

# Study of Medico-Legal Techniques in Mycology Science as an Application Tool in Forensic Investigations

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## Abstract

Microbial forensics can be defined as a scientific discipline that combines two branches of science, microbiology and forensics to track down and analyze the crimes. It covers a wide range of forensics science mashed up with microbiology. This field is popping up every day around the world. Microbial forensics deals with myriad organisms, including viruses, bacteria, fungi, parasites and some toxins these organisms produce. "Microbial forensics" is becoming an ideal requirement in India. But it includes not limited to the analysis of microbes or their toxins and materials used in manufacture, storage and delivery toxin or pathogen. The main focuses of forensic taphonomy is the study of Environmental conditions affecting the decomposition process estimate the autopsy interval and determine the cause and manner of death. The study is part of a specific branch of forensic science using a wide range of methods stemming from different ones. Subjects such as botany, archaeology, soil microbiology, etc. Entomology, all used in uncovering and investigating secret tombs to be successful in the investigation. Therefore, the "forensic mycology" emerges as a new scientific term meaning the study of mycology Coexistence of species of fungi in crime scenes for the criminal investigations.

**Keywords:** Mycology; Applications; Forensic science; Toxicology; Medico-legal investigation

## Introduction

Forensic science is a multidisciplinary stream that involves the application of scientific knowledge related to forensics. Plants and plant parts, bones, teeth, clothing and microbes are some of the potential pieces of evidence that are extremely common in the environment, but their use in forensics has not received much attention. One such possible piece of evidence is members of the fungal kingdom, which are among the most widespread organisms on earth [1]. The study of members of the fungal kingdom is called mycology [2]. Fungi are eukaryotic in nature and can be both unicellular and multicellular. They are

heterotrophs. Mushrooms, toadstools, yeast, penicillium are some of the most commonly found fungi [3].

In clandestine burials, they use a variety of different techniques examine the ground changes where the corpse decomposition takes place. The aim was to isolate and identify the presence of soil mycobiota underneath human corpses in decomposition based on evaluation of interaction between those under the current conditions [4]. After that, investigators or the police considered death "of a suspicious nature", but the cause and manner of death not yet it has been established that the officer is authorized to take soil samples studies [5]. The investigating tools consisted of a set of sterile spoons. Coincidentally us collected small portions of soil from under the body and a little away from transporting the samples to the laboratory in hermetic laboratory bags. The mycobiota of the collected soil was analyzed using the following techniques: Serial dilutions, wet chamber and floor washing [6].

The use of mycological evidence for criminal investigations and their examination in court is known as forensic mycology [7]. Fungi play an important role in the decomposition process but are not often used in forensic studies of human and animal remains [8]. Most fungi found are related to corpses and are also found in alternative substrates high in ammonia. One such species of fungi is *Hebeoma syriense*, which has earned the title of the corpse finder [9].

A systematic study of fungal structures on grassland soils could be used to mark potential burial sites and thereby reduce the plenty of time to screen a large area [10]. Such surveys would be appropriate when a burial has been anticipated for months or years corpse-related fruiting would not occur immediately after burial [11]. Although in order to be used as an effective forensic tool, the fungal communities to be found in the soil beneath decaying corpses Additional studies indicate the results obtained here are very important starting point [12]. The work aimed at knowledge of fungal communities and the sequence of these experiences at the death of the human body goes through the process of decomposition in the grave or on it floor [13]. In Argentina, these studies represent the beginning of a new one line of mycological examination. Human decomposition has been found to begin within 4 to 5 minutes

after death occurred. This decomposition process is called autolysis or self-digestion [14]. A microbial clock was designed to calculate the Postmortem Interval (PI) at which mouse cadavers were placed on soil and decomposition monitored over 48 days. The size of fungal colonies found on skin or other materials were used to estimate death or deposition times, leading to positive and successful results [15].

## Materials and Methods

### Objectives

The main aim of this study is to understand the major applications of mycology in forensic science and the relationship between the forensic mycology and toxicology that relates to the aspects of applications in criminal investigations. The various applications intended to be used in Forensic science as an investigating tool in crime scenes have been elaborated.

### Relationship between forensic mycology and toxicology

The main toxicological significance of mycological evidence lies in mycoses (fungal infections) and mycotoxins. These antifungals can be of great forensic value in detecting suspect/victim environmental backgrounds, matching between scenes/tools/objects and identifying contributing factors prior to death. Ramirez, et al. pointed out that some microbes can migrate from the mucosal surface to various body tissues and fluids and lead to the microbiological degradation of drugs and toxins, affecting their concentrations or metabolic profiles in the body.

### Fungi as evidence

Various species of fungi also serve as evidences in crime scenes as investigation tools (which are the objects or substances used as evidence when contact is made between the suspect, the victim or the crime scene). Unlike plants, fungi (including lichen fungi) can grow and act as marks on objects such as rocks, bricks, tiles, cobblestones, wooden objects, leather, plastics, rubber and textiles. Lichen fragments, moldy items are separated and incorporated into items of criminal importance.

### Mushrooms as an indicator to determine the time since death (post-mortem interval)

While healthy people can have fungal infections, the fungi that commonly grow on and in cadavers are ones that are generally unable to colonize living tissue. A corpse buried directly in the ground often shows signs of wet decomposition with skin peeling and fungal growth. Janaway, et al. stated that soil fungi could be found on the body surface "after the main phase of decomposition" and mentioned that "mold fungi begin to appear on the body surface in the first week after death" [16]. It is believed that mushrooms could help determine the time of death, provided the temperature data of the mushrooms found is available. The reliability of all estimates made depends on the accuracy of identifying the fungus, methods of storing the body

and the availability of data on temperature and humidity at the site.

### Mushrooms as an indicator for finding corpses

Some fungi do not produce sporophores until disturbed for 1-2 years, but this is a feature of disturbed soil. Fungi reproduce sexually and asexually and as a result produce large numbers of spores as a means of dispersal. Although not all species of fungi produce spores, the species that produce spores can have distinctive morphologies that make them easier to identify [17]. Some fungi have a restricted distribution, specific ecological requirements and only produce spores at certain times of the year. Therefore, their presence can be useful in associating a person or object with a place.

### Mushrooms as a weapon in biological warfare

Many species of fungi such as mold and fungus can produce toxins and the effect of most of them is long-term (for example they are carcinogenic) and some can be cultivated in VATS (block that acts as a light source when placed down) in large quantities and produce faster-acting substances that have potential as biological weapons. Fungal parasites of plants can be used as biological warfare weapons as they can be engineered to destroy crops in the same way they are used to control weeds.

### Mushrooms as psychotropic and toxic substances

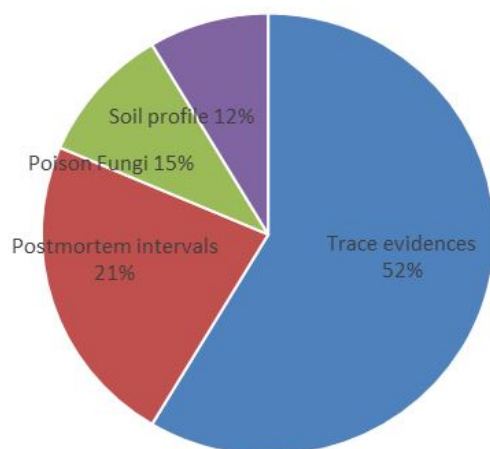
Several different species of fungi are reported to be the cause of fatal poisoning. Varieties of fungal species are extremely toxic and can be fatal if not treated early enough. Because of this, they have been exploited by criminals from time to time. For example, some neurotrophic psychotropic species may be relevant in forensic situations apart from their normal geographic ranges, as they are exported to Europe from Central America. Some can be cultivated both indoors and outdoors.

### Mushrooms as an indicator of the time of deposition

Exposed bones can be colonized by fungi such as mold under ambient conditions. Lichen colonies, particularly of *Caloplaca* and *Lecanora* species, can develop if the bone is exposed in well-lit situations over many years. A good indication of minimum exposure times is the colony diameter.

The effect of fungal mycology was studied and the application of fungal species based on their fatal rate is pictorised in Figure 1.

### Effects of Fungal Mycology based on Fatal rate



**Figure 1:** Pie-chart showing the effects of applications of fungal species based on the fatal rate.

Fungal infections and mycotoxins like, these fungal agents can have high legal medical values to establish contribution factors before death, in response to the environmental history of the suspect or victim, the response between scenes, tools, objects and a contribution factor before death.

### Legal approach to mushrooms

There are no laws against growing, collecting or possessing the mushrooms, but any effort involved in preparing them (such as cutting, drying, powdering or freezing and packaging) makes them a class A controlled drug. Identifying and linking mold species to health problems a person convicted of food or household damage could be important in a legal case.

### Discussion

The application of legal medicine is useful for criminal surveys and testimony in a specific case based on the law. From now on, there are important and effective applications for medico-legal fungal science that manage medico-legal and medico-legal poisoning. Discussions on mycology in legal medicine are clearly studied and the relationship between forensic science and mycology is completely clear. Identifying a fungal species can be a process that requires a lot of time and expensive processes, also this includes a great search for scale literature and a comparison with the reference collection of a group of specific mushrooms in the world [18]. However, if the various exhibitions are the same, the study of mycology can be revealed in the case. The identity is recommended because you can provide additional value to the guest plant. This can provide ecological information that may promote specific elimination of the aspect in the survey [19]. The precise identification allows you to see how species are reported in the appropriate database.

The demand described here is not a proposal for possibilities and in fact it has not been studied. However, to carry out more research, it is important to recognize the possibility that

research is provided by fungi and that bacterial evidence can provide important evidence. In this case, you must request an expert advice. The people involved in all aspects of legal medicine (in particular, pathology and poisoning) must recognize the evidence of fungi, in particular when they show psychiatric substances and poison. They can provide important evidence in criminal matters.

### Conclusion

It is evident that forensic mycology is still an emerging field. The study of fungi is referred to as mycology and applications of mycology in the field of forensics are referred to as forensic mycology. It plays a crucial role in the process of decomposition of living things. It's useful for spotting tracks; estimate of time since death (post-mortem interval); determining the deposition time; investigation into the cause of death; finding buried bodies and biological warfare, etc. The application of forensic mycology is helpful in criminal investigations as well as testifying in court. There are now significant applications of forensic mycology in relation to forensic medicine and forensic toxicology. There are certain legal issues related to the preparation of mushrooms. The presence of fungi inside the corpse can adversely affect the components of the body.

### Conflicts of Interest

The author(s) declared no potential conflicts of interesting this respective research, authorship and publication of this study.

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### Limitations of the Study

This application of mycology science here is not a proposal that has not yet been studied due to a broader extension, but in fact it is used in the case and what is tested in the courtyard is usually defined in several ways. In addition, it is necessary to investigate the possibility of a forensic system to provide criminal evidence of future surveys to recognize the possibilities.

### Recommendations

There are tools that are useful to recognize evidence of fungi, particularly for people involved in aspects of medical medicine (particularly pathology and poison studies), in particular to demonstrate traces, psychotropic substances and poison. Otherwise, they can provide important evidence that has neglected. The application of fungal studies in legal medicine must be complete beyond the level of understanding.

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