

## Plant Pandemics

### Why in news?

Plant pandemics have been forecasted as the next big contagion and posing threats to global food security.

### What is Plant pandemic?

- **Plant pandemic** - It is the disease outbreak that spreads across continents or subcontinents and causes mass mortality in plants.

Major Pandemic Plant Diseases and Outbreak			
Disease	Pathogen	Origin	Outbreak
<b>Wheat blast disease</b>	Mangalore oryzae Triticum (Moot) - Fungus	South America - Brazil	In Bangladesh in 2016 and 2018 outbreak in South Africa and Zambia
<b>Banana Fusarium Wilt</b>	Fusarium oxysporum - Soil fungus	Central America	By 1960, it spread to tropical America, the Caribbean and West Africa
	Fusarium Tropical race 4	Taiwan, East Asia	Spread to 20 countries, including India
<b>Maize lethal necrosis</b>	Combination of 2 viruses—maize chlorotic mottle virus (MCMV) & sugarcane mosaic virus (SCMV)	United States in the 1970s.	Now prevalent in Rift valley region East Africa, Southeast Asia, and South America.
<b>Coffee leaf rust</b>	Fungus Hemileia vastatrix	East Africa	Spread to all coffee cultivation areas in Asia, the Americas and Africa
<b>Cassava brown streak</b>	Cassava brown streak virus	Tanzania in 1935	Now spread to central and southern Africa.
<b>Late blight disease - Tomato &amp; potato</b>	Fungus Phytophthora infestans		In India, the disease continues to cause outbreaks since the 1800s.

<b>Citrus tristeza disease</b>	Closterovirus	First recorded in Argentina in the 1930s	Spread to South Africa, West Africa and California
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## What are the factors driving plant pandemics?

- **Climate Change** - With the consequent expansion of warmer and more humid conditions to higher latitudes, tropical diseases are spreading to temperate and higher latitudes.
- **Higher global trade** - *Introduction of foreign crops* and flow of agricultural produces across the globe enables the pathogens to spread across the globe favouring disease outbreak
  - In the *1980s, citrus plants infected by Citrus tristeza virus* were shipped in vast numbers to unaffected countries, leading to a large-scale infestation and extending the pandemic.
- **Increased industrial Farming** - Large scale mono cropping pattern facilitates the quick spread of the pathogen across the field.
  - High-density monocultures soybean and wheat are *compromised by the fungus Phakopsora pachyrhizi*.
  - Wheat blotch caused by the fungus *Zymoseptoria tritici*.

## What are the impacts of plant pandemic?

- It could provoke a humanitarian crisis that could deprive people of livelihood and lead to widespread hunger.
- **Threats global food security** - Plant pandemics affects the yields of diverse food crops and cause food shortage across the globe
  - Yield losses of more than 50% have been documented during severe epidemics.

*Fungal disease outbreak could reduce global wheat production by 13% by 2050.*

- **Famine** - Plant pandemics causes famine and large-scale death
  - **1943 Bengal famine** - Caused by *Cochliobolus miyabeanus*, a brown spot disease in rice led to the death of over 2 million people.
- **Loss of Livelihood** - Farmers lose their livelihood and are pushed to poverty.
- **Promote out migration** - Loss of crops causes farmers and people to migrate to other regions for food and livelihood.
  - Between 1845 and 1852, *Phytophthora infestans* wiped out potato

crops in Ireland, resulting in famine & mass migration.

- **Damage ecosystem** - Pathogen outbreak disrupts the natural food web and ecosystem functions.

### Impact of Climate Change in Plant Pandemic

- **Support pathogen transmission** - Extreme weather events like hurricanes can transport pathogen spores over continents.
  - In a warming climate, wheat blast will spread to countries that so far remain untouched.
- Rise in global warming from 1.5°C to 4°C is expected to increase the risk of Pierce's disease.
- **Reduce plant immunity** - Elevated temperatures can suppress plant immunity, leading to increased pathogen infection.
- **Increase virulence** - Elevated carbon dioxide levels in the atmosphere are also seen to increase the severity of certain pathogens.
  - For example, powdery mildew that infects gourds.

*Pierce's disease* is a bacterial disease that affects grapevines and can cause epidemics in vineyards of southern Europe, particularly in France, Italy and Portugal.

### What are the challenges in controlling plant pandemic?

- **Ineffective fungicides** - Existing fungicides are ineffective in controlling these newly evolved pathogens.
- **Increasing resistance** - High usage of fungicides is making the pathogens like *Magnaporthe oryzae Triticum* to develop higher resistance to those fungicides.

*Magnaporthe oryzae Triticum (MoT)*, a fungus that attacks wheat crops and can wipe out the entire harvest in a matter of days.

- **Complexity pathogen** - Physiological and genetical complexity of the pathogens makes it difficult to understand their interaction with the target crops.
  - For example, in case of MoT fungal infection, there is difficulty in deciphering the gene responsible in MoT or in wheat that confer durable resistance to it.
- **Evolution** - Pathogens are evolving fast to reproduce quickly infect new hosts.

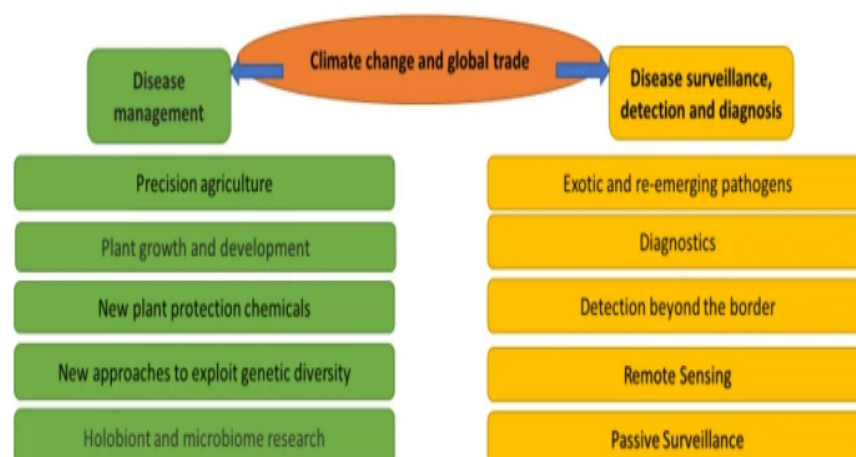
- As the fungus spreads to wider geographies, it may evolve to become more virulent or infect other species.
- **Inter species spread** - Some pathogens could jump to other crops.
  - For instance, pathogens may jump from wheat to paddy.

## Measures by India to Tackle Magnaporthe oryzae Triticum (MoT)

- **Burning infected crops** - The state's agriculture department directed farmers in the villages, which had reported wheat-blast-like infection, to set fire to the standing crops to prevent the fungal spores from spreading further.
  - 400 ha of wheat fields were reportedly set ablaze.
- **Declaration of Wheat holiday** - Since the fungus can survive on seeds for up to 22 months, the government also announced a "wheat holiday" for three years in the state.
- **Banned cultivation** - India have banned cultivation of the crop within 5 km of the border with Bangladesh.
- **Enhanced surveillance** - The Border Security Force was also instructed to keep a vigil on grain trading.
- **Growing alternative crops** - Farmers in the border villages of West Bengal are reluctant to grow wheat and are shifting to banana, maize and lentils.

## What lies ahead?

- Diversify crops to limit the outbreak and yield loss.
- Create genetic libraries of crops and pathogens to mitigate the future risk.
- Screen seeds and certify them for the fungus and quarantine measures to help thwart its spread to other countries.
- Model the global food system using advanced technologies like data analytics to forecast the disease outbreak in plants.
- Implement a greater disease surveillance by improved detection.



## References

1. [Down To Earth| Magnaporthe oryzae Triticum Infection across Ind0-Bangladesh Border](#)
2. [Down To Earth | Plant Diseases - Causes, Origin and Impacts](#)
3. [Down To Earth| Efforts to be taken to control Plant Pandemic](#)

