, Springer, RefSeek, Microsoft Academic, Science, ERIC, Science Research.com, SEEK education, Periódicos CAPES, Google Academic, Bioline International, VADLO, Scopus, and Web of Science.

3. Study carried out

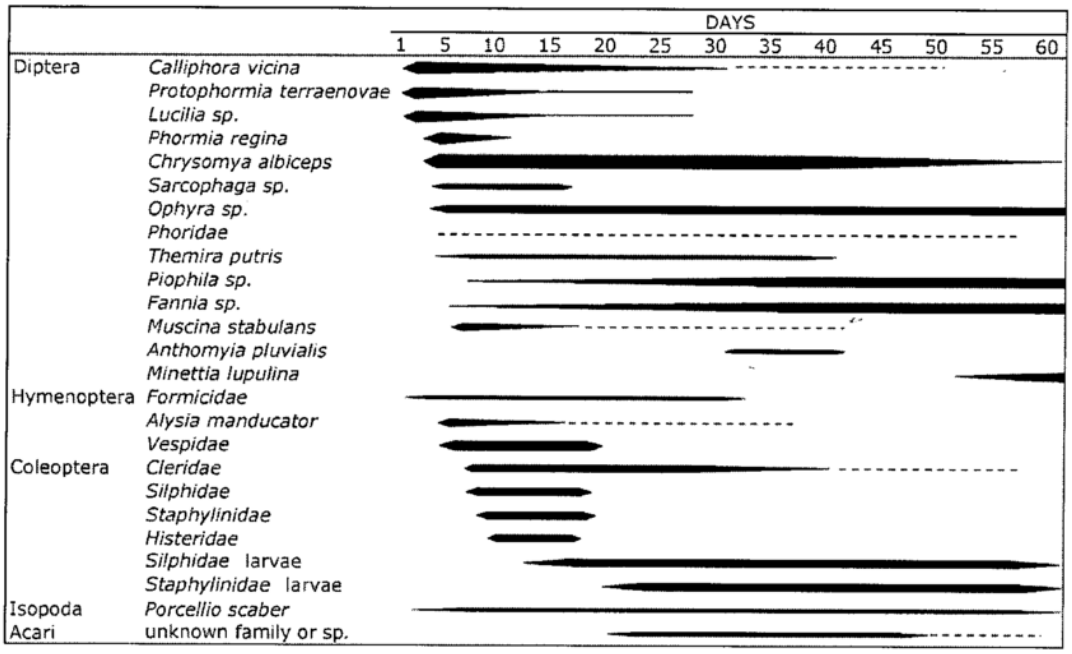
3.1. Study 1

In the rural area of the municipality of Florencia, Caquetá, the succession of arthropods associated with cadaveric decomposition was monitored, using the corpses of three pigs (*Sus scrofa*) as a study model. Insect sampling and environmental data collection were performed every five hours (Figure 18).

Figure 18 Decomposition of a 10-week-old (~40 kg) pig (*Sus scrofa* L.) cadaver during the summer of 2005 at the University of Nebraska-Lincoln Agricultural Research and Development Center near Ithaca, NE, USA. (a) Depicts the 'Bloated' stage approximately 48 h after death. The onset of 'Active Decay' (b) can be designated by skin ruptures that result in the loss of moisture and increased surface area for maggot development. The release of cadaveric fluids and/or maggot activity results in the formation of a cadaver decomposition island (CDI) that is visible as dead plant material (c: bar represents 1 m). The arrow denotes the path and direction of maggot migration. Approximately 80 days after death the cadaver decomposition island (CDI) is surrounded by an area of increased plant growth (d), which might be used as a marker for the onset of the 'Dry' stage of decomposition; (Source: https://www.researchgate.net/figure/Decomposition-of-a-10-week-old-40-kg-pig-Sus-scrofa-L-cadaver-during-the-summer-of_fig2_6706562)

The total duration of the process from death to skeletonization was 545 hours (22.7 days). A total of 30833 specimens of insects were collected, distributed in nine orders, 46 families, 95 genera and 106 species. Diptera was the most representative group, with 23215 individuals (75.3%), followed by Coleoptera, with 3711 individuals (12%) and Hymenoptera, with 3154 individuals (10.2%) (Table 3).

Table 3 Chronology of insects at pig cadaver exposed on 20 August 2001 (experiment 2). Thickness of bands indicates relative abundance of each group at different times, based on number of individuals collected and observed during each visit



Source: https://www.researchgate.net/figure/Chronology-of-insects-at-pig-cadaver-exposed-on-20-August-2001-experiment-2-Thickness_fig5_8521046

The immature stages of *Cochliomyia macellaria*, *Chrysomya albiceps*, *Hemilucilia semidiaphana* and *Ophyra aenescens* were the main species involved in tissue consumption and acceleration of the decomposition process. Due to the presence of *Cheliomyrmex* sp., *Camponotus* sp. and *Dinoponera* sp. and from *Hister* sp. beetles, *Acylophorus* sp. and *Philonthus* spp., it was not possible to obtain enough Diptera egg masses for the creation of the colonizing species [20].

3.2. Study 2

Figure 19 Cut the top off the bottle; (Source: https://www.thespruce.com/how-to-make-a-fly-trap-1389066)

To verify the attractiveness of swine baits/tissues for Sarcophagidae species in two environments in the rural region of Uberlândia and aspects of the biology of the species of flies in this family.

The flies of the Sarcophagidae family were captured with traps like Ferreira's trap (1978) (Figure 19, 20 and 21) [21].

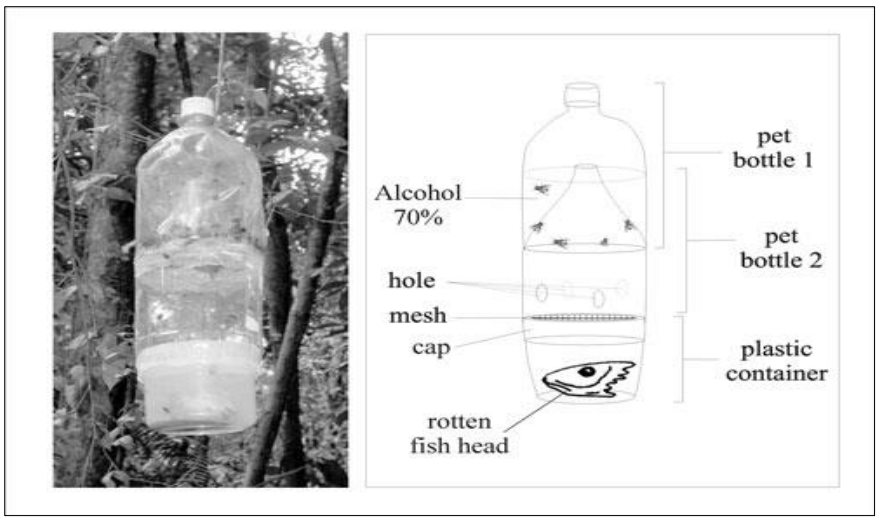


Figure 20 The modified trap model proposed by Ferreira (1978) for fish carrion feeding flies; (Source: https://acta.inpa.gov.br/fasciculos/40-2/BODY/v40n2a18.html)

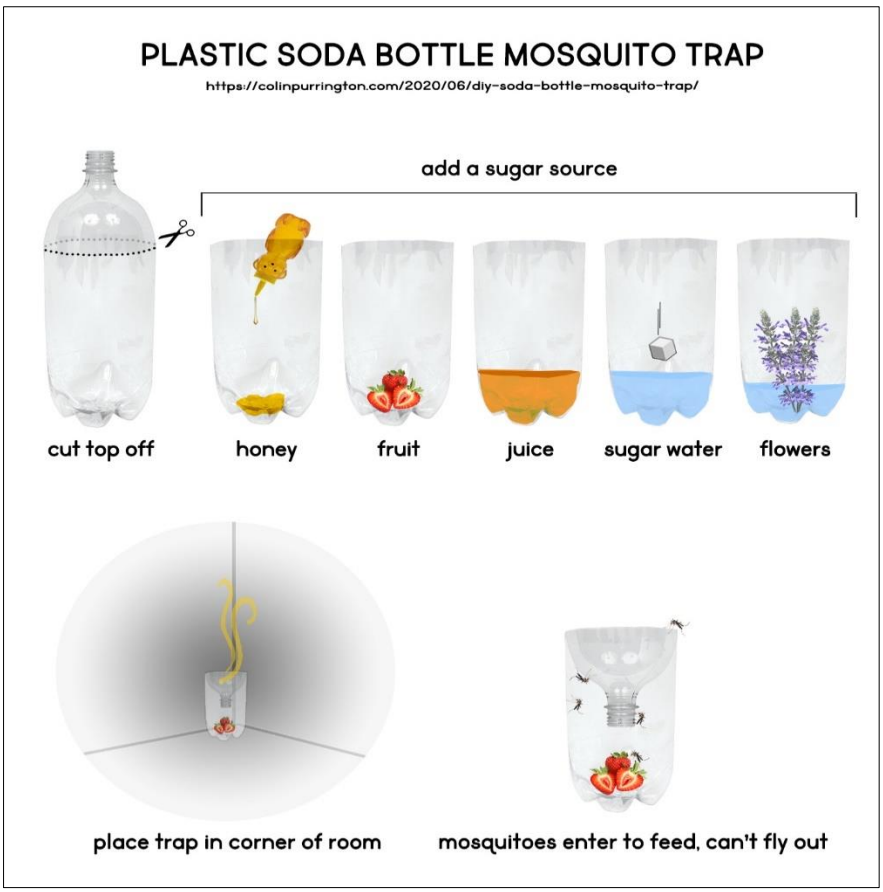


Figure 21 Diy mosquito trap using plastic soda bottle: If you have a house free of small kids and meddlesome pets, you can add bit of boric acid to the solution to create an attractive toxic sugar bait (ATSB) station. Then, when mosquitoes ingest the fluid, they will die even if they manage to escape the trap (it can happen). In fact, once you have a toxin in the

fluid you can and should just get rid of the funnel part of the trap — its presence is likely a barrier to some mosquitoes even though it's relatively wide (~2 cm). Instead, cut a 3 cm hole in the side and keep the cap on the bottle. Note that because these devices are indoors you don't need to worry about the boric acid (or whatever) poisoning the pollinators in your yard (Source: https://colinpurrington.com/2020/06/diy-soda-bottle-mosquito-trap/)

During the experiment, 2,921 individuals of the Sarcophagidae family were collected, belonging to at least 41 species. Flies were more abundant in the dry period, among the species with greater abundance, *Oxysarcodexy thornax* (Walker, 1849) (F=45.354; P=0.00), *Sarcodexy lambens* (Wiedemann, 1830) (F=5.845; P) =0.019), *Oxysarcodexy diana* (Lopes, 1933) (F=8.679; P=0.005) and *Tricharaea occidua* (Lopes, 1935) (F=0.085; P=0.771). The first three species had significantly higher abundances in this period. In addition to the three species mentioned above, *Helicobia morionella* (Aldrich, 1930) (F=22,085; P=0.00) and *Oxysarcodexia paulistanensis* (Mattos, 1919) (F=9.281; P=0.004) also showed greater abundance in the dry period. *Tricharaea occidua* (Lopes, 1935) (F=0.085; P=0.771), *Peckia collusor* (Curran & Walley, 1934) (F=0.878; P=0.353), *Ravinia belforti* (Prado & Fonseca, 1932) (F=3.645; P=0.062) and *Peckia intermutans* (Walker, 1861), (F=2.719; P=0.106) did not present significant differences in the abundances obtained in the two periods of the year.

A greater abundance of sarcophagids was observed in the forest environment, among the most frequent species in this environment, the following stand out: *S. lambens* (F=10.825; P=0.002), *O. dian*a (F =17.583; P=0.000), *P. collusor* (F=10.958; P=0.002) and the 16 *P. intermutans* (F=7.281; P=0.010). On the other hand, *O. paulistanensis* (F=7.737; P=0.008), *R. belforti* (F=12.570; P=0.001) and *T. richaraea* (F=8.777; P=0.005) showed significantly higher frequencies in the pasture environment. The species *H. morionella* (F=1.014; P=0.319) and *O. thornax* (F=0.002; P=0.961) showed no significant differences in their abundance between the two environments.

The brain substrate was more attractive than the other substrates for sarcophagids. It is noteworthy that although the substrate brain has attracted a greater number of individuals, only the species *R. belforti* (F=4.526; P=0.007) presented a significant preference for this substrate. Several species showed significant preference for a given substrate, *H. morionella* showed greater abundance per liver, *O. paulistanensis* showed lower frequency in the substrate/gut bait. Despite the great abundance, *S. lambens* (F=0.453; P=0.716), *O. diana* (F=0.949; P=0.430), *O. thornax* (F=2.658); P=0.059) and *T. occidua* (F=0.824; P=0.487) showed no significant differences in their frequencies in relation to the four substrates used [22].

3.3. Study 3

(Source: https://www.researchgate.net/publication/291825508_A_forensic_entomology_case_from_the_Southeastern_Iberian_Peninsula)

Figure 22 General view of the room where the corpse was found

This contribution describes a forensic case, for which entomological evidence provided a more precise answer when medical evidence offered too wide a range for the possible time of death. The data take on an added interest because they are taken from a region where this type of evidence has not traditionally been.

On 25 February, the corpse of an initially unidentified male was found on the floor of a room in Lorca (SE Spain), which did not receive direct sunlight. The cadaver was found in a prone position dressed in a short-sleeved shirt and light-weight tracksuit top. The building was abandoned with access officially barred, although it must have been easy to enter because the body was found by playing children. The cadaver was skeletonized and showed bites of, presumably, rodents. Medical evidence suggested that death had been caused by craneocephalic traumatism. Entomological evidence was abundant and present in all parts of the body. In zones covered by clothes there were live insects. During the autopsy, which was carried out on 26 February, numerous Coleoptera moving over the joints and tendons were observed.

The entomological material collected during the autopsy was preserved live at room temperature and, after inspection in the laboratory, was preserved in 70% ethanol. This is a low-resolution file for preview purposes. Get the real high-resolution file at the web sites listed on page 1. Remains of arthropod activity between clothes. Peritrophic membranes of Dermestidae larvae. Empty puparium of *Chrysomya albiceps* (Diptera, Calliphoridae) (Figures 23, 24 and 25).

Figure 23 Skeletonized cadaver: Detail of upper part of the cadaver in situ; (Source: https://www.researchgate.net/publication/291825508_A_forensic_entomology_case_from_the_Southeastern_Iberian_Peninsula)

Figure 24 Adult *Necrobia rufipes* (DeGeer, 1775) (Coleoptera: Cleridae); (Source: https://www.researchgate.net/publication/291825508_A_forensic_entomology_case_from_the_Southeastern_Iberian_Peninsula)

The entomological study was conducted with no additional information, such photographs, about the case. The material consisted of live adult samples of *Necrobia rufipes* (DeGeer, 1775) (Coleoptera. Cleridae), one live adult of *Dermestes maculatus* DeGeer, 1774 (Coleoptera, Dermestidae), abundant remains of activity feces included in peritrophic membranes and more or less fragmented remains of Dermestidae larval exuviae, empty *Piophila casei* (Linnaeus, 1758) puparia (Diptera, Piophilidae), empty puparia of *C. albiceps* one empty puparium of Ophyra sp. (Diptera, Muscidae) and two live caterpillars of *Tineoida (*Lepidoptera) [23].

Figure 25 Remains of arthropod activity between clothes;(Source: https://www.researchgate.net/publication/291825508_A_forensic_entomology_case_from_the_Southeastern_Iberian_Peninsula Figures - uploaded by María-Dolores García)

4. Conclusion

There is a high number of species making up the carrion fly and coleopterans community and possibly they are restricted to continuous and preserved areas of rain forest. These species have a high rate of dispersion and broad habitat preferences. Unfortunately, there is no information available about synanthropic flies in closed urban environments. Many physical, ecological, and biological factors will affect the assemblage patterns of these complex communities which remain largely unknown for most habitat.

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