Study reveals how lncRNAs modulate balance between plant immunity and growth

August 8 2022, by Li Yuan

The Yin-Yang fish shows the fine-turning mechanism of lncRNA on plant immunity and growth balance. The black fish represents the growth of plants and the red fish represents the immunity responses of plants. Credit: IOZ

Researchers led by Prof. Zhang Xiaoming and Prof. Chen Jinfeng from the Institute of Zoology (IOZ) of the Chinese Academy of Sciences (CAS) and Prof. Qian Weiqiang from Peking University have unraveled a long non-coding RNA (lncRNA)-based regulatory mechanism that modulates the balance between plant immunity and growth.

The study was published in *Cell Host & Microbe* on July 30.

In response to different biotic stresses, terrestrial plants have evolved complex and powerful immune systems. However, the persistent activation of the immune system seriously damages plant development and growth.

To balance immune responses and fitness costs, plant immunity is tightly controlled under normal conditions and quickly activated upon pathogen infection. The underlying molecular mechanisms in balancing plant immunity and growth are still poorly understood.

Long non-coding RNAs (lncRNAs) are a class of RNAs that lack functional open reading frames (ORFs). Although the biological functions of a few lncRNAs in plant development have been revealed, how these lncRNAs with low expression effectively modulate diverse biological processes, including plant immune responses, remain largely unknown.

In this study, the researchers identified a lncRNA, termed salicylic acid biogenesis controller 1 (SABC1), which decreases upon infection of bacteria pathogen, Pseudomonas syringae strain DC3000-avrRpt2.

They further clarified the regulatory role of SABC1 as a lncRNA in suppressing plant immunity and promoting plant growth through

inhibiting its neighboring gene NAC3. NAC3 acts as a transcription factor to activate transcription of isochorismate synthase 1 (ICS1), a key enzyme catalyzing salicylic acid (SA) biosynthesis.

SABC1 inhibits the transcription of NAC3 by recruiting the polycomb repressive complex 2 to mediate the H3K27me3 of NAC3, which would finally repress SA production, so as to restrict immunity response and make way for plant growth. Upon bacteria and virus infection, SABC1 is downregulated to activate NAC3 transcription to trigger SA production and derepress the resistance to bacteria and viruses.

These findings reveal lncRNA SABC1 as a molecular switch to balance plant defense and growth by modulating SA biosynthesis, which improves our understanding of plant immune regulation.

More information: Ningkun Liu et al, A lncRNA fine-tunes salicylic acid biosynthesis to balance plant immunity and growth, *Cell Host & Microbe* (2022). DOI: 10.1016/j.chom.2022.07.001

Provided by Chinese Academy of Sciences