



Forensic Acarology

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Abstract

With the onset of decomposition following death, various species of insects begin to appear on a person's corpse in a particular order. By identifying the characteristics of these insects, it is possible to reach important information that might contribute to an ongoing forensic investigation, such as a person's post-mortem interval (PMI). In the evaluation of forensic cases, mites (acari) represent a form of evidence that is as important as insects. Especially in cases where conditions such as the environment the corpse is found and the manner of death are not suitable for the presence/arrival of insects, mite populations on corpses can become an importance evidence for elucidating these cases. Different species of flies carry specific mite species to corpses, while certain mite species normally found on the human body before death remain viable for specific periods of time. Such information can significantly contribute to resolving forensic cases. Mites can be found in a wide range of environments, including freshwater and saltwater environments, houses, clothes, beds, and the human skin. The diversity of mite species varies considerably between different seasons and regions, between different areas of the same region, and between different natural habitats. Mites found on beds are different than those found on linens, just as mites found on human skin are different than those found on human clothing. Owing to their ubiquity, diversity and wide distribution, mite species can be used as valid and reliable pieces of evidence for resolving forensic cases.

Keywords: Forensic acarology, Forensic Sciences, Post Mortem Interval

INTRODUCTION

Forensic Entomology or Medicocriminal Entomology is the branch of science in which insects and other Arthropod species are used as evidence in clarifying suspicious criminal cases. After death, and from the start of decomposition, various species of insect arrive at the corpse, and do so in a particular order. Using the characteristics of these insects, information can be obtained to guide the judicial investigation; in particular, estimations as to the time of death (Post Mortem

Interval=PMI) and the identification of the place of death can be evaluated. In solving criminal cases, mites also bear as much importance as insects with regard to evidence. Specifically, when conditions such as the environment in which the corpse lies, and the way of death, prevent the presence of insects in the medium, the mites form a population on the corpse and become important evidence in solving many cases.

Attraction of different mite species through the decomposition of the corpse

Death is defined as the irreversible loss of the characteristics of living, thus, ending life. The answers to questions, such as when and how death occurred, whether it was a suicide or murder can only be given by the assessment of the signs of death. **Decomposition** one of the late signs of death, is a finding that occur the latest after death. This decaying period involves five stages: fresh stage, bloat stage, active decay stage, advanced decay stage and dry decay stage. Each of these stages attracts different insect and mite species to the corpse.

It was Megnin who first listed Arthropods (1894) with respect to succession waves; he determined that the mites arrive at the corpse in the 1st wave (48 hours-3 months), and that the 6th wave (5-6 to 10-12 months) is a full mite period. Similarly, Braig and Perotti (2009) listed the mite species detected on both human and animal corpses in studies made since 1879.

Phoretic mites in forensic acarology

Some mites utilize insects and other arthropods during their development and dispersal, and are called **phoretic mites**. The phoretic relationship is the transportation of an organism on another organism, which is mostly observed in mites. This type of relationship is mostly seen in species of the Macrochelidae, Parasitidae, Ascidae, Uropodidae and Anoetidae families.

The Arthropods that first arrive at the corpse are the species of the Calliphoridae family, commonly known as blow-flies. These flies can carry the phoretic mites, specific to themselves, to the corpse (Astigmata, Mesostigmata, Prostigmata). When the mites arrive at a suitable environment, they leave their hosts and feed on the eggs and larvae of the insects on the corpse. Thus, phoretic mites are also the first species to arrive at the corpse, which makes them important in identifying the time of death.

Ticks in forensic acarology

Ticks are the mites that include the species of the Metastigmata order of the Arachnida class of the Arthropoda phylum. They are ectoparasites, which are abundant virtually worldwide, and feed by sucking blood from various vertebrates during their development. As they suck blood, they infect their hosts with their saliva secretion and cause toxicities and paralyses.

It is highly probable that these ticks, which are non-phoretic mites and which are found temporarily found on the corpse, infect a corpse. By DNA investigation of these Arthropods, the host can be identified. In addition, seasonal specificity of ticks may be used in solving a criminal event.

Hair follicle mites and scabies in forensic acarology

Some mites may be present on an individual's body before death and their survival time after death contributes to solving criminal cases.

Hair follicle mites, which are permanent parasites living in the skin, belong to the Demodicidae family of the Prostigmata order of the class Arachnida. There are two species of hair follicle mites that live on humans, especially in hair follicles, at the bottom of hairs and in the sebaceous glands, called *Demodex folliculorum* and *Demodex brevis*. These mites are dispersed worldwide and are commonly found on the faces of humans, and may be found in all races and age groups, except the newborn. They may survive for more than one week after their host dies.

Another species of mite, which completes all its development within the human skin, and which belongs to the Sarcoptidae family of the Astigmata order of the class

Arachnida, is *Sarcoptes scabiei hominis*.

This is an obligate parasite, feeding on the epidermal keratin in humans, and the cause of the surface infection called **scabies**. This mite species, which is seen especially school children and those who live in communal living areas, and which is present in every society, independent of race, age or gender, can survive up to two weeks on the corpse after the death of their hosts.

The above-mentioned characteristics mean that hair follicle and scabies mites are vital evidence in forensics, especially in an environment where Arthropods feeding on corpses are not present. These mites gain importance in determining the time of death.

Indoor mites in forensic acarology

Indoor mites is a term used for all dust mites and allergy mites. Such mites, the majority of which are house dust mites, cover the species of the families and genera Astigmata, Prostigmata, Mesostigmata, and Oribatida of the Acarina order.

Indoor mites may be found in all living areas, especially in the house and at work, where there is suitable food, moisture, and warmth. Since indoor mite species feed on the hair, feathers, and skin debris of humans and animals, they are abundant at home on bed linens, furniture fabrics, in carpets and rugs, which are a rich source of food. The abundance of mites in such environments varies, depending on various social situations, such as the house being wooden or moist or not receiving sunlight, having second hand furniture in the house or a lack of ventilation.

The diversity of species of indoor mites varies according to the season and regions.

Moreover, the intensity, diversity, and the species might differ between areas, such as having different mite species on the bed and on the carpet in the same house. Such characteristics of indoor mites may present important information on the time and conditions of death.

Aquatic mites in forensic acarology

Mites can be found in aquatic environments, such as lakes, ponds, and puddles, and even in potable water. In cases where the conditions of the crime scene prevent the insects from reaching the corpse or hinder their propagation on the corpse, such as for corpses submerged in water, the mites called **aquatic mites** may contaminate the corpse or other criminal evidence, providing important evidence on the crime scene. Although they do not have an important effect on the decay of the corpse, they may provide hints as to the crime scene and any change of position of the corpse after death, thus contributing to solving criminal events.

CONCLUSION AND DISCUSSION

Mites can be found almost anywhere, in fresh water, salt water, our homes, on our clothes and beds, and on our skin. They exhibit high diversity from one season or region to another, in different areas within the same environment, from one living area to another. The mites on our beds, linen, and clothes are different from those on our skin. This abundance, diversity, and wide distribution of mites make them valid and reliable evidence in solving criminal cases. In particular, conditions such as the environment in which the corpse is present, or a way of death that would prevent the presence of insects, mites can form populations on the corpse, becoming important evidence in solving many crimes. All this information shows that mites can make important contributions in solving crimes. Forensic scientists should not neglect such crucial information and should not forget that mites support and supplement the information provided by the insects collected from corpses and that they are a rich source of evidence in criminal cases. Therefore, just as biological stains, hairs and insects, mites should be recognized as valid and reliable evidence.

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