

## Microbial Analysis of Soil in Forensic Analysis

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### Abstract

Soil is a very valuable evidence due to its diversity and ubiquity. It is very helpful in indicating the origin and helps in establishing relationship between suspect and crime scene. Recent studies on soil microbiology have helped to determine its origin, and diversity in soil samples have been successfully developed. Whenever the soil is transferred from one place to another and collected as a evidence, its microbial structure can also changes with time. Soil is examined on the basis of colour, texture but it can also be examined on the basis of microbiome present in it. Bacteria and fungi can be very helpful in determining the relation between the suspect and crime by various method TRFLP, CLPP, C-substrate. The technique T-RFLP is reliable and it is easily available in almost laboratories due to its use in extraction of human DNA. Also it is easy to work with and cost effective. In today era we can use soil micro biome to establish link between suspect and crime as the use of bacterial and fungal profile have shown promising result in differentiation and comparison of soil sample to a great extent.

**Keyword:** soil, bacterial, fungal, T-RFLP.

## INTRODUCTION

Soil covers almost two third part of earth surface and found everywhere. It plays important role in outdoor crime scene by establishing a link between the crime scene and the suspect or victim. In forensics investigation, soil traces can be used as a evidence and can provide valuable resources as

they contain both mineral ad organic compound which can provide a clue to investigation and have a evidential value as the soil sample can be transferred from different places of crime scene like soil on shoes, clothing car tire, motorcycle tire and this soil samples can be compared against the soil sample from suspects with samples available from a crime scene to establish link between each other. Earlier soil sample evidences were largely utilized through the analysis of soil colour, particle size, textures, and mineral examination however using this technique it was not possible to effectively differentiate the soil samples. Now a days recent advancement in the field of science, soil are examined on the basis of bacterial and fungal microbiome diversity.<sup>4,5,9,10</sup>

### *Examination of soil on the basis DNA profiling*

Jcqui Horse well et al. conducted a study on DNA

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profile of top soil on bacterial communities using terminal restriction fragment length polymorphism (T-RFLP) in Greater wellington, New Zealand, based on their bacterial and fungal DNA profile. The data was collected from both bacterial and fungal T-RFLP profiles. Significant results were obtained when both bacterial and fungal categories taken and they differ significantly between vegetative community while negligible results obtained with fungal profile.<sup>1</sup>

### *Examine the soil with CLPP plates*

Amiee T Claseen et al. Conducted a study on two semiarid soils from southwestern United states, by Using temperature sensitivity community-level physiological profile (CLPPS) in different substrate profile micrometre plate (biolog GN2, GNP2, ECO, SFN2, SFP2). The study shows distinguish soil features when combined with fungal plate.<sup>3,5</sup>

### *Examination of soil on natural grassland*

J.H Warcup et. al. conducted a study on natural grassland soil and founds that the distribution of fungus differs at depth and the Ph level of soil also effect the fungal species of soil.<sup>5</sup>

## **EXAMINATION OF SOIL TO ESTABLISH LINK BETWEEN CRIME SCENE**

Sukriyee Kardyl et al. made a study on bacterial and fungal microbiome in soil to establish link between crime scene and criminal/victim by analyzing the sample under illumine nova sequence platform and resulting sequence under QIIME2 microbiome by informative platform.<sup>10</sup>

## **DISCUSSION**

The use of diversity between soil microbes can serve a tool for forensic analysis which further requires an analytical approach to determine its reliability. It can also be understood that it is possible to establish a link between the case (criminal/victim) and the crime scene with the help of microbiome analysis. Significant results were observed in DNA in cells of the soil that was collected under different environmental conditions and with the help of techniques including T-RFLP, CLPP, C-substrate plate, INSP, QIIME2. All these techniques are found suitable for analysis of bacteria and fungi in the soil. Among all techniques T-RFLP is found to be great for forensic analysis where control soil sample can be compared with the soil sample found as a evidence as it can work on small quantity of

samples. This technique along with developed and validated methods are available in most of the laboratories.<sup>1,2,3,5</sup>

## **CONCLUSION**

Bacteria and fungi play a important role in ecosystem by creating diversity in its species. It's the diversity in their nature can be used as a basis in environmental monitoring and agriculture field. These bacteria and fungi are microscopic in nature, not and it assists in microbial activity of soil nitrogen fixation and conversion of nitrogen and sulfur into nitrate, ammonia and ammonium which are beneficial for plant growth and healthy ecosystem. Fungi and actinomycete's on other hand contribute significantly to biological decay. Soil microbial analysis can be done by various technique like T-RFLP, CLPP, C-substrate plate, the results can be compared on the basis of the bacteria and fungus present in the soil which in turn can be very useful for forensic analysis regardless of color and texture of soil.<sup>1,2,3,10</sup>

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