Plant Pathology Seminar Series

Antiviral mechanism in Orchid plants under *Cymbidium mosaic virus* and *Odontoglossum ringspot virus* infection

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Abstract:

The orchid industry faces severe threats from diseases caused by viruses. Argonaute proteins (AGOs) have been shown to be the major components in the antiviral defense systems through RNA silencing in many model plants. However, the roles of AGOs in protecting orchids against viral infections have not been analyzed comprehensively. In our previous studies, *Phalaenopsis aphrodite* subsp. *formosana* was chosen as the representative to analyze the AGOs (PaAGOs) involved in the defense against two major orchid viruses, *Cymbidium mosaic virus* (CymMV) and *Odontoglossum ringspot virus* (ORSV). A total of 11 PaAGOs were identified from the expression profile analyses of these PaAGOs in *P. aphrodite* subsp. *formosana,* singly or doubly infected with CymMV and/or ORSV. PaAGO5b was found to be the only one that was highly induced. Overexpression of individual PaAGO5 family genes revealed that PaAGO5b plays critical roles in *P. aphrodite* subsp. *formosana* antiviral defense mechanism.

To understand the underlying antiviral defense mechanism, we cloned PaAGO5s promoters (*p*PaAGO5s) and analyzed their activity in transgenic *Nicotiana benthamiana* using β-glucuronidase (GUS) as a reporter gene. GUS activity analyses revealed that during CymMV and ORSV infections, *p*PaAGO5b activity significantly increased compared to *p*PaAGO5a and *p*PaAGO5c. Analysis of *p*PaAGO5b 5′-deletion revealed that *p*PaAGO5b_941 has higher activity during virus infection. Further, yeast one-hybrid analysis showed that the transcription factor NbMYB30 physically interacted with *p*PaAGO5b_941 to enhance its activity. Overexpression and silencing of *NbMYB30* resulted in up- and downregulation of *GUS* expression, respectively. Exogenous application and endogenous measurement of phytohormones have shown that methyl jasmonate and salicylic acid respond to viral infections. NbMYB30 overexpression and its closest related protein, PaMYB30, in *P. aphrodite* subsp. *formosana* reduced CymMV accumulation in *P. aphrodite* subsp. *formosana*. Based on these discoveries, this study provided insights into the underlying antiviral defense mechanism in orchids in response to virus infections. Findings may provide useful information for the breeding of traits for resistance or tolerance to CymMV or ORSV infections in *Phalaenopsis* orchids.

4:10 pm | February 6,2023 | Plant Pathology 515, Spring 2023

Zoom Link: https://wsu.zoom.us/j/95501196325?pwd=aGdCeTZGM0pQaXZoY05qT3M0SFVHQT09

Meeting ID: 955 0119 6325 **Passcode:** 5498

Call in number: 1 253 215 8782

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References:

Kuo, S.Y., Hu, C.C., Huang, Y.W., Lee, C.W., Luo, M.J., Tu, C.W., Lee, S.C., Lin, N.S. and Hsu, Y.H., 2021. Argonaute 5 family proteins play crucial roles in the defense against Cymbidium mosaic virus and Odontoglossum ringspot virus in Phalaenopsis aphrodite subsp. formosana. *Molecular Plant Pathology*, *22*(6), pp.627-643.

Kasi Viswanath, K., Kuo, S.Y., Huang, Y.W., Tsao, N.W., Hu, C.C., Lin, N.S., Wang, S.Y. and Hsu, Y.H., 2022. Characterization of Virus-Inducible Orchid Argonaute 5b Promoter and Its Functional Characterization in Nicotiana benthamiana during Virus Infection. *International Journal of Molecular Sciences*, *23*(17), p.9825.