



Zabol University
Graduate Management
College of Agriculture
Department of plant protection
A Thesis for Ph.D Degree in Plant pathology

Title:

**Molecular and biochemical activity of some Iranian commercial rice cultivars to
Xanthomonas oryzae pv. *oryzae* the causal agent of bacterial blight**

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Septamber 2020

potential for resistance to this bacterium in the Iranian Khazar cultivar. The study on *Xa21* gene was performed for the first time on Iranian rice, and the presence of such a potential could be a strong supporter of resistant cultivars. Study on rice leaf proteome expression in response to the pathogen showed that out of a total of 188 reproducible spots, about 30% of protein spots had differential expression in susceptible and resistant infected cultivars. Probably the most abundant proteins involved in stress and defense. In general, it seems that the induction of resistance genes and the activation of different pathways of systemic resistance and increase the accumulation of oxidative enzymes, antioxidants and proteins in the development of resistance of Khazar cultivar to sensitive cultivar local Taron, is part of the mechanism in rice a defense against *Xoo* bacteria. The results of this study can be effective in using new genetic resources to produce resistant cultivars and provide a reliable basis for contributing to food security through crop health.

Keywords: Rice, Biochemical interactions, Pathogenesis-related genes, Gene expression, Two-dimensional electrophoresis.

Abstract:

Bacterial blight of rice *Xanthomonas oryzae* pv. *oryzae* (Xoo) is one of the most destructive bacterial diseases of rice in most rice growing areas of the world, especially in tropical Asia. The rate of damage from the disease has been reported from 20 to 30 percent of the average to 50 to 80 percent in acute conditions depending on climatic conditions and geographical areas. This bacterium is a vascular pathogen that enters the plant through wounds and water holes (Hydatodes) leading to woody vessels and multiplies there. then causes blockage of woody vessels and death of rice by producing factors such as extra cellular polysaccharides (EPS-Xanthan). Infection in the stages of seedling along with wilting (keresk) and later stages, it is seen as long, broad spots that gradually turn greenish-gray and yellow (blight). Low performance of chemical management and lack of access to proper forecasting system led most studies to identify resistant cultivars and understand resistance mechanisms through the study of biochemical interaction and the identification of resistance genes. Lack of sufficient information in the field of cultivars resistant to bacterial blight of rice in Iran, the molecular interaction between the most important commercial cultivars and the disease agent is logical and necessary. The aim of this study was to evaluate the resistance of 24 commercial Iranian rice cultivars against bacterial blight and to study some mechanisms of resistance at biochemical levels and the expression of several genes related to pathogenicity and Xa21 gene by qRT-PCR. The results of greenhouse evaluation showed that different cultivars differ in the development of leaf necrotic spot length as the most important disease evaluation trait. Khazar and Nemat commercial cultivars showed the highest level of resistance and local Tarom and Dilmani cultivars showed the highest susceptibility to this disease based on the evaluation index (quantitative resistance). Biochemical evaluation including total protein, catalase enzymes, *guaiacol* peroxidase, superoxide dismutase and total phenol in the resistant Khazar cultivar and sensitive local Tarom cultivar shows the high activity of these enzymes resistant cultivar (Khazar) compared to sensitive cultivar (local Tarom) in the first hours after inoculation, the difference between resistant and sensitive cultivar is significant at the level of one percent. The results of the expression level of the studied genes (*PR1-b*, *PR3*, *PR5*, *PR13*, *PAL*, *NPR1*, *LOX*, *Xa21*) show the trend of increasing the expression of these genes in resistant cultivar from the first hours after inoculation to the sensitive cultivar approved. Since the accumulation of mRNA transcription and increased activity of these genes is an important indicator of the development of a defense response in interaction with the disease agent, the activity of these genes indicates the