Dissection of the Molecular Mechanism of Rice Immunity Against Magnaporthe Oryzae

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Importance of rice blast disease
- Rice feeds about half of the world's population and is lifeline for millions in the developing countries
- Rice blast is the most devastating and wide-spread fungal disease of rice (10-30% yield loss). The total annual yield loss is about $5 billion and can feed about 60 million people

PAMP- and Effector-triggered immunity in plants

PRRs: Pattern Recognition Receptors

PAMPs: Pathogen-Associated Molecular Patterns

Molecular Plant Pathology

The AvrPiz-t-Piz-t gene pair

Ectopic expression of AvrPiz-t displays more susceptible to rice blast and suppresses PAMP triggered ROS burst in rice

AvrPiz-t is a negative regulator of rice blast resistance and PTI pathway

Review
The Top 10 fungal pathogens in molecular plant pathology

Dean et al., Molecular Plant Pathology, 2012

The table represents the ranked list of fungi as voted for by plant pathologists associated with the journal Molecular Plant Pathology.
**Magnaporthe oryzae effector AvrPiz-t-mediated regulation mechanisms**

How the *Magnaporthe oryzae* effector AvrPiz-t targets rice ubiquitin-proteasome pathway?

**Identification of AvrPiz-t Interacting Proteins (APIPs) by yeast-two hybrid screen (Y2H)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Putative function</th>
</tr>
</thead>
<tbody>
<tr>
<td>APIP2</td>
<td>Hypothetical protein</td>
</tr>
<tr>
<td>APIP3</td>
<td>Hypothetical protein</td>
</tr>
<tr>
<td>APIP4</td>
<td>Bowman-Birch protease inhibitor</td>
</tr>
<tr>
<td>APIP5</td>
<td>UFP1 transcription factor APIP12</td>
</tr>
<tr>
<td>APIP6</td>
<td>C3HC4-type RING-finger E3 ligase</td>
</tr>
<tr>
<td>APIP7</td>
<td>AKT1-like protein</td>
</tr>
<tr>
<td>APIP8</td>
<td>UFP1-like protein</td>
</tr>
<tr>
<td>APIP9</td>
<td>Actin-asparagine/Phox/Bem1p</td>
</tr>
<tr>
<td>APIP10</td>
<td>C3HC4-type RING-finger E3 ligase</td>
</tr>
<tr>
<td>APIP11</td>
<td>Nucleoporin containing protein</td>
</tr>
</tbody>
</table>

*APIP2, 6 and 10 encode putative E3 ubiquitin ligases, which involved in ubiquitin-proteasome pathway*

Bo Zhou

**Magnaporthe oryzae effector AvrPiz-t-rice E3 ligase APIP6-mediated regulation mechanisms**

**Magnaporthe oryzae effector AvrPiz-t-rice E3 ligase APIP6-OsELF3-2 mediated regulation mechanisms**

**Magnaporthe oryzae effector AvrPiz-t-rice E3 ligase APIP6/10-mediated regulation mechanisms**

Park et al., *Plant Cell*, 2012

Ning et al., *Molecular Plant*, 2015

Park et al., *Plos Pathogens*, 2016
APIP5 interacts with the fungal effector AvrPiz-t in vitro and in vivo

APIP5 N-Terminal is sufficient for the interaction with AvrPiz-t

Transcription factor APIP5 is a transcription activators

AvrPiz-t specific attenuate transcriptional activity of APIP5

Suppression of APIP5 causes cell death phenotypes in rice

Suppression of APIP5 enhanced resistance to M. Oryzae
Ectopic expression *AvrPiz*-t enhances cell death phenotype of *APIP5* RNAi plants

Piz-t partially suppresses *APIP5* silencing-induced cell death

**APIP5** interacts with Piz-t *in vitro* and *in vivo*

**APIP5** is accumulated in the Piz-t background but suppressed in the non-Piz-t background

**Summary**

1. *AvrPiz*-t is a negative regulator of rice blast resistance and PTI pathway
2. *AvrPiz*-t interacts with E3 ligases *APIP6/10* and degrade each other
3. *APIP6/10* are positive regulators of blast resistance PTI pathway
4. *APIP6* interacts with and degrades OsELF3-2
5. *APIP10* negatively regulates Piz-t accumulation
6. *AvrPiz*-t suppresses *APIP5* transcriptional activity and protein accumulation
7. *APIP5*, a negative regulator of cell death, interacts with Piz-t
8. Piz-t suppresses the AvrPiz-t-mediated *APIP5* degradation
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