JUST AGRICULTURE
multidisciplinary e-Newsletter

Diagnosis and Detection of Soil-Borne Fungal Phytopathogens in Major Crops

Pravallikasree Rayanoothala
C.V. Raman Global University, Bhubaneswar, India-752054

ARTICLE ID: 22

Abstract:

Various crops, whether it is any food particle or fruit ones are getting damaged through pathogens such as bacteria, viruses, fungi, and insects. Damage to crop plants and seeds is an important issue during formulation in management strategies. Testing of the seed condition and the capacity to detect seed-borne pathogen is an important platform to check for management of crop diseases. Most important thing is to choose the healthy seeds and its best method or technique. The first method i.e., Visual method to choose whether the plant is healthy or not then second one is Selective method or Seedling grow out method. In seedling grow out method, we get to know that which seed is of better quality or not thus, we can specify the seeds. PCR (Polymerase chain reaction) is generally used for detection of microorganisms derived from the environment. PCR-based seed test requires removal of PCR -quality DNA from target pathogen in background of saprophyte organism. PCR-quality of DNA is not acceptable, and restricted. To come out of these modifications PCR methods and their limits. PCR and ELISA are present for detection of all seed borne pathogens and environmental observation methods. Overall process and its concept give us all the methods and techniques, also modern tools are used for detection and identification of seed borne fungal pathogens.

Keywords: Soil-borne, fungal Phytopathogen, PCR, Microorganisms, Disease.

Detection methods for soil borne fungal pathogen:

The following methods are used to detect soil borne fungal pathogens which include conventional and modern methods.

Conventional detection methods:

- **Visual examination of dry seeds:** Examining dry seeds with the naked eye or using magnifying glasses is the first step in the detection of seed-borne diseases.

JUST AGRICULTURE
multidisciplinary e-Newsletter

Certain seed-borne fungal infections or seed surfaces can cause infected seeds to display distinct traits and symptoms. Seeds that are rotted, necrotized, withered, changed colour, or shrivelled over anyone of the parts. Along with these symptoms, dry seeds are inspected for admixtures such as sclerotia, fungal fructification like pycnidia and acervuli, smut balls and sori, etc.A sample containing 400 or more seeds can be analysed using this method using a stereoscope, microscope, hand lens, or the naked eye. The examination has also revealed some conventionally substantial hazards. An illustration would be seeds from weeds that are contaminated by insects and pests (Table 1).

Table 1: visual symptoms and associated pathogens

s.no	**crop**	**Visual sign or symptom on seed**	**Possible fungi associated**	**references**
1	Maize	Seed rot	*Fusarium graminearum*	Palmer*et al*., 1967
2	Pea	Brown spot	*Ascophytapisi*	Pearce *et al*(1967)
3	Rice light	Light pink discoloration	*Fusarium graminearum*	Schaad*et al*., (1995)
4	Barley	Scald symptom	*Rhynchosporiumsecalis*	Jacobson (1995)

- **Embryo count:** The embryo count method is used to separate the embryo from the remainder of the seed for microscope observations when the inoculum of a fungus is found in the embryo, as in the cases of Ustilago nuda and U. tritici (Rennie, 1982).

Immunodiagnostic method:

Immunoassays using antibodies, such as the micro-titre Enzyme-Linked Immune Sorbant Assay (ELISA), immune fluorescence staining test (IFST), seed immune blot binding assay (SIBA), dyed latex bead agglutination test, immunological dipstick assay, etc. have all been used in studies to determine the presence of certain diseases.

JUST AGRICULTURE
multidisciplinary e-Newsletter

Pathology of seeds: pathogen identification. The field-use immunodiagnostic assays are quick, cheap, and don't need highly skilled workers.

Research innovations in seed pathology:

Detection techniques for seed borne diseases are normally the focus of seed pathology research, and numerous advancements are currently being made in this field. The development of the polymerase chain reaction (PCR) revolutionized biological diagnostics, ushering in a new era of pathogen identification in medicine and veterinary medicine as well as the possibility of pathogen detection in seed (Hensen, 1993; Pearce, 1998). Since then, numerous PCR-based detection techniques have been created and used to identify seed-borne diseases. The polymerase chain reaction (PCR) and other DNA-based detection methods, such as Bio, PCR, Immuno-magnetic Separation and PCR (IMS-PCR), Magnetic Capture Hybridization and PCR (MCH-PCR), real-time PCR, and DNA chip technology (microarray), are discussed by Agarwal (1983).

To summarize, the diagnosis and detection of soil-borne fungal phyto pathogens in major crops are crucial for effective plant disease management. Through various techniques such as visual observation, microscopic examination, and molecular methods, researchers and plant pathologists can identify and characterize these pathogens.

Visual observation helps in identifying initial symptoms of fungal pathogen presence, such as wilting, discoloration, necrosis, lesions, and deformities. However, visual symptoms alone may not be sufficient for accurate diagnosis and require further confirmation.

Microscopic examination plays a vital role in identifying and classifying fungal pathogens. By isolating fungal structures from infected plant tissues or soil samples, experts can identify the specific fungal species responsible for the disease. Microscopic techniques include staining, culturing, and microscopic observation using compound and electron microscopes.

Molecular methods, such as PCR and DNA sequencing, have revolutionized the detection and identification of soil-borne fungal pathogens. These techniques amplify and detect specific DNA sequences of fungal pathogens, providing accurate and rapid results. Immunoassays, such as ELISA, also utilize specific antibodies to detect and quantify fungal pathogens.

JUST AGRICULTURE
multidisciplinary e-Newsletter

Next-Generation Sequencing (NGS) technologies enable comprehensive characterization of soil-borne fungal pathogens by sequencing entire fungal genomes. This allows for a detailed understanding of their genetic diversity, virulence factors, and potential resistance to fungicides.

Conclusion:

In conclusion, the diagnosis and detection of soil-borne fungal phytopathogens in major crops rely on a combination of visual observation, microscopic examination, and molecular techniques. These approaches provide valuable insights into the identity, prevalence, and genetic characteristics of fungal pathogens, enabling the development of effective disease management strategies to protect crop health and maximize agricultural productivity.

Acknowledgement:

I acknowledge the authors who provided all the information for helping us to write this diagnosis and detection of soil-borne fungal phyto-pathogens in major crops.

References

Jacobsen C.S., (1995): Microscale detection of specific bacterial DNA in soil with a magnetic capture hybridization and PCR amplification assay. *Appl. Environ. Microbiol*. 61: 3347–3352

Palmer LT, MacDonald D, Kommedahl T. (1967). The ecological relationship of *Fusarium moniliforme* to *Pratylenchusscribneri* in seedling blight of corn. *Phytopathology* 57:825

Pearce DA. DK Arora, CA Reddy, RP Elander.(1998). PCR as a tool for the investigation of seedborne disease. In *Applications of PCR inMycology*, pp. 309–324. New York: CAB Internatl.

Rennie W.J., (1982): Barley. Loose smut. In: ISTA handbook on seed health testing. Working sheet n. 25. ISTA, Zürich

Rennie WJ (1982) Wheat Loose Smut. ISTA Handbook on Seed Health Testing,Section 2, Working Sheet No. 48,

Schaad N.W., Cheong S.S., Tamaki S., Hatzilouka E., Panopoulos N.J., (1995): A combined biological and enzymatic amplification (BIO-PCR) technique to detect *Pseudomonas syringae*pv. *phaseolicola* in bean seed extract. *Phytopathology* 85: 243–248.