Diseases Caused by Bacteria and Phytoplasmas

First Report of New Bacterial Leaf Streak of Rice Caused by *Pantoea ananatis* in China

Chongchong Lu,¹ Mingxia Hao,¹ Lingguang Kong,¹ Lulu Wang,¹ Yanke Jiang,¹ Yurong Sui,¹ Yingzhe Yue,¹ Baoyou Liu,^{1,2} Ziyi Yin,¹ Yang Li,¹ Hansong Dong,¹ and Xinhua Ding^{1,†}

¹ State Key Laboratory of Crop Biology, Shandong Provincial Key Laboratory for Biology of Vegetable Diseases and Insect Pests, College of Plant Protection, Shandong Agricultural University, Taian, Shandong 271018

² Yantai Academy of Agricultural Sciences, Yantai Shandong 265500, China

C. Lu, M. Hao, and L. Kong contributed equally to this work.

Funding: Funding was provided by Shandong Province Key Research and Development Plan (2019GNC106152, 2019JZZY020608, 2020CXGC010803), Natural Science Outstanding Youth Fund of Shandong Province (JQ201807), Science and Technology Support Plan for Youth Innovation of Colleges and Universities of Shandong Province (2019KJF023), and National Natural Science Foundation of China (31872925, 32072500). Plant Dis. 106:1747, 2022; published online as <https://doi.org/10.1094/PDIS-11-21-2423-PDN>. Accepted for publication 6 January 2022.

Rice (*Oryza sativa* L.) is the largest grain crop, accounting for about 40% of all grain production in China. In mid-July 2021, a bacterial leaf streak-like disease emerged in rice varieties Chunyou584 and Yongyou2604 in Linyi city, Shandong Province, China. Disease incidences ranged from 80 to 90% in surveyed fields. Infected rice leaves displayed dark green to yellowish-brown water-soaked thin streaks, and a large amount of beaded yellow oozes were observed on the lesions. After drying, there were gelatinous granules that did not easily fall off and spread between leaf veins. Based on the field symptoms, this disease was initially suspected to be rice bacterial leaf streak caused by *Xanthomonas oryzae* pv. *oryzicola*, which is a common disease in China. To isolate the causal agent, leaf discs (~1 cm²) of diseased leaves were collected from the margins of the lesions, surface sterilized, and ground into pieces in sterile double distilled water. Then, 10⁻³, 10⁻⁴, and 10⁻⁵ dilutions were spread onto peptone sugar agar (PSA) and incubated at 28°C for 36 h. Yellow mucous bacterial colonies were consistently obtained on PSA medium. To identify the pathogen, fragments of the 16S rDNA, *leuS*, and *rpoB* were amplified and sequenced using the primers previously reported (Yu et al. 2021). Three strains (LY01, LY02, and LY03) showed identical

colony morphology, and LY01 was used for further analyses. Sequence analyses showed that the fragments of 16S rDNA (955 bp, GenBank accession no: OK261898), *leuS* (755 bp, GenBank accession no: OK298387), and *rpoB* (926 bp, GenBank accession no: OK298388) of strain LY01 shared 99.16, 99.46, and 100% similarities, respectively, with those of *Pantoea ananatis* TZ39 (GenBank accession nos.: CP081342.1 for 16S rDNA, MW981338.1 for *leuS*, and MW981344.1 for *rpoB*), which suggest isolate LY01 is *P. ananatis*. In addition, a single colony of *P. ananatis* LY01 appears in the supplementary material. Pathogenicity tests were also performed according to the following steps. A bacterial suspension at OD₆₀₀ = 0.1 was inoculated into eight rice leaves of four healthy rice plants (Chunyou 584) at 25 to 33°C and 60 to 80% relative humidity in the field using a clipping method (Yang et al. 2020) or spraying methods, and sterile distilled water was used as a negative control. Clipped leaves and spray-inoculated leaves showed dark green water-soaked streaks at 14 days after inoculation, with similar symptoms to samples collected from the fields. In contrast, control leaves remained healthy and symptomless. The bacterium was reisolated in the inoculated leaves and the reisolated bacterial isolates, which was confirmed by sequencing 16S rDNA, *leuS*, and *rpoB*, incited the same symptoms as in the fields, fulfilling Koch's postulates. In the past decade, *P. ananatis* was reported to cause grain discoloration and leaf blight in China (Xue et al. 2021; Yan et al. 2010; Yu et al. 2021), which could result in 40 to 60% yield losses. To our best knowledge, this is the first report of the bacterial leaf streak-like disease occurred in Shandong Province caused by *P. ananatis*, so we name it *Pantoea* leaf streak of rice. Although *P. ananatis* was also reported in Zhejiang province and Jiangxi province, where it caused leaf streak lesions on rice, the disease symptoms are completely different from those of *Pantoea* leaf streak of rice. To the best of our knowledge, this is the first report of *Pantoea* leaf streak of rice caused by *P. ananatis*. This study provides solid evidence that *Pantoea* leaf streak of rice in Eastern China can be caused by the new pathogen, *P. ananatis*, rather than *X. oryzae* pv. *oryzicola* as traditionally assumed. Disease development and quarantine of *Pantoea* leaf streak of rice disease caused by *P. ananatis* on rice need more attention in the near future.

References:

- Xue, Y., et al. 2021. Plant Dis. 105:2078.
- Yan, H., et al. 2010. Plant Dis. 94:482.
- Yang, W., et al. 2020. Rice (N. Y.) 13:28.
- Yu, L., et al. 2021. Plant Dis. 106:310.

The author(s) declare no conflict of interest.

e-Xtra

Keywords: bacterial leaf streak, *Pantoea ananatis*, rice

[†]Indicates the corresponding author.
X. Ding; xhdng@sdaa.edu.cn