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ENVIRONMENTAL SPECIATION, SIGNIFICANCE AND CHARACTERISTICS OF EMERGING FOLIAR FUNGAL DISEASES

Dr. Firdos Katiar

Associate Professor, Department of Botany, Christ Church College, Kanpur

ABSTRACT:

Environmental speciation is a process by which a single species diversifies and adapts to different environmental conditions, resulting in the formation of distinct subpopulations or subspecies. In the case of emerging foliar fungal diseases, environmental speciation can occur as the fungal pathogens adapt to different environmental conditions within their host plants or in the surrounding ecosystem.

Fungal diseases that emerge on plant foliage can be caused by a variety of fungal species, each of which may have distinct environmental preferences and requirements for growth and reproduction. For example, some fungal pathogens may be adapted to thrive in warm and humid conditions, while others may be adapted to cooler and drier conditions. As the fungal pathogens encounter different environmental conditions, they may adapt through genetic changes or natural selection to become better suited to those conditions. Over time, this can lead to the formation of distinct subpopulations or subspecies with unique characteristics and adaptations. These subpopulations may differ in their virulence, resistance to fungicides, or other factors that influence their impact on the host plant and the surrounding ecosystem.

Understanding the environmental factors that contribute to the emergence and spread of foliar fungal diseases is an important aspect of disease management and control. By identifying the specific environmental conditions that favor the growth and spread of fungal pathogens, researchers and growers can develop strategies to mitigate the impact of these diseases and prevent their spread. This may include cultural practices, such as altering planting density or irrigation schedules, as well as the use of fungicides or biological controls.

Keywords: *Environmental speciation, foliar fungal diseases, pathology*

INTRODUCTION

Fungal diseases that affect the leaves of plants are called foliar fungal diseases. These diseases can have significant impacts on the health and productivity of plants and can also affect the environment and human health. Here are some of the characteristics and significance of emerging foliar fungal diseases:

- Host specificity: Emerging foliar fungal diseases often have a narrow host range, meaning they only affect certain plant species or families. This can make them difficult to control and eradicate, as they may be able to persist in the environment even if infected plants are removed.
- Environmental impact: Foliar fungal diseases can have significant impacts on the environment, as they can affect the health and productivity of trees and other plants, leading to reduced carbon sequestration and increased erosion. In addition, many fungal diseases are spread through the movement of infected plant material, which can lead to the introduction of invasive species and the disruption of natural ecosystems.
- Economic impact: Foliar fungal diseases can have a significant economic impact, both in terms of the cost of controlling and managing outbreaks, and in terms of the loss of productivity and revenue for affected industries. For example, foliar fungal diseases can reduce crop yields and quality, and can also affect the value of timber and other forest products.
- Human health impact: Some foliar fungal diseases can have direct impacts on human health, such as the fungal spores that cause respiratory problems in people with allergies or asthma. In addition, the use of fungicides to control fungal diseases can also have potential health impacts, both for farmers and for consumers of affected crops.
- Climate change impact: Climate change can play a role in the emergence and spread of foliar fungal diseases, as warmer temperatures and changing rainfall patterns can create conditions that are more favorable for fungal growth and transmission. As a result, it is important to monitor and respond to emerging foliar fungal diseases as part of broader efforts to mitigate the impacts of climate change on ecosystems and human health.

ENVIRONMENTAL SPECIATION OF EMERGING FOLIAR FUNGAL DISEASES

Environmental speciation of emerging foliar fungal diseases refers to the process by which new fungal species evolve and emerge as pathogens of plants in response to changes in environmental conditions. Fungi are known to play a critical role in the ecology of plants, as both mutualists and pathogens, and are capable of adapting to a wide range of environmental conditions. Environmental changes, such as alterations in temperature, humidity, and rainfall patterns, can lead to changes in the distribution and abundance of fungal species. In some cases, these changes can result in the emergence of new fungal species that are adapted to specific environmental conditions and are capable of causing disease in previously healthy plants. For example, recent studies have suggested that climate change may be contributing to the emergence of new fungal pathogens of trees, including the devastating oak wilt disease in North America.

The process of environmental speciation of fungal pathogens involves a complex interplay between genetic and environmental factors. As environmental conditions change, fungal

populations may become isolated from one another and experience different selective pressures, leading to the evolution of new genetic variants. These variants may then become adapted to specific environmental conditions and may have an increased ability to cause disease in plants. Overall, understanding the environmental speciation of emerging foliar fungal diseases is important for predicting and managing disease outbreaks in agricultural and natural ecosystems. This requires ongoing surveillance and monitoring of fungal populations, as well as the development of effective strategies for disease prevention and control.

Example of environmental speciation:

Environmental speciation refers to the process by which new species arise as a result of environmental factors, such as changes in climate, soil composition, or host availability. In the case of emerging foliar fungal diseases, environmental speciation may occur as a result of changes in the environment that promote the evolution of new fungal strains or species that are better adapted to infecting specific hosts or environments.

One example of environmental speciation in emerging foliar fungal diseases is the emergence of new strains of the fungus causing sudden oak death (Phytophthora ramorum). This pathogen originally emerged in California in the 1990s, but has since spread to other regions and hosts, including tanoak and other tree species. Genetic analysis has shown that the pathogen has undergone environmental speciation, with distinct strains evolving to better adapt to different hosts and environments.

Similarly, the fungus causing white-nose syndrome in bats (Pseudogymnoascus destructans) has undergone environmental speciation as it has spread across North America. The fungus originally emerged in the northeastern US and Canada, but has since spread to other regions and hosts, including different bat species. Genetic analysis has revealed the emergence of new strains of the fungus that are better adapted to infecting specific bat species and regions.

Environmental speciation of emerging foliar fungal diseases can have significant implications for disease management and conservation efforts. By understanding the environmental factors that promote the evolution of new fungal strains or species, researchers can develop strategies to mitigate the spread of these pathogens and protect vulnerable hosts and ecosystems.

Role of barrier in environmental speciation

In environmental speciation, barriers impede the flux of genetic material between populations, but environmental factors induce mutations that result in new species. In optional speciation, the growths of pathogens are dependent on the environment basis at the earlier stage. The human actions are contributed toward the variations of bio network. There is growing evidence that these fluctuations play major roles in determining the establishment of microbial pathogens in plants [6]. In this regard, many researchers have concentrated on the increasing incidence of fungal leaf

diseases on the host owing to its significance with a consequence of the profusion of recognized cases. The significances of different fungal illnesses on the host are important for agricultural yield under the natural environment. However, this theoretical structure does not account for adaptation or differences among pathogens despite evidence that the contamination of a new plant could increase the incidence of developing diseases [7].

Information about fungal leaf diseases is required for the study of well-known views of environment speciation. It can enhance the host plant's physiology and the growth due to its environmental speciation interaction with pathogens. There are several indications that plant pathogens may undergo rapid environmental speciation via changes in the host itself. Elucidation of the connections among emergent diseases and environmental speciation will help in the development of more realistic models and simulations that integrate the characteristics of the fungal pathogen and new experimental methods to study them. These incidences are responsible for the growth of fungal leaf illnesses [8].

Characteristics of Environmental Speciation

Pathogen virulence may be determined by a single diallelic loci in the pathogen and the host. Host resistance may be identified when the host transports a resistant allele, and the pathogen carries an avirulent allele. The allelic mixtures facilitate contagion as the host does not transport the unaffected allele, or while the pathogen carries the 'deadly' allele that escapes host recognition. Pathogen alleles are called as virulent strain. It can be denoted as virulence for the qualitative capacity of the host genotype (Figure 1) [9].

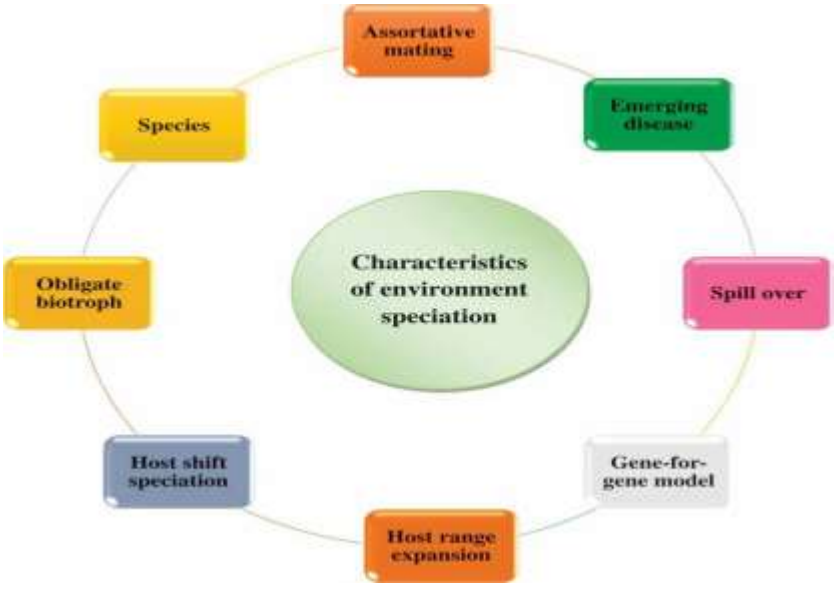

Figure 1. Characteristics of Environment Speciation

Plants could change speciation through concentration on a fresh mass. Obligate biotope is a pathogenic living organism that gains resources from the host. Though, lots of mysterious varieties have been discovered inside morphological varieties through utilizing the hereditary concordance of phylogenetic strain for reorganization measures. These strain criterions are used for the phylogenetic concordance of many nonlinked genes. The phylogenetic strain reorganization decisive factor has proven considerably useful for fungi as it is frequently more discerning than other criteria and is also more convenient to use. We regard the whole fungi capable of reproduction. Moreover, the cross-strain communication of pathogen can be stored in the organization of new tissue [10].

Characteristics of fungal pathogens of plant leaves promoting environmental speciation

Some history characteristics of fungal pathogens are favorable to environment speciation as they reduce the constraint for harmful speciation. We detail these features below and speculate their significances for the probability of environment changes. The number of spores is a particularly important determiner determination of alteration input for individuals. Pathogenic fungi can generate thousands of microspores in lesions and lead to considerably increased propagation in similar hosts that could give way to split the diseases [11]. Furthermore, high spore numbers permit the rapid generation of gene differences via mutation. Original variety of resistance gene can confer the full confrontation inside for only some months [12].

Such quick development could arise uniformly for growing pathogens and could be identical for lower inherited multiplicity. If the progeny is lower, the selection of plant could be vital intended for the progeny through the superlative probable inherited with ecological circumstantial. This ‘magical trait’ state is a single trait and is mainly favorable for environmental speciation. In theoretical models, the restriction on gene flow is the reduced viability of emigrants. With a very robust choice, it can totally avoid the impartial genetic transformation. Several studies have provided experimental evidence for the generalization of a mechanism in fungal host pathogens [13,14].

CONCLUSION

Environmental speciation of emerging foliar fungal diseases refers to the process by which new fungal species evolve as a result of environmental factors such as climate change, land use changes, or introduction of non-native plant species. Fungal pathogens that infect plant leaves can cause significant damage to crops, forests, and natural ecosystems. These pathogens have the ability to rapidly evolve and adapt to changing environmental conditions, which can lead to the emergence of new strains and species.

Environmental factors such as temperature, humidity, and nutrient availability can affect the growth and survival of fungal pathogens. For example, as temperatures increase due to climate

change, some fungal species may be able to expand their range into previously unsuitable regions, where they can infect new host plants and cause previously unknown diseases. Human activities such as deforestation, urbanization, and global trade also play a role in the spread of fungal diseases. As new plant species are introduced to new regions, they may bring with them novel fungal pathogens that can cause disease in native plant species. Understanding the mechanisms of environmental speciation of fungal pathogens is important for predicting and managing emerging diseases. By monitoring environmental factors and identifying potential new host plants, researchers can develop strategies to prevent and control the spread of fungal diseases.

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