CAPS Datasheets provide pest-specific information to support planning and completing early detection surveys.

Pyricularia oryzae Triticum pathotype

Scientific Name

Pyricularia oryzae Cavara *Triticum* pathotype

Synonyms:
Magnaporthe oryzae B. C. Couch *Triticum* pathotype
Pyricularia graminis-tritici Castroagudín et al.

Common Name

Pathogen: PoT, MoT
Disease: wheat blast, brusone

Type of Pest

Fungus

Figure 1. A wheat spike bleached by *Pyricularia oryzae Triticum* pathotype (PoT). Photo courtesy of M. Tofazzal Islam, IBGE, Bangabandhu Sheikh Mujibur Rāhmān Agricultural University, Bangladesh.

Taxonomic Position

Class: Sordariomycetes, **Order:** Magnaporthales, **Family:** Pyriculariaceae

Notes on taxonomy and nomenclature: *Pyricularia oryzae Triticum* pathotype and *Magnaporthe oryzae Triticum* pathotype are used interchangeably to refer to wheat blast. *Magnaporthe oryzae Triticum* pathotype (MoT) was previously used in the CAPS program to remain consistent with diagnostic tools at the time, but *Pyricularia oryzae Triticum* pathotype (PoT) is the accepted name (Zhang et al., 2016) and will be used going forward.

There are numerous pathotypes of *Pyricularia oryzae*, and each pathotype is typically host-specific to a single plant genus (Gladieux et al., 2018; Tosa et al., 2016). This datasheet describes the *Pyricularia oryzae Triticum* pathotype. In addition to *P. oryzae Triticum*, other pathotypes include: *Oryza* pathotype (PoO), which causes rice blast; and

Lolium pathotype (PoL), which causes gray leaf spot disease in annual/perennial ryegrass (*Lolium perenne*) and tall fescue (*Schedonorus arundinaceus*) (Valent et al., 2021). The wheat blast fungus was recently assigned to a separate species, *Pyricularia graminis-tritici* (Ceresini et al., 2019). This assignment was incorrect, and this name is now a synonym of *Pyricularia oryzae Triticum* pathotype (Valent et al., 2019).

Pest Recognition

This section describes characteristics of the organism and symptoms that will help surveyors recognize possible infestations/infections in the field, select survey sites, and collect symptomatic material. For descriptions of diagnostic features, see the Identification/Diagnostic resources on the AMPS pest page on the CAPS Resource and Collaboration website.

Pest Description

Pyricularia oryzae Triticum pathotype is a filamentous fungal pathogen of wheat. Conidia are produced on infected wheat head stems (rachises) and older leaves. Infected wheat head stems and the underside of leaf lesions become gray due to heavy spore formation (Igarashi, 1990).

Symptoms

Infected heads lose their green color and appear bleached (Figs. 1, 2) (Gongora-Canul et al., 2020). This is the most characteristic symptom, but all aboveground plant parts can become infected and show symptoms (Figs. 1-3) (Fernandez-Campos et al., 2020; Gongora-Canul et al., 2020; Valent et al., 2021). Bleaching is in a characteristic pattern, wherein bleaching occurs **above** the point of infection (Fig. 2), which may be the stem inside the wheat head (Fig. 2A) (Valent et al., 2021). To find the point of infection, remove the spikelets just below the point of bleaching to find discolored lesions, which turn from brown/black to dark gray due to heavy spore formation (Fig. 2A) (Igarashi, 1990; Valent et al., 2021). When the pathogen infects the stem just below the wheat head, the entire wheat head appears bleached (Fig. 2B, C) (Valent et al., 2021). Individual spikelets may also be infected (Valent et al., 2021). Grain development is limited in infected wheat heads (e.g., affected grains are shriveled/wrinkled with low test weight) (Fig. 2D) (Urashima et al., 2009).

Eye-spot or elliptical lesions typically form on older leaves, and the fungus can be isolated from lesions in the deteriorating basal leaves at the base of the plant (Fig. 3) (Cruz et al., 2015; Valent et al., 2021). Initially, leaf lesions are water-soaked to gray-green (Cruz and Valent, 2017). Leaf lesions are white with a reddish-brown margin from the top of the leaf, and gray from the bottom of the leaf where sporulation occurs (Fig. 3) (Igarashi, 1990).

Figure 2. Severely infested wheat fields containing bleached spikes **(A&B)**, infected peduncle **(C)**, and infested grains **(D).** Photo credits: (A) Nick Talbot, Stainsbury Laboratory, UK, (B) Guillermo I. Barea Vargas, Coperagro SRL, Bolivia, (C&D) M. Tofazzal Islam.

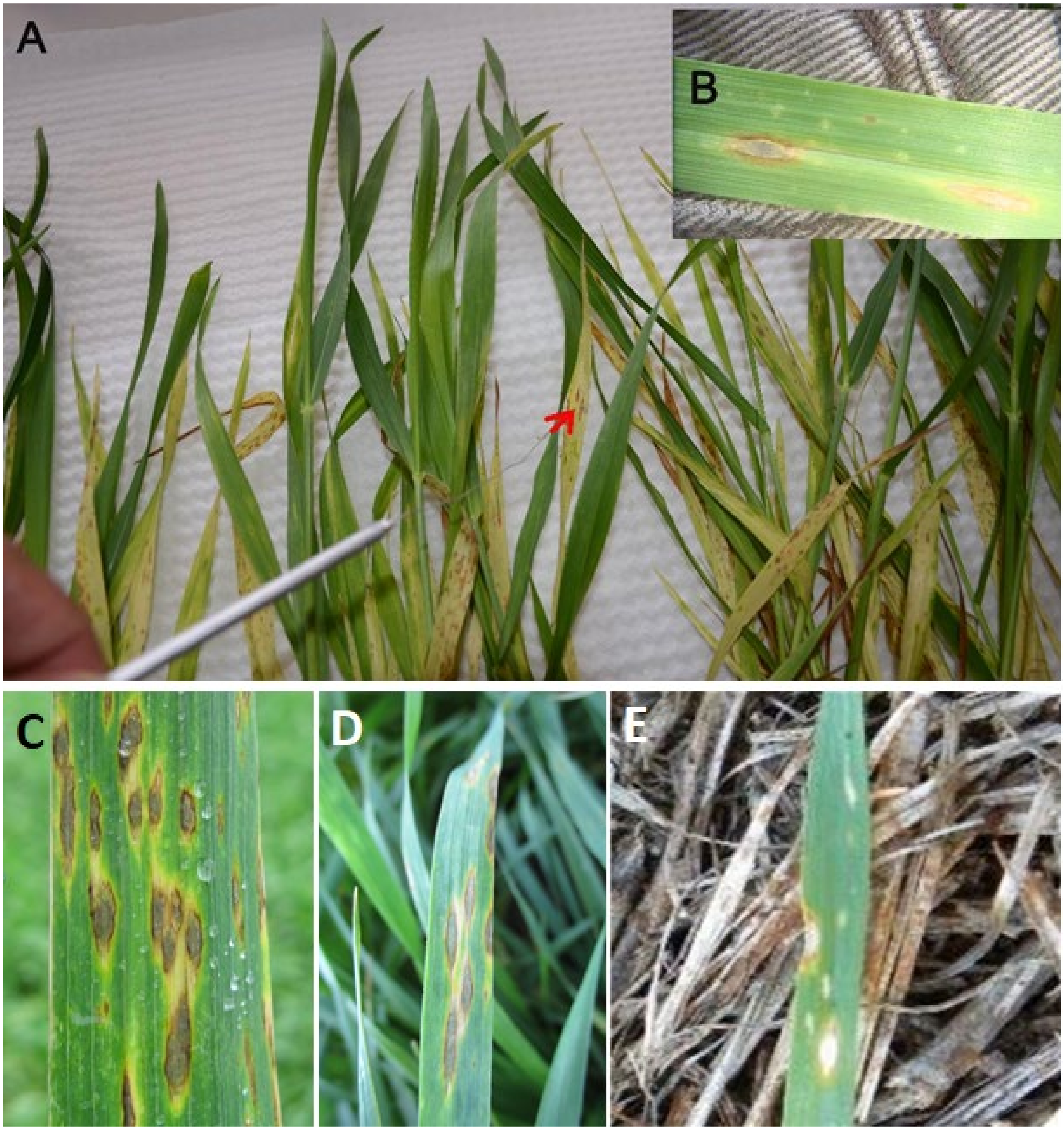

Figure 3. Wheat leaf lesions are typically seen on older leaves **(A)**. Lesions have characteristic grey centers during sporulation **(B, C, D)**. After spore release, lesions have white to tan centers **(B&E).** Photo credits: (A, B) C.D. Cruz, (C,D) Guillermo I. Barea Vargas, Coperagro SRL, Bolivia, (E) Nick Talbot.

Easily Mistaken Species

Fusarium head blight (FHB)
Wheat blast symptoms closely resemble those of another type of wheat spike infection, Fusarium head blight (Fig. 4), which is caused by *Fusarium* spp., fungi that are prevalent in the United States, especially the *F. graminearum* species complex (Gale et

al., 2011; Valent et al., 2021; Valverde-Bogantes et al., 2020). Due to the similar symptoms of these two diseases, wheat blast may be overlooked in the field.

Close examination and training are essential to differentiate between wheat blast and FHB (Valent et al., 2021). When wheat blast infects the wheat head stems, it causes spike bleaching **above** the point of infection and creates spore-producing gray lesions at the point of infection (Valent et al., 2021). Conversely, FHB causes spike bleaching **above and below** the point of infection (Wise et al., 2015) and may contain pink to orange masses of spores (Valent et al., 2021; Wise et al., 2015). Determine the point of infection by removing spikelets to find lesions which may produce spores.

Figure 4. Fusarium Head Blight, with inset showing masses of orange fungal spores **(left)**. Wheat Blast, with inset showing gray fungus/spores after removing spikelets at the point of infection **(right)**. Photo credits: Erick De Wolf, KSU Extension Publication MF3458 (left), Guillermo I. Barea Vargas (right).

Fusarium crown rot

Fusarium culmorum and *F. pseudograminearum*, causal agents of Fusarium crown rot, sometimes cause spike bleaching, especially during drought conditions (Fig. 5A) (Knight et al., 2017; Smiley, 2019). The primary signs and symptoms of Fusarium crown rot are pink mycelium under leaf sheaths and chocolate brown discoloration of the crown tissue and lower stem (Fig. 5A) (Hagerty et al., 2021; Urashima, 2010). These symptoms do not occur in wheat blast. Fusarium crown rot is a common disease of wheat in the Pacific Northwest of the United States (Poole et al., 2013; Smiley et al., 2005).

Take-all disease of wheat

Gaeumannomyces graminis, causal agent of take-all disease of wheat, is a soil-borne fungus that causes chlorotic, stunted plants, and a dark stem base (Fig. 5B) (Cook, 2003; Freeman and Ward, 2004). These primary symptoms are distinct from wheat blast. Take-all also causes white heads of wheat and is a common problem in the United States (Fig. 5B) (Wrather et al., 1997).

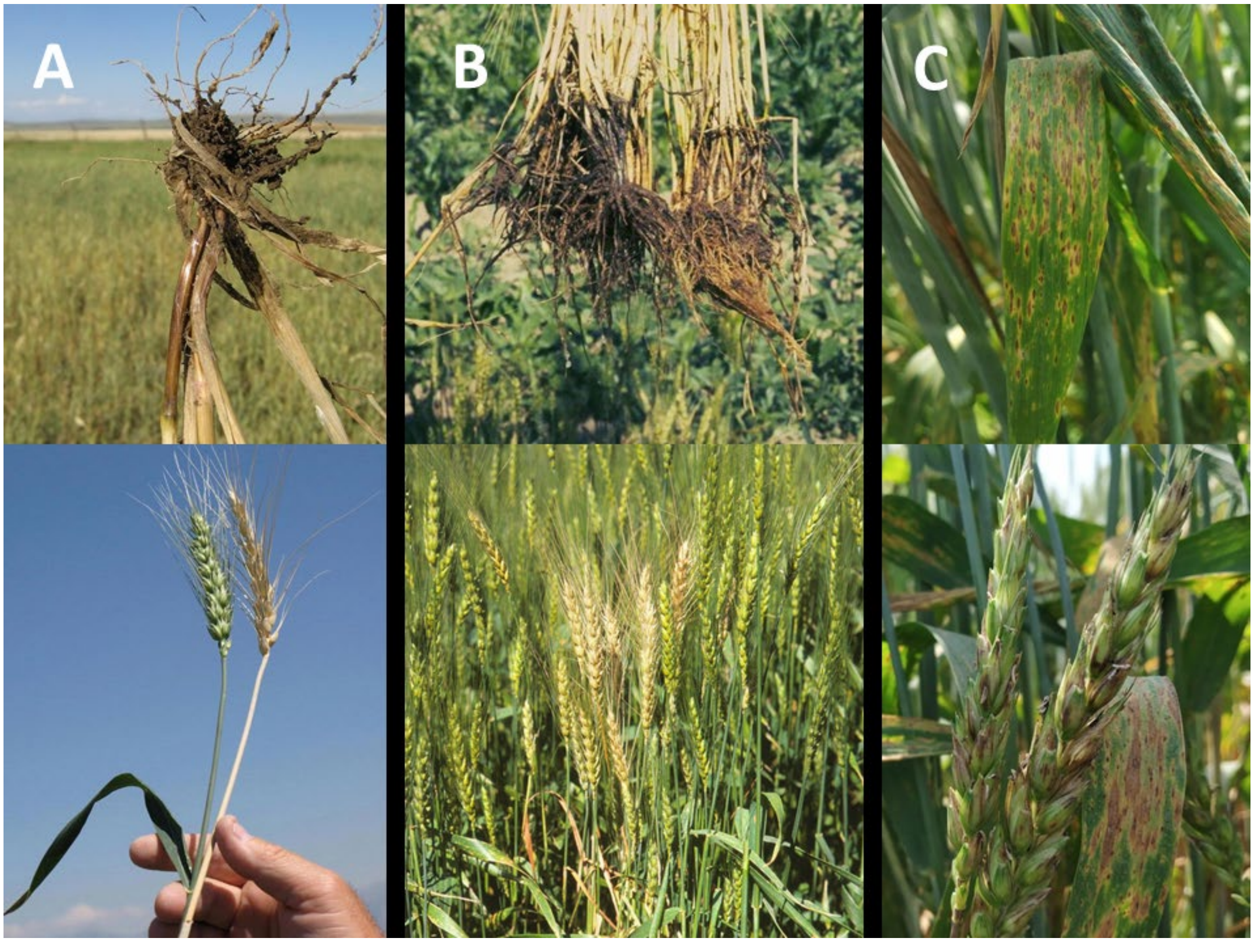

Figure 5. Other wheat diseases that may be mistaken for wheat blast. Fusarium crown rot causing chocolate brown discoloration of the crown tissue and lower stem (**top**) and bleached heads (**bottom**) (**A**); Take-all disease causing root rot (**top**) and bleached heads (**bottom**) (**B**); Spot blotch of wheat causing brown blotches on leaves (**top**) and dark brown discoloration on infected spikes (**bottom**) (**C**). Photo credits: (A, top) Ernesto Moya, bugwood.org, CC BY-NC 3.0 US; (A, bottom) Mary Burrows, Montana State University, bugwood.org, CC BY-NC 3.0 US; (B, top) William M. Brown Jr., Bugwood.org, CC BY-NC 3.0 US; (B, bottom) Craig Grau, Bugwood.org, CC BY-NC 3.0 US; (C, top and bottom) Thirunarayanan Perumal, Banaras Hindu University, Bugwood.org, CC BY-NC 3.0 US.

Spot blotch

Bipolaris sorokiniana, the causal agent of spot blotch, resembles wheat blast because both diseases cause spike discoloration and leaf spots (Zohura et al., 2025). Spot blotch causes dark brown or black discoloration on infected spikes and oval to elongated brown blotches on leaves and leaf sheaths (Fig. 5C) (Kumar et al., 2002; Singh, 2007). This dark brown discoloration on infected spikes does not occur in wheat blast. Spot blotch is an important disease in the United States (Manan et al., 2023; Roy et al., 2023).

Different pathotypes of *P. oryzae*

The different pathotypes of *P*. *oryzae* have morphologically indistinguishable spores, and they have some common but less preferred hosts (Pieck et al., 2017). *Lolium* pathotype (PoL) typically infects annual and perennial ryegrass (*Lolium perenne*) (Valent et al., 2021) but was also found infecting a wheat spike in Kentucky (Farman et al., 2017). Although PoL is not a severe pathogen on wheat, individual infected wheat heads appear identical to PoT-infected heads (Pieck et al., 2017; Yasuhara-Bell et al., 2018). *Oryza* pathotype (PoO) typically infects rice (Wang et al., 2017) and it is unclear whether it can infect wheat. It is considered much less virulent to wheat and is likely to have identical symptoms to PoT (Castroagudín et al., 2016). Any symptomatic tissues suspected of *P*. *oryzae* infection would need molecular diagnostics to confirm the pathotype.

Commonly Encountered Non-targets

The approved survey method is a visual survey, using general visual observation to collect symptomatic plant material.

When collecting bleached wheat spikes, surveyors are likely to encounter the previously mentioned easily mistaken species *F*. *culmorum*, *F*. *pseudograminearum*, *G*. *graminis*, and PoL (Farman et al., 2017; Knight et al., 2017; Wegulo et al., 2010).

Additionally, premature head bleaching may be due to wheat stem maggot (*Meromyza americana*), a minor pest widespread in the United States (Sloderbeck et al., 2013; Wegulo et al., 2010) or abiotic factors, including frost injury, excess water, excessive heat, and micronutrient deficiencies (Snowball and Robson, 1991; University of Minnesota, 2024; Wegulo et al., 2010). Plants affected by wheat stem maggot have bleaching that extends from the head to the stem below the head. If the head is pulled upward, it will separate from the rest of the plant just above the first node, revealing a ragged edge where the stem has been chewed (Wegulo et al., 2010). Plants affected by abiotic factors may have other systemic symptoms that are inconsistent with wheat blast (e.g., bleaching of the entire plant) (Snowball and Robson, 1991; University of Minnesota, 2024). If the cause of head bleaching is not obvious, bleached spikes should be tested.

Biology and Ecology

The disease cycle of wheat blast is similar to that of rice blast (Fig. 6) (Valent et al., 2021). Asexual reproduction occurs when spores from lesions on aboveground plant parts are dispersed to new host material (Couch et al., 2005). One lesion can produce 2,000–6,000 spores per day for up to 14 days, and multiple reproduction cycles may occur during a single growing season (Chakrabarti et al., 1998; Couch et al., 2005). The optimum temperature and wetting period for PoT spore formation is 77–86°F after 25–

40 hours of wetness (Cardoso et al., 2008). Wheat blast severity is substantially reduced at temperatures of 59°F or less, and a minimum of 10 hours of wetness is needed for infection at any temperature (Cardoso et al., 2008). Outbreaks are more likely to occur during warmer, wetter growing seasons (Kohli et al., 2011). Epidemics in South America have been associated with El Niño weather patterns that bring high levels of rainfall (Kohli et al., 2011).

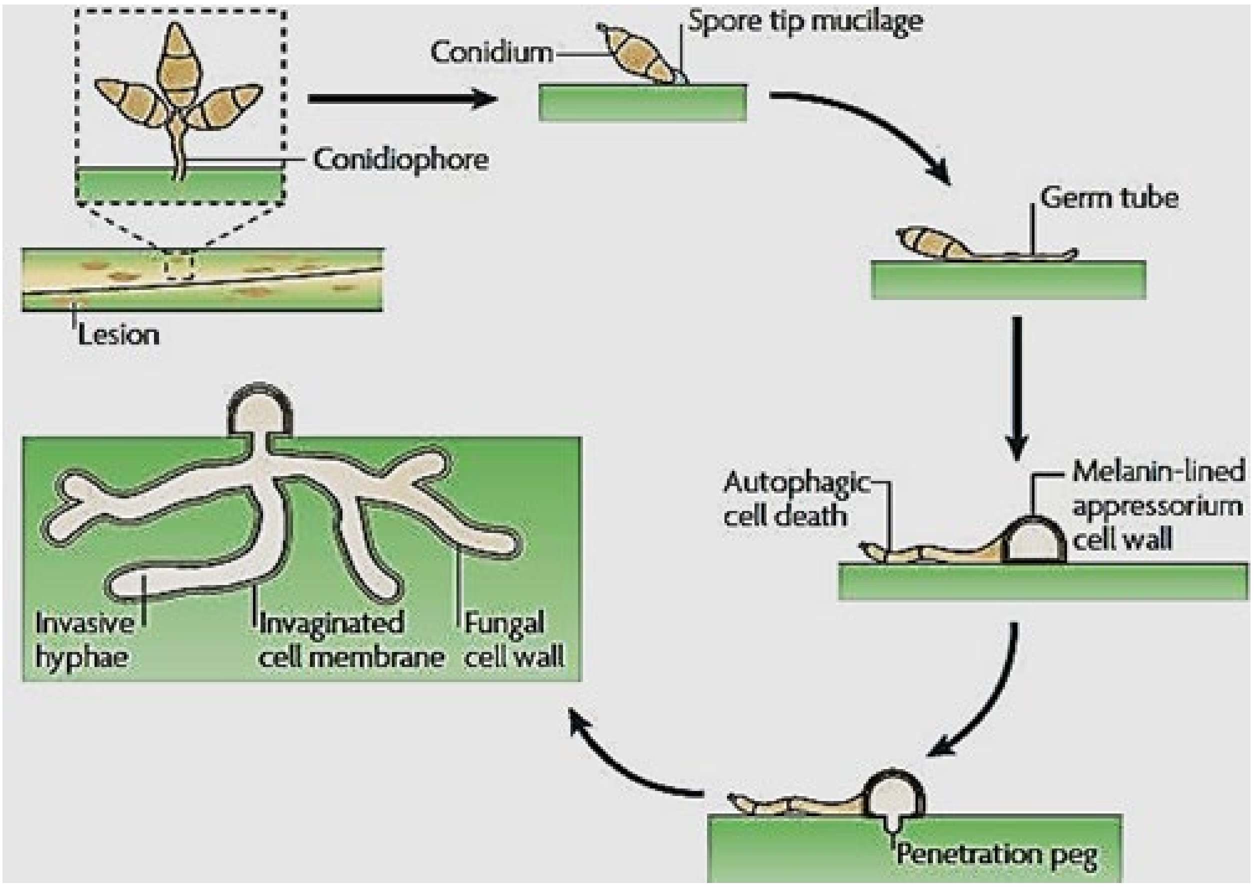

Figure 6. Rice blast disease cycle. Conidia are carried to new hosts via splashing water and/or moist air. On the new host, water absorption generates the tremendous turgor pressure required to puncture and enter the plant tissue. Next, specialized invasive hyphae colonize the rice cell with lesions appearing 72–96 hours after infection. Photo credit: used with permission from Wilson and Talbot (2009).

Aerial dispersal plays a significant role in the local spread of PoT (Urashima et al., 2007). Spores are capable of dispersing on the wind more than ½ mi. from an infected wheat field (Urashima et al., 2007). PoT is capable of infecting hosts at any stage of growth from vegetative up to reproductive (Cruz et al., 2015; Gongora-Canul et al., 2020; Valent et al., 2021). Long distance human-assisted dispersal may occur via the transport of infected seed (Goulart and Paiva, 1990; Valent et al., 2021). Plants infected during the heading or ripening stages can produce infected seed, which can be asymptomatic (Urashima et al., 2009). Infected seed that is planted can produce spores which infect the seedling shortly after germination, and the infected seedlings serve as an inoculum for nearby healthy plants (Faivre-Rampant et al., 2013).

Known Vectors (or associated insects)

This species is not a known vector, is not known to be vectored, and does not have any associated organisms.

Known Hosts

Wheat (*Triticum aestivum*) is the preferred host of *Pyricularia oryzae Triticum* pathotype and is the only host where economic damage has been reported (Kohli et al., 2011; Urashima and Silva, 2011). *Pyricularia oryzae Triticum* pathotype has a wide range of other natural hosts in the Poaceae family, including cultivated species, such as *Hordeum vulgare* (common barley) and weed hosts such as *Bromus tectorum* (cheatgrass), *Eleusine indica* (Indian goosegrass), and *Eragrostis plana* (South African lovegrass) (Ascari, 2021; Dorigan et al., 2023; Pieck et al., 2017; Roy et al., 2021). Weeds and grasses adjacent to wheat fields may become infected with PoT and may serve as an inoculum source for healthy wheat plants (Cunfer et al., 1993; Perelló et al., 2015). However, the relative susceptibility of other hosts to PoT and their importance in the spread of this pathogen are not well known (Valent et al., 2021).

Susceptibility to wheat blast varies across wheat cultivars and research demonstrates there are diverse mechanisms that may contribute to resistance (Cruppe et al., 2020; Cruz et al., 2016b; Fernandez-Campos et al., 2020). *Pyricularia oryzae* pathotypes also have the ability to gain pathogenicity on new hosts as a result of genetic mutation (Cruz and Valent, 2017; Tosa et al., 2016). Wheat blast is believed to have emerged as the result of a 'host jump' in South America (Inoue et al., 2017; Tosa et al., 2016). For this reason, new pathotypes may emerge on novel hosts in the future.

Known Distribution

Pyricularia oryzae Triticum has been reported from parts of South America, Bangladesh, and Zambia (Igarashi et al., 1986; Malaker et al., 2016; Mills et al., 2021; Perelló et al., 2015; Tembo et al., 2020; Viedma, 2005).

Table 2. Countries where *Pyricularia oryzae Triticum* is known to occur.

Region/Continent	Country	Reference
Africa	Zambia	(Tembo et al., 2020)
Asia	Bangladesh	(Malaker et al., 2016)
South America	Argentina	(Perelló et al., 2015)
South America	Bolivia	(Mills et al., 2021)
South America	Brazil	(Igarashi et al., 1986)
South America	Paraguay	(Viedma, 2005)

Region/Continent	Country	Reference
South America	Uruguay	(Kohli et al., 2011)

Pest Importance

Wheat blast is one of the most devastating diseases of wheat (Singh et al., 2021; Valent et al., 2021). Yield losses up to 100% have been reported (Islam et al., 2016). Early infections, during the flowering and grain formation stages, reduce grain quality and yield, causing the highest losses (Goulart, 2005; Goulart et al., 2007). Grains from infected heads are small, shriveled, and deformed and are typically discarded during threshing and winnowing (Malaker et al., 2016; Urashima et al., 2009). In addition to direct yield losses, there have been major losses from efforts to contain the disease by official control programs. For example, in Bangladesh, approximately 355 ha of wheat seed-producing farms were burned in 2016 (Islam et al., 2016).

Wheat is one of the most important crops in the United States. In 2024, wheat was grown commercially in 36 states, and the estimated value of the harvest was over $10.9 billion (NASS, 2025). *Pyricularia oryzae Triticum* is on the EPPO alert list (EPPO, 2025), though it is not on the A1 or A2 lists (EPPO, 2024a; EPPO, 2024b). *Pyricularia oryzae* is listed as a harmful organism in Egypt, French Polynesia, and New Caledonia (USDA-PCIT, 2025), so there may be trade implications with these countries if *P. oryzae Triticum* becomes established in the United States.

Pathway

Long distance dispersal of wheat blast is through infected seed (Goulart and Paiva, 1990; Urashima et al., 2009; Valent et al., 2021). Reis et al. (1995) determined that *P. oryzae* was viable from 50–60% of infected seeds after storage for 7–8 months but could no longer be recovered from infected seed after 22 months.

Wheat blast was reported for the first time outside of South America in Asia in 2016 (Malaker et al., 2016) and then in Africa in 2018 (Tembo et al., 2020). Molecular analysis of the wheat blast isolates in Bangladesh and Zambia confirmed the pathotype was introduced from South America in two independent introductions (Islam et al., 2016; Latorre et al., 2023; Malaker et al., 2016), most likely through international grain trade (Valent et al., 2021).

Use the PPQ Commodity Import and Export manual listed below to determine 1) if host plants or material are allowed to enter the United States from countries where the organism is present and 2) what phytosanitary measures (e.g., inspections, phytosanitary certificates, post entry quarantines, mandatory treatments) are in use. These manuals are updated regularly.

Agricultural Commodity Import Requirements(ACIR) manual: ACIR provides a single source to search for and retrieve entry requirements for imported commodities.

Potential Distribution within the United States

Cruz et al. (2016a) has done an in-depth analysis of the areas at risk from *P. oryzae Triticum* in the United States. Louisiana, Mississippi, and Florida are predicted to be at greatest risk of outbreaks due to suitable temperatures and high precipitation (Cruz et al., 2016a). Although these states are not among the highest wheat-producing states, Mississippi produced $9.6 million of wheat in 2024 (NASS, 2025). Approximately 40% of winter wheat production areas in the United States have a suitable climate for *P. oryzae Triticum*, including parts of Alabama, Arkansas, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Michigan, Mississippi, Missouri, Nebraska, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, and West Virginia (Cruz et al., 2016a). Collectively, these states produced $4.7 billion of wheat in 2024 (NASS, 2025).

Survey and Key Diagnostics

Approved Methods for Pest Surveillance*:

For the current approved methods and guidance for survey and identification, see Approved Methods for Pest Surveillance (AMPS) pest page on the CAPS Resource and Collaboration website, at https://approvedmethods.ceris.purdue.edu/.

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USDA-APHIS-PPQ-ST staff developed this datasheet. Cite this document as:

PPQ. 2025. Cooperative Agricultural Pest Survey (CAPS) Pest Datasheet for *Pyricularia oryzae Triticum* pathotype (Pyriculariaceae): Wheat blast. United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (PPQ), Raleigh, NC.

Versions

April 2020: Datasheet completed and published as part of the Small Grains manual. (Version 1)

December 2025: Datasheet revised (Version 2)

- Added **Commonly Encountered Non-targets** section
- Updated **Scientific Name**
- Updated **Common Name**
- Updated **Pest Recognition** section
- Updated **Easily Mistaken Species** section
- Updated **Biology & Ecology** section
- Updated **Known Hosts** section
- Updated **Pest Importance** section
- Updated **Known Vectors** section
- Updated **Known Distribution** section
- Updated **Pathway** section
- Updated **Potential Distribution within the United States** section
- Updated guidance for **Approved Methods** section