Krishi Netra

"Forensic Plant Pathology: Understanding Importance And Prospects"

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Abstract

The ideal bioforensic investigation will be supported by scientific data that will assist investigators in linking a crime to its perpetrator(s), including the identification and characterization of a specific crime-associated microbe and determination of how the microbe was prepared and introduced. A decision tool was developed to help law enforcement officials determine whether an agricultural crime had occurred. The method involved assigning weights and values to factors in order to calculate the likelihood of purpose, was created. A fact sheet and worksheet that go along with the program help novice users make use of it. In order to help law enforcement officials determine the possibility that a disease outbreak was caused by criminal activities, the tool was also modified into a web-based survey format.

Keywords- Forensic plant pathology, epidemiology, investigation

Introduction

Scientific evidence that helps investigators connect a crime to its perpetrator(s), such as the identification and characterization of the offender(s), would underpin the perfect bioforensic investigation of a particular bacterium linked to crime and an assessment of the microorganism's introduction and preparation processes. The use of established and approved methods—such as those created by the International Organization for Standardization—for the gathering and preservation of samples and other evidence, as well as trustworthy and strong assays for pathogen identification and characterization, should be given top priority in the bioforensic investigation.

The need for forensic plant pathology

It is imperative to keep strict chain-of-custody documentation. Even while it is ideal to reduce the amount of time needed for controlled laboratory analysis to be completed and the time between on-site sample collection and arrival at a forensics laboratory, some case investigations must still be completed (Caccianigaet al., 2021), Forensic and law enforcement professionals are involved if plant diseases or their products are intentionally utilized to inflict societal or economic harm or are unintentionally introduced through illicit activity.accountable for figuring out the introduction's technique, source, and timing as well as identifying the people.

Epidemiology in forensic investigation

A crucial component of forensic inquiry is plant disease epidemiology, which is the study of plant pathogen populations in plant populations. It offers information, analysis, and quantitative analysis proving the plant pathogen-related biocrimes' attribution. The areas and/or plant systems that are most biologically vulnerable to a biocrime can be identified with the use of epidemiological analyses. They can also be used to determine the origin of an outbreak, support the question of whether it was intentional or not, forecast the potential spread of the outbreak, and create suitable sampling plans.

Fig 1- Hand-launched unmanned aircraft systems (UASs) can be used to collect and monitor plant pathogens in the atmosphere (left). Rotary-wing UASs equipped with weather and particle monitors can be used to collect weather and pathogen data (right)

The informational and operational flow for responding to an outbreak of a plant disease outbreak is displayed. When signs are present, a plant disease outbreak is frequently identified at the outset. These may include soft rotting, stunting, wilting, chlorosis, necrosis, deformities, tissue proliferations, inhibition or reduction of flowering, seed or fruit production, and other occurrences, depending on the type of plant host and the pathogen (Fletcher et al., 2020).

HPLC, GC/MS, and LC/MS are routinely used to determine the types and concentrations of mycotoxins in grain samples, but these methods rely on expensive equipment, internal and external controls for the toxins of interest, and well-trained operators at private and government-funded laboratories, for safety certification of grain for feed and food processing.

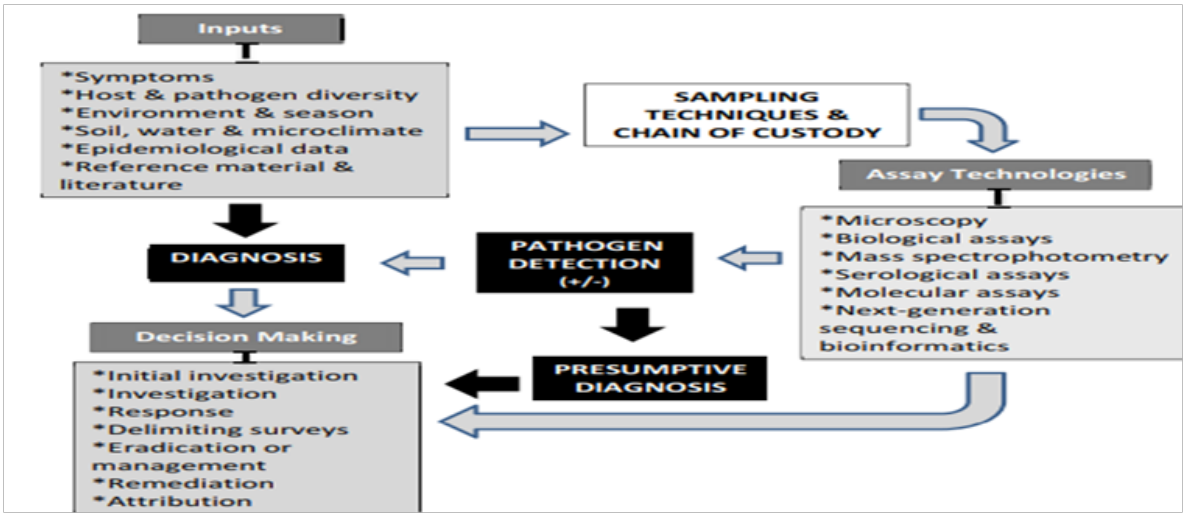

Fig 2- Flow of activity and information for decision-making based on pathogen detection and disease diagnosis

Mutation, evolution, and forensic plant pathology

Evolution and mutation affect the relationship between the organism(s) that caused the sickness and those connected to suspects, which is why they are important in forensic plant pathology. The technique of determining the likelihood that germs from two sources originated from a recent common source (attribution) or, alternatively, that they did not share a recent ancestor (exclusion), relies heavily on the comparison of pathogen genomes. Plant pathogens, like other microorganisms, experience mutations that, if left unchecked, turn into variants that are subject to selection, which drives evolution.

Current efforts supported by the United States Department of Agriculture Animal and Plant Health Inspection Service (APHIS) focus on training detector dogs to rapidly identify Candidatus Liberibacter asiaticus-infected citrus trees before symptoms of citrus greening (huanglongbing) appear in orchards having scattered pathogen infections as well as at ports of entry for surveillance of imported plants (Fletcher et al., 2016).

A forensic inquiry is different from the work of standard plant disease diagnosticians in that it aims to establish criminal attribution. It is frequently required to identify and thoroughly describe related pathogens, going considerably beyond what is required for disease management.

Gaps

Future forensic plant pathologists could come from a variety of backgrounds, including adjacent fields such as genetics, molecular biology, and microbiology must satisfy the exacting standards of forensic science. Some of the plant pathology resources, knowledge, and technologies that have been around for peaceful purposes and natural disease outbreaks are currently being adapted. Targeted new technologies are still required, though. Merely identifying a disease by its name and species is insufficient; we also need to distinguish between pathogen strains that are very similar (Keim., 2013)

Conclusion

Numerous fields are combined in forensic plant pathology. The following parties are the focus of forensic plant pathology: members of the security and law enforcement sectors, whose immediate objectives are to locate the source of a deliberately introduced pathogen, assign blame to the offending party(s) so that they can face justice, and act as a deterrent against future attacks or crimes. Effective communication between the law enforcement community and plant pathologists is essential for the successful functioning of this burgeoning specialty. To ensure its relevance and usefulness in resolving actual issues, forensic plant pathologists also need to arrange their work based on frequent engagement and contact with members of the security community.

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