

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

Xanthomonas oryzae

Scientific Name

Xanthomonas oryzae pv. *oryzae* (Ishiyama, 1922) Swings et al. 1990

Xanthomonas oryzae pv. *oryzicola* (Fang et al. 1957) Swings et al. 1990

Synonyms:

Xanthomonas campestris pv. *oryzae* (Ishiyama 1922) Dye 1978

Xanthomonas campestris pv. *oryzicola* (Fang et al. 1957) Dye 1978

Common Name

***X. oryzae* pv. *oryzae*:** Bacterial blight (BB), bacterial leaf blight (BLB), Xoo

***X. oryzae* pv. *oryzicola*:** Bacterial leaf streak (BLS), Xoc

Type of Pest

Bacterium

Taxonomic Position

Class: Gammaproteobacteria, **Order:** Xanthomonadales, **Family:** Xanthomonadaceae

Notes on taxonomy and nomenclature:

- *Xanthomonas oryzae* at the species level is listed as a Select Agent by the Federal Select Agent Program. All infraspecific *X. oryzae* taxa are also considered select agents (e.g., *X. oryzae* pv. *oryzae*, *X. oryzae* pv. *oryzicola*, and U.S. endemic strains).
- Currently, only two pathovars of *Xanthomonas oryzae* have been described: *X. oryzae* pv. *oryzae* and *X. oryzae* pv. *oryzicola*. These two pathovars are the focus of this document.
- U.S. endemic strains of *X. oryzae* (Xo-USA) have been identified in Louisiana and Texas, but they are genetically distinct from the *X. oryzae* pathovars mentioned in this document. These strains are weakly pathogenic.

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 morphological descriptions, see the Identification/Diagnostic resources on the AMPS pest page on the CAPS Resource and Collaboration website.

Symptoms

Symptoms caused by *Xanthomonas oryzae* pv. *oryzae* (bacterial blight (BB)) and *Xanthomonas oryzae* pv. *oryzicola* (bacterial leaf streak (BLS)) are easily differentiated in the early stages of disease, but can appear similar in later stages (Vera Cruz et al., 2017). Symptoms of BB typically develop in the tillering stage (when tillers or secondary shoots are formed) (Leach et al., 2013; Ou, 1985); whereas, symptoms of BLS can appear at any stage of growth (Xie and Mew, 1998).

Symptoms on rice (*Oryza sativa*) infected with *X. oryzae* pv. *oryzae*: There are two primary symptoms caused by bacterial blight: leaf blight and a more severe wilt known as kresek. Leaf blight (Fig. 1 A-C, E), the most common symptom, generally occurs from the maximum tillering stage onward (the end of the seedling stage when the fourth true leaf emerges). Initial symptoms of leaf blight appear 5 to 7 days after infection (Schaad et al., 1996) with the formation of water-soaked spots at the leaf margins. These spots increase in length and width, becoming elongated lesions that turn yellow and then necrotic as the disease progresses (Ou, 1985; Vera Cruz et al., 2017). Drops of bacterial exudates (ooze) may form on young lesions, typically 8 to 10 days after infection. This ooze may dry to form small, yellow beads (Ou, 1985; Schaad et al., 1996). Bacteria may also ooze out from hydathodes (water pores) (Nino-Liu et al., 2006). In susceptible cultivars, leaf wilting and rolling may occur (Ou, 1985). Infected plants produce fewer, lighter, and poor-quality grain. Seed infected with bacterial blight may be discolored and poorly filled (Nino-Liu et al., 2006; Ou, 1985).

Kresek wilt syndrome (Fig. 1D) is the most destructive manifestation of bacterial blight. Kresek typically occurs in the tropics from the seedling to early tillering stage, often 1 to 2 weeks after transplanting (Leach et al., 2013; Mew et al., 1993). Leaves of infected plants wilt and roll, becoming grayish-green in color (Fig. 1D). The leaves subsequently turn yellow to straw-colored and wither (Goto, 1964; Reitsma and Schure, 1950). The entire plant generally dies, but the plants that survive remain stunted and yellow in color. Total crop failure can occur with kresek (Ou, 1985).

In the tropics, a third possible symptom associated with bacterial blight is called yellow leaf. The youngest leaf of the plant becomes uniformly pale yellow or has a broad yellow stripe. With yellow leaf, the bacteria are not present in the leaf itself but can be found in the internodes and crowns of affected stems (Ou, 1985).

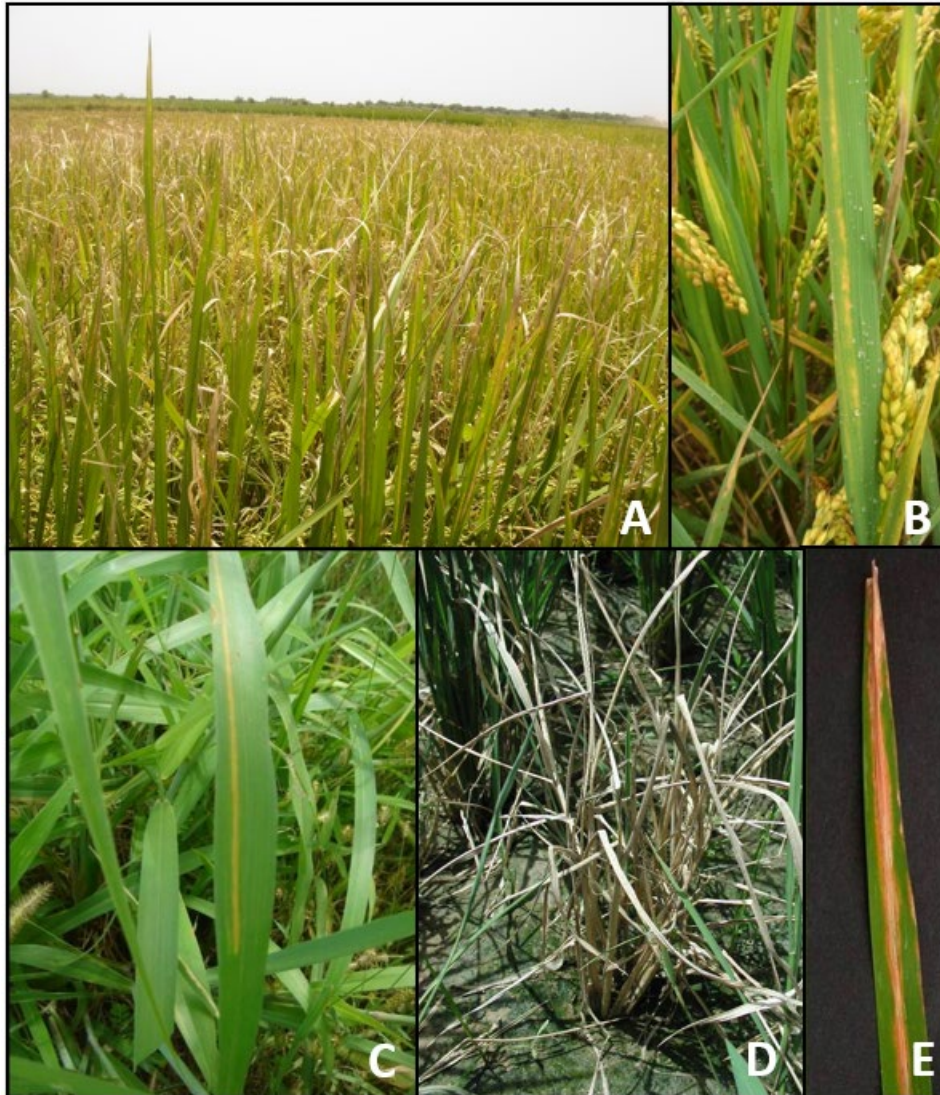


Figure 1. Bacterial blight (caused by *Xanthomonas oryzae* pv. *oryzae*) symptoms in the field (Africa) (A-D). Symptoms of bacterial blight by artificial inoculation (E). Photos courtesy of Valerie Verdier, Institut de Recherche pour le Développement (IRD).

Symptoms on rice (*Oryza sativa*) infected with *X. oryzae* pv. *oryzicola*: Bacterial leaf streak (Fig. 2 A-C) can occur at any growth stage and initially appears 5 to 6 days after infection as small, interveinal, water-soaked streaks. The streaks are dark green at first and later become translucent (Leach et al., 2013; Mew and Misra, 1994; Vera Cruz et al., 2017; Xie and Mew, 1998). Under humid conditions, bacterial ooze may develop on the surface of lesions. This later dries into small, yellow beads (Ou, 1985; Xie and Mew, 1998). Eventually, entire leaves turn brown and then grayish-white and die (Vera Cruz et al., 2017).

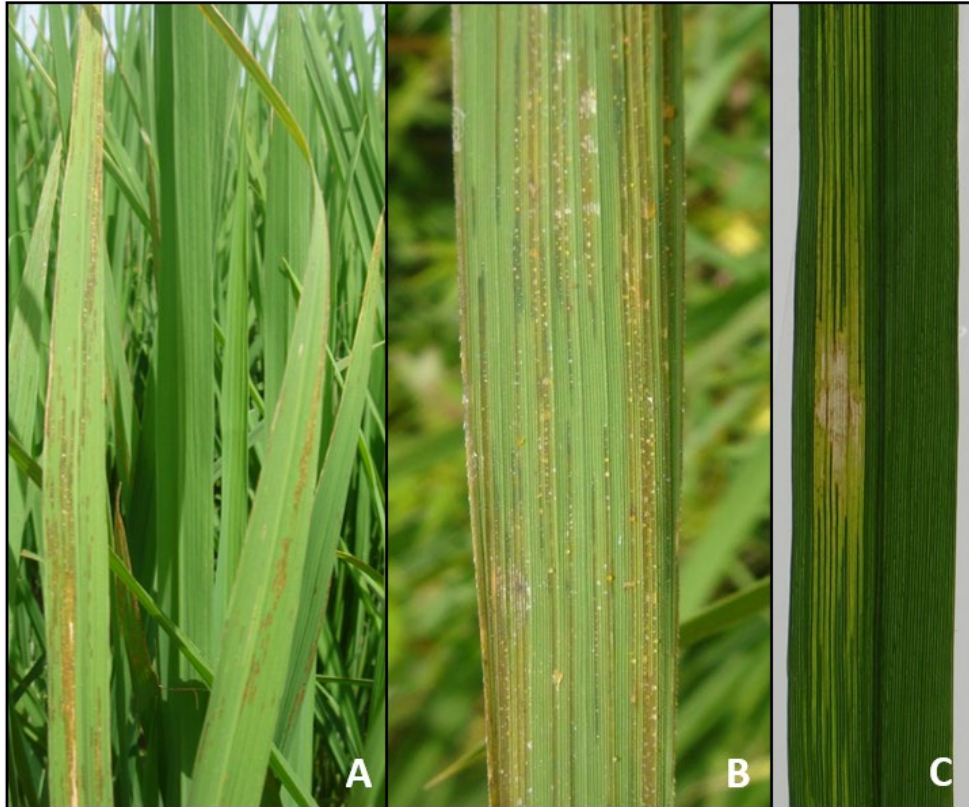


Figure 2. Bacterial leaf streak (caused by *Xanthomonas oryzae* pv. *oryzicola*) symptoms in the field (Africa) (A, B). Symptoms of bacterial leaf streak by artificial inoculation (C). Photos courtesy of Valerie Verdier, Institut de Recherche pour le Développement (IRD).

Easily Mistaken Species

Bacterial leaf blight of rice caused by *Pantoea agglomerans*, *P. ananatis*, *P. dispersa*, *P. stewartii*, and *P. wallisii* cannot be differentiated from BB based on visible symptoms (Arayaskul et al., 2020; Doni et al., 2023; González et al., 2015; Kini et al., 2017; Toh et al., 2019). *Pantoea agglomerans*, *P. ananatis*, and *P. stewartia* are present in the United States, but only *P. ananatis* has been found in rice (Edens et al., 2006; Luna et al., 2023; Roper, 2011).

Cercospora janseana, a fungal pathogen that causes narrow brown leaf spot on rice in the United States, produces symptoms similar to BLS (Uppala et al., 2019).

Xanthomonas oryzae can be distinguished from these organisms through semi-selective media isolation followed by classical biochemical tests, serological tests, or PCR identification (Lang et al., 2010; Schaad, 1981).

Biology and Ecology

Xanthomonas oryzae pv. *oryzae* typically enters the plant through the hydathodes (water pores) at the leaf tip and leaf margin, or through wounds caused by transplanting or wind-driven rains (Mew, 1993; Ou, 1985). Plants less than 21 days old are more susceptible to

infection than older plants (Mew, 1993). Once the plant is infected, initial symptoms typically appear within 5 to 7 days (Schaad et al., 1996). After 8 to 10 days, ooze droplets containing bacteria form on the surface of young lesions, often drying into beads that disperse easily and initiate new infections (Ou, 1985). Bacterial blight is favored by warm temperatures (77 to 86 °F), high humidity, and rain (Webster and Gunnell, 1992). The bacteria can survive in the soil for up to 3 months, although soil is not considered to be a source of infection (Ou, 1985; Tagami et al., 1963; Tagami and Mizukami, 1962). In temperate regions, BB can overwinter in the roots and stem bases of rice stubble, weed hosts, and infected straw (Inoue et al., 1957; Mew, 1993; Ou, 1985; Tagami et al., 1963). In tropical areas, the bacteria may also survive in irrigation water (Mew, 1992).

Xanthomonas oryzae pv. *oryzicola* enters the host plant through leaf stomata and wounds (Ou, 1985; Xie et al., 1991b), and initial symptoms appear 5 to 6 days after infection (Schaad et al., 1996). Infectious droplets of bacterial ooze appear after 7 to 14 days, and when leaves are wet, these droplets can spread the pathogen between leaves on the same plant or to adjacent plants (Ou, 1985). Bacterial leaf streak can be found in the tropics year-round. Temperatures >86 °F favor lesion development, while humidity >80 percent favors infection and dissemination of the pathogen (Mew and Misra, 1994; Ou, 1985). BLS can overwinter in leaf debris for up to 10 months and in infected leaves for up to 2 years, although the bacterial population is higher in infected leaves on the soil surface rather than those mixed into the soil (Devadath and Dath, 1970).

Known Vectors (or associated insects)

This species is not known to be vectored.

Known Hosts

Rice (*Oryza sativa*) is the primary host of both *X. oryzae* pv. *oryzae* and *X. oryzae* pv. *oryzicola* (Swings et al., 1990). One or both pathogens have been found to infect wild rice, grass, and weed species in the genera *Brachiaria*, *Cenchrus*, *Cynodon*, *Cyperus*, *Dinebra*, *Echinochloa*, *Eleocharis*, *Isachne*, *Leersia*, *Megathyrsus*, *Oryza*, *Paspalum*, and *Urochloa* (Chattopadhyay and Mukherjee, 1968; Fang et al., 1957; IRRI, 1967; Noda and Noda, 2008; Ranga-Reddy and Nayak, 1975; Roat et al., 2017; Valluvaparidasan and Mariappan, 1989; Zacharia et al., 2021), but infection of many of these genera has only been confirmed under experimental conditions.

The host list below includes cultivated and wild plants that 1) are infected or infested by the pest under natural conditions, 2) are frequently described as major, primary, or preferred hosts, and 3) have primary evidence for feeding and damage documented in the literature. Plants are highlighted in bold if they are commercially produced and the pest causes economically significant damage.

Table 1. Preferred hosts of *X. oryzae* pv. *oryzae*

Scientific Name	Common Name	Type/Use	References
<i>Oryza australiensis</i>	Australian rice	cultivated	(Aldrick et al., 1973)

<i>Oryza sativa</i> *	rice	cultivated	(Mizukami, 1961; Swings et al., 1990)
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Table 2. Preferred hosts of *X. oryzae* pv. *oryzicola*

Scientific Name	Common Name	Type/Use	References
<i>Oryza sativa</i> *	rice	cultivated	(Onaga et al., 2018; Swings et al., 1990)

Table 3. Additional natural hosts of *X. oryzae* pv. *oryzae*

Scientific Name	Common Name	Type/Use	References
<i>Leersia sayanuka</i>	rice cutgrass	weed	(Inoue et al., 1957)
<i>Oryza longistaminata</i>	wild rice	weed	(Afolabi et al., 2016)
<i>Oryza rufipogon</i> *	wild rice	weed	(Aldrick et al., 1973)

Table 4. Additional natural hosts of *X. oryzae* pv. *oryzicola*

Scientific Name	Common Name	Type/Use	References
<i>Brachiaria lata</i>	signalgrass	weed	(Wonni et al., 2014)
<i>Oryza barthii</i>	wild rice	weed	(Wonni et al., 2014)
<i>Oryza longistaminata</i>	wild rice	weed	(Wonni et al., 2014)
<i>Paspalum vaginatum</i> *	silt grass	perennial grass	(Wonni et al., 2014)

*Hosts with known U.S. distribution

Note: North American wild rice (*Zizania palustris*) is in a different genus from the wild rice mentioned above

Known Distribution

Bacterial blight is one of the most serious diseases of rice worldwide and is found in both tropical and temperate regions (Mew, 1992).

Table 5. Countries where *Xanthomonas oryzae* pv. *oryzae* is known to occur

Continent	Country	References
Africa	Benin	(Afolabi et al., 2016; Amos et al., 2013)
Africa	Burkina Faso	(Amos et al., 2013)
Africa	Cameroon	(Gonzalez et al., 2007; Lang et al., 2010)
Africa	Gambia	(Amos et al., 2013)
Africa	Guinea	(Amos et al., 2013)
Africa	Madagascar	(Raveloson et al., 2023)
Africa	Mali	(Amos et al., 2013; Poulin et al., 2015; Tekete et al., 2020)
Africa	Niger	(Amos et al., 2013)
Africa	Nigeria	(Amos et al., 2013)
Africa	Senegal	(Tall et al., 2020)
Africa	Uganda	(Lussewa et al., 2016)
Asia	Bangladesh	(Rashid et al., 2021)

Asia	Cambodia	(Mizukami and Wakimoto, 1969)
Asia	China	(Leach et al., 1995; Mew et al., 1982)
Asia	India	(Bharathkumar et al., 2014)
Asia	Indonesia	(Leach et al., 1995; Mew et al., 1982)
Asia	Iran	(Ghasemie et al., 2008)
Asia	Japan	(Mew et al., 1982)
Asia	Korea	(Leach et al., 1995; Mew et al., 1982)
Asia	Laos	(Leach et al., 2013)
Asia	Malaysia	(Leach et al., 1995; Poulin et al., 2015)
Asia	Myanmar	(Sakthivel et al., 2001)
Asia	Nepal	(Adhikari et al., 1996; Leach et al., 1995)
Asia	Pakistan	(Mew and Majid, 1977)
Asia	Philippines	(Mew et al., 1982; Poulin et al., 2015)
Asia	Sri Lanka	(Mew et al., 1979; Sridhar, 2002)
Asia	Taiwan	(Tseng et al., 2015)
Asia	Thailand	(Nino-Liu et al., 2006; Poulin et al., 2015)
Asia	Vietnam	(Nino-Liu et al., 2006)
Oceania	Australia	(Mew et al., 1993)

Table 6. Countries where *Xanthomonas oryzae* pv. *oryzicola* is known to occur

Continent	Country	References
Africa	Burkina Faso	(Wonni et al., 2014; Wonni et al., 2011)
Africa	Burundi	(Afolabi et al., 2014a)
Africa	Côte d'Ivoire	(Diallo et al., 2021)
Africa	Kenya	(Onaga et al., 2018)
Africa	Madagascar	(Poulin et al., 2014)
Africa	Mali	(Wonni et al., 2014)
Africa	Nigeria	(Wonni et al., 2015)
Africa	Senegal	(Wonni et al., 2015)
Africa	Uganda	(Afolabi et al., 2014b)
Asia	Bangladesh	(Corral et al., 2013)
Asia	Cambodia	(Corral et al., 2013)
Asia	China	(Wahab et al., 2022; Wang et al., 2010)
Asia	India	(Corral et al., 2013; Lang et al., 2010)

Asia	Indonesia	(Corral et al., 2013; Ou, 1985)
Asia	Laos	(Corral et al., 2013)
Asia	Malaysia	(Gonzalez et al., 2007; Lang et al., 2010)
Asia	Myanmar	(Corral et al., 2013)
Asia	Nepal	(Corral et al., 2013)
Asia	Pakistan	(Corral et al., 2013)
Asia	Philippines	(Gonzalez et al., 2007; Wahab et al., 2022)
Asia	Taiwan	(Chen et al., 2015)
Asia	Thailand	(Corral et al., 2013)
Asia	Vietnam	(Tran et al., 2015)
Oceania	Australia	(Chang, 1987)

There are isolated reports of *X. oryzae* pv. *oryzae* in Central and South America (Lozano, 1977), but *Xoo* has not been confirmed to be endemic in these areas.

Status of infestation in the United States (June 2025)

Xanthomonas oryzae pv. *oryzae* and *X. oryzae* pv. *oryzicola* are not known to occur in the United States. United States endemic strains of *X. oryzae* form a clade phylogenetically distinct from *X. oryzae* pv. *oryzae* and *X. oryzae* pv. *oryzicola* and cause weak bacterial blight-like symptoms (Jones et al., 1989; Triplett et al., 2011).

Pest Importance

Xanthomonas oryzae at the species level is listed as a Select Agent by the Federal Select Agent Program (CDC and USDA-APHIS, 2023). *Xanthomonas oryzae* pv. *oryzae*, *X. oryzae* pv. *oryzicola*, and U.S. endemic strains (*Xo*-USA) are all considered select agents. *Xanthomonas oryzae* pv. *oryzae* and *X. oryzae* pv. *oryzicola* are listed on the EPPO A1 list of pests recommended for regulation as quarantine pests (EPPO, 2024).

Xanthomonas oryzae pv. *oryzae* is listed as a harmful organism in Albania, Brazil, China, Colombia, Ecuador, Egypt, European Union, Guatemala, Mexico, Morocco, Oman, Panama, Paraguay, Qatar, Serbia, Taiwan, United Arab Emirates, United Kingdom, and Uruguay (USDA-PCIT, 2024). *Xanthomonas oryzae* pv. *oryzicola* is listed as a harmful organism in Algeria, Madagascar, Namibia, and South Africa (USDA-PCIT, 2024). There may be trade implications with these countries if this pest becomes established in the United States.

In 2022, rice was grown on about 2,219,000 acres in the United States, with the most acres planted in Arkansas, California, Louisiana, Mississippi, Missouri, and Texas. The estimated value of the 2022 U.S. rice harvest was over \$3.2 billion (USDA-NASS, 2024). The United States is the fifth-largest exporter of rice, accounting for almost 5 percent of global rice exports (USDA-ERS, 2023).

***X. oryzae* pv. *oryzae*:** Bacterial blight was first recorded in Japan in 1884 and is considered one of the most serious diseases of rice worldwide (IRRI, 1989). Bacterial blight has had the greatest economic impact in Asia but is becoming increasingly severe in West Africa (Nino-Liu et al., 2006; Sileshi and Gebeyehu, 2021). Bacterial blight can cause yield losses as high as 80 percent, with total crop loss possible if the infection occurs during the tillering stage (the end of the seedling stage when the fourth true leaf emerges) (Mew et al., 1993; Srivastava et al., 1966; Wang et al., 2017).

***X. oryzae* pv. *oryzicola*:** Bacterial leaf streak is widely distributed in tropical Asia and West Africa in both lowland and upland rice-growing areas, and is especially severe in southern China (Afolabi et al., 2014a; Leach et al., 2013; Tran et al., 2015; Wang et al., 2010; Webster and Gunnell, 1992; Xie et al., 2014). Bacterial leaf streak is now considered an emerging disease in at least eight African countries (Sileshi and Gebeyehu, 2021). Yield losses due to bacterial leaf streak are variable in the literature, but losses of up to 20 to 30 percent have been reported (Naik et al., 1973; Opina and Exconde, 1971; Sileshi and Gebeyehu, 2021).

Pathway

Xanthomonas oryzae pv. *oryzae* and *X. oryzae* pv. *oryzicola* are both dispersed by wind-blown rain, irrigation, and plant-to-plant contact (Ou, 1985). In Asia, outbreaks of bacterial leaf blight and bacterial leaf streak are more likely to occur during the monsoon season than other times of year; strong winds, wind-blown rain, and hail damaged rice plants create entry points for the bacteria (Mew et al., 1993; Nino-Liu et al., 2006). Both pathovars overwinter in rice stubble from previous crop seasons, and this is an important source of primary inoculum for new infections (Nino-Liu et al., 2006; Ou, 1985). Both pathovars can be seed-borne (typically on the seed coat); however, infection of progeny plants from infected seed has only been confirmed in BLS (Shekhawat and Srivastava, 1972; Vera Cruz, 2023; Vera Cruz et al., 2017; Xie et al., 1991a; Xie and Mew, 1998). Studies to determine true seed transmission of BB and BLS are ongoing.

Use the PPQ Commodity Import and Export manuals 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.

[Treatment Manual](#): This manual provides information about treatments applied to imported and domestic commodities to limit the movement of agricultural pests into or within the United States.

Potential Distribution Within the United States

Arkansas, California, Louisiana, Mississippi, Missouri, and Texas plant the most acres of

rice in the United States (USDA-NASS, 2024); therefore, they are considered to be at risk for establishment of *X. oryzae*. Both BB and BLS favor high humidity and frequent rainfall (Ou, 1985) so rice production areas in the south-central United States are likely at greater risk.

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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Versions

2011: *X. oryzae* pv. *oryzae* initial datasheet completed (Version 1)

2011: *X. oryzae* pv. *oryzicola* initial datasheet completed (Version 1)

November 2014: *X. oryzae* pv. *oryzicola* (Version 2)

- Uganda and Burundi added to **Known Distribution** section

July 2016: *X. oryzae* pv. *oryzicola* (Version 3)

- **Pathway** section updated with rice commodity acreage map

January 2017: *X. oryzae* pv. *oryzae* (Version 3)

- Host map added to **Known Hosts** section

May 2026: *X. oryzae* combined (Version 4)

- *Xanthomonas oryzae* pv. *oryzae* and *X. oryzae* pv. *oryzicola* datasheets combined and all sections updated

Reviewers

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