



Xoo Infection: Rice

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Why in News

Recently, scientists from the **Centre for Plant Molecular Biology (CPMB)** have uncovered the mechanism by which a bacterium called Xoo interacts with rice plants and causes disease.



Key Points

- **About:**
 - **Xanthomonas oryzae pv. oryzae (Xoo)** causes a **serious bacterial leaf blight disease in rice**. It is also known as **Bacterial blight**.
 - Xoo is a **gram-negative bacteria**.

- **Transmission:**
 - Xoo infection **causes huge yield losses** to rice cultivation throughout the world.
 - Xoo infection initiates from the leaf sheath and eventually spreads to mature leaves through the water flow under optimum temperature and high humidity conditions (**Vascular disease**).
 - Since **rice paddies are flooded** throughout most of the growing season, Xoo may easily spread among crops; bacteria travel through the water from infected plants to the roots and leaves of neighbouring rice plants.
 - **Wind** may also help spread the Xoo bacteria to other crops and rice paddies.
- **Impact on Other Crops:**

In addition to rice, Xoo **may infect other plants**, such as rice cut-grass (*Leersia oryzoides*), Chinese sprangletop (*Leptochloa chinensis*), and common grasses and weeds.
- **Prevention:**
 - The **most-common method of defending against rice bacterial blight** is the **cultivation of rice varieties with genes that confer resistance to Xoo infection**.
 - Over 30 resistance genes, termed **Xa1 to Xa33**, have been identified in rice plants, and some, such as Xa21, have been integrated into the genomes of commercial rice strains.
 - However, this method **involves breeding or gene manipulation techniques** that are laborious and time-consuming.
 - Also, the introduced resistance genes **provide only race-specific resistance** that will prevent infections by only specific strains of Xoo.
- **New Approach:**
 - Scientists from **Centre for Plant Molecular Biology (CPMB)**, Osmania University, **Hyderabad** are working to identify and develop few molecules which are derived either from the Xoo bacterium or from the infected rice cell walls.
 - Treatment of rice with **cellulase, a cell wall degrading enzyme secreted by Xoo** induces rice immune responses and protects rice from subsequent infections by Xoo.
 - The cellulase protein has the **features of a typical vaccine** as it is a potent elicitor of rice immune responses.

Rice

- **Kharif Crop**
- **Temperature:** Between 22-32°C with high humidity.
- **Rainfall:** Around 150-300 cm.
- **Soil Type:** Deep clayey and loamy soil.

- Some of the **most important rice-growing regions** are Assam, West Bengal, coastal regions of Odisha, Andhra Pradesh, Telangana, Tamil Nadu, Kerala and Maharashtra, particularly the (Konkan coast) along with Uttar Pradesh and Bihar.
 - Development of a dense network of **canal irrigation and tubewells** have made it possible to grow rice in areas of less rainfall such as **Punjab, Haryana** and **western Uttar Pradesh** and parts of **Rajasthan**.
- In states like Assam, West Bengal and Odisha, **three crops of paddy** are grown in a year. These are **Aus, Aman** and **Boro**.
- **National Food Security Mission, Hybrid Rice Seed Production** and **Rashtriya Krishi Vikas Yojana** are few government initiatives to support rice cultivation.
- Diseases in rice are mainly caused by **bacteria, viruses, or fungi**. Few major diseases are:
 - **Sheath blight:** Caused by fungus ***Rhizoctonia solani***.
 - **Brown Spot:** One of the most common and most damaging **fungal diseases**.
 - **Tungro:** Caused by the combination of two viruses, which are transmitted by leafhoppers.
 - **Bakanae:** Seedborne **fungal disease**.
 - **Blast (node and neck):** Caused by the **fungus *Magnaporthe oryzae***.
- **Gram-negative Bacteria**
 - **Bacteria** can be classified into **two groups** on the basis of the **differences in the cell envelopes** and the manner in which they **respond to the staining procedure** developed by the Danish bacteriologist Gram viz., **those that take up the gram stain are Gram positive** and the **others that do not are called Gram negative bacteria**.
 - Gram-negative bacteria **cause infections** including **pneumonia**, bloodstream infections, wound or surgical site infections, and meningitis in healthcare settings.
 - Gram-negative bacteria are **resistant to multiple drugs** and are increasingly resistant to most available antibiotics. These bacteria have **built-in abilities** to find new ways to be resistant and can pass along genetic materials that allow other bacteria to become drug-resistant as well.
 - Gram-negative infections include those caused by **Klebsiella, Acinetobacter, Pseudomonas aeruginosa**, and **E. coli.**, as well as many other less common bacteria.
- **Centre for Plant Molecular Biology**
 - CPMB is **one of the 7 Centers of Excellence** created in the country with initial financial assistance from the **Department of Biotechnology**, Government of India.
 - Currently it is one of the leading Centers of the country in **Plant Molecular Biology** (study of molecular basis of plant life).

Source: PIB