

Wheat Blast

—A menace to wheat cultivation

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The wheat blast fungi, Magnaporthe oryzae pathotype triticum, has more than 50 hosts to complete its life cycle. This disease was first reported from South America, Brazil. Sudden outbreak of this disease was reported in 2016 in Bangladesh. The states of Bangladesh near the border of West Bengal are at risk for cultivating wheat. This can be the cue for this pathogen to take entry into India. Therefore, care should be taken by implementing regular monitoring and continuous vigilance to prevent the entry of the pathogen in India.

Keywords: *Magnaporthe* sp., Pathogen, Wheat blast

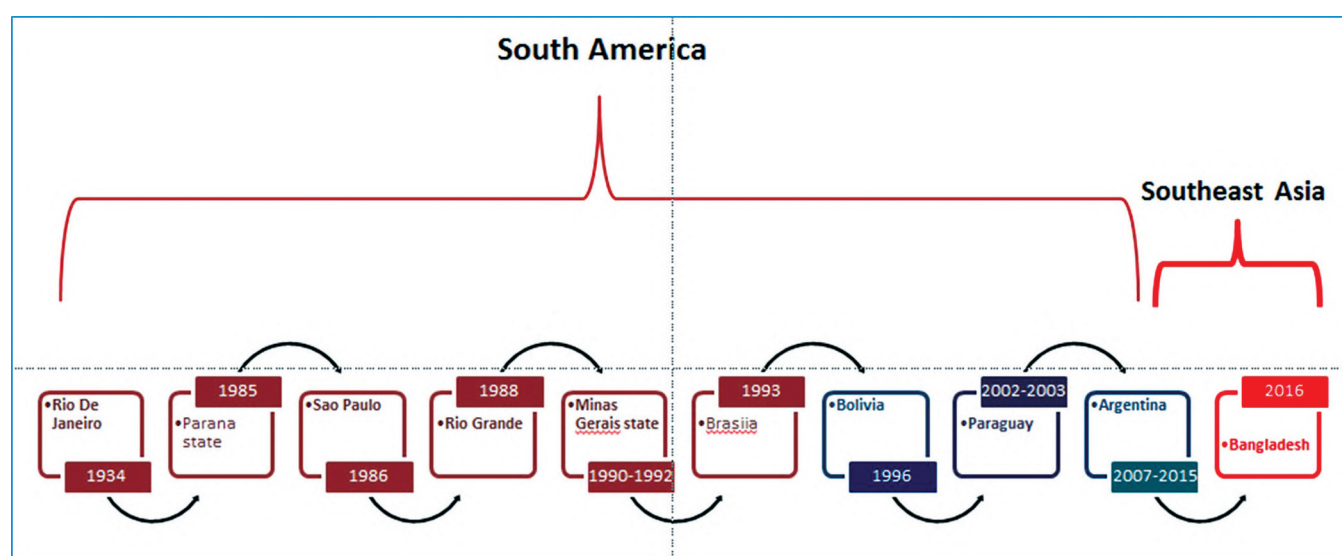
OUTBREAK of new disease causing agents and their increased frequency is a major menace towards global food security. One example is blast; a fungal disease of rice, wheat and other grasses that can destroy food supply sufficient to sustain millions of people. It can cause up to 100% yield losses under congenial environmental conditions. Till 1930, there was no historical report on occurrence of the blast disease of wheat. During 1985, wheat blast disease was reported and

confined to the tropical regions of South America. Inefficient quarantine facility of the exporting and importing country is the only responsible factor for distant appearance of this disease. Moreover, erratic changes of climatic conditions combined with the global warming may trigger spread of this disease to rice-wheat growing areas in near future. It has now become a major threat to the wheat growing area of Bangladesh. Eventual movement to the Asian continent particularly

Bangladesh in 2016 is likely to affect economic yield of wheat. Climatic condition of Bangladesh is more or less similar to India and Pakistan. Bangladesh also shares a long border with India which puts the wheat growing areas of India and Pakistan at risk. After 2016 in Bangladesh, it was unofficially reported from India in 2017.

Symptoms

Initial symptom of spike infection is very much confusing with



Historical occurrence of the wheat blast pathogen

symptoms of head blight disease incited by *Fusarium*. Unlike *Fusarium* head blight, instead of attacking each isolated spikelet, it infects the rachis. Initial pathogen invasion occurs to the rachis; either at the base or upper part, interrupting translocation of photosynthates above the point of infection and subsequent spikelet formation. Complete or partial bleaching of the spike above the point of infection with either no grain or shrivelled grain is common in affected plants. Commonly observed bleached or grey coloured heads with thin layer of fungal sporulation is indicative for successful infection. If infection starts at the mid region of spikelet, above portion of the infection remains bleached and no grains are formed while below portion remains healthy with normal grains. In case of severe infection, eye-shaped or spindle shaped necrotic lesions with grey centres on infected leaves may be observed.

Pathogen biology and taxonomy

Anamorphic stage of the fungus is infectious and the name *Pyricularia* was given by Saccardo as it produces pyriform shaped conidia. The genus *Pyricularia* so far has been identified on rice signifying its species name as *oryzae*, given by Cavara (1892). In 1970 the sexual spore of the genus *Pyricularia* was observed in laboratory on the leaves of *Digitaria* and designated as *Pyricularia grisea*. Based on host specificity; sexual compatibility and genetic similarity, *P. oryzae* isolates have been classified into several subgroups. These are the *Oryza* pathotype- pathogenic on rice (*Oryza sativa*), *Setaria* pathotype- pathogenic on foxtail millet (*Setaria italica*), *Panicum* pathotype- pathogenic on common millet (*Panicum miliaceum*), *Triticum* pathotype- pathogenic on wheat (*Triticum aestivum*), *Eleusine* pathotype- on finger millet (*Eleusine coracana*), *Lolium* pathotype- pathogenic on perennial ryegrass (*Lolium perenne*) and *Avena* pathotype- pathogenic on oats (*Avena sativa*). But this basis of classification was not fruitful for a long time because pathogenicity test of the many pathotypes has revealed

broader host range. For example, isolates of *Triticum* pathotype can cause disease on oats, barley and rye; similarly, *lolium* and *avena* pathotype can infect wheat. The rice-infecting isolates of *M. oryzae* are not pathogenic on wheat and genetically different from wheat infecting populations of *M. oryzae*. Therefore, the wheat blast pathogen was named as *Pyricularia graminis tritici* (Pygt). *Pyricularia oryzae* (*Magnaporthe oryzae*) designated as a single species with multiple lineages and limited primary host whereas, wheat infecting *Pyricularia* species has large host range and high genetic variations. The reason behind the huge difference between rice-infecting *Pyricularia* and wheat-infecting *Pyricularia* regarding host range and new host adaptation is mutations in avirulence gene *PWT3* and *PWT4*. A recent study based on multi-gene phylogenetic analysis of blast causing isolates revealed that there are two species causing wheat blast- *Pyricularia graminis tritici* (Pygt) and *Pyricularia oryzae* pathotype *tritici* (PoT) both of which are independent to *Pyricularia oryzae*; a pathogen of rice. The wheat blast pathogen of Bangladesh is similar to South American isolate of wheat blast that has been recognized as *Pyricularia graminis tritici* (Pygt).

Epidemiology

Occurrence of the disease symptom is associated with high humidity and average temperature ranges between 18°-25°C during flowering stage followed by hot-humid, sunny weather for several days.

Management

For a long time the disease was endemic to Brazil and later it became sporadic. Due to high variability and large host range there is a chance to be epidemic. It will be difficult to find resistance source because of its high variability. In this context, integrated management practices can be a good strategy to manage this disease.

Reinforcement of strong quarantine facilities: Sudden outbreak of Brazilian pathotype of

wheat blast pathogen in Bangladesh is the consequence of spread to inefficient legislative measures. Earlier also the pathogen spread to Bolivia, Paraguay and Argentina from imported Brazilian seed lot. The rigorous vigilance and detection method can decrease the further spread of the pathogen.

Use of healthy seeds: As the pathogen is seed borne, spore can remain viable up to two years both on surface and inside the seed. Healthy and certified seeds should be used.

Field sanitary practices: The pathogen produces perithecia on crop residues. Weeds serve as connecting bridges between two growing seasons and also source of primary inoculum. Therefore, clean cultivation practices should be adopted to break the continuity of life cycle of the pathogen.

Deep ploughing: Deep ploughing can be implemented to reduce the primary source of inoculum by burying crop residues into deeper soil layer.

Eradication of weed hosts: Elimination of certain weed hosts like *Brachiaria* spp., *Cenchrus* spp., *Chloris* spp., *Digitaria* spp., *Echinochloa* spp., *Eleusine indica* and *Lolium* spp. will be helpful for reducing primary inoculum load.

Crop rotation: Crop rotation with non-grass crops like soybean, potato, jute cultivation could be followed.

Alternate date of Planting: Planting should be done in such a way that early flowering and heading of crops will not coincide with the favourable weather of wheat blast pathogen infection.

Breeding for host resistance: Because of high variability and extensive host range, development of resistant cultivar is vital. Gene deployment can be done to encounter the gene flow within the population of different pathotypes.

Chemical treatment: Seed treatment and spraying of chemicals combining strobilurins and triazole fungicides from flowering to heading stage will give better results.

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