Autophagy mediates a direct synergistic interaction during co-transmission of two arboviruses by insect vectors

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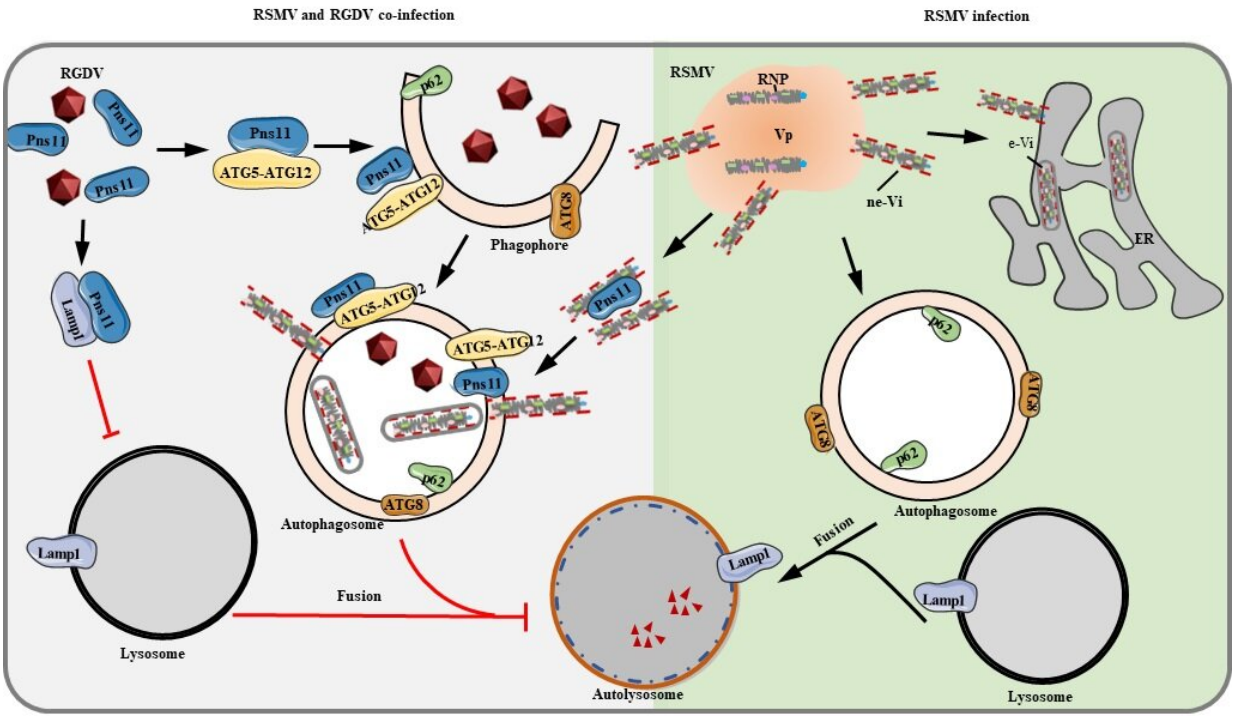

Model depicting Pns11-mediated viral synergism in co-infected vectors. The non-enveloped virions of RSMV assembled at the viroplasm periphery bud into the ER to assemble enveloped virions. RSMV-induced complete autophagy serves as an anti-viral defense mechanism. RGDV Pns11 induces the formation of initial autophagosomes via the recruitment of ATG5-ATG12 conjugation and blocks autophagosome degradation by mediating the reduced expression of N-glycosylated Lamp1 on lysosomal membranes. In co-infected vectors, non-enveloped virions of RSMV bind to Pns11 and then bud into Pns11-induced

autophagosomes to assemble enveloped virions via the interaction of N-Pns11-ATG5, finally regulating autophagy from the anti-viral status to pro-viral status during RSMV infection. Credit: Science China Press

Multiple viral infections in insect vectors with synergistic effects are common in nature, but the underlying mechanism remains elusive. A new study, published in *Science China Life Sciences* and led by Dr. Taiyun Wei (Institute of Vector-borne Virus Research Center, State Key Laboratory of Ecological Pest Control for Fujian and Taiwan Crops, Fujian Agriculture and Forestry University), looked more closely at a mosaic virus and its transmission by leafhoppers.

Last year, the team reported the rhabdovirus rice stripe mosaic virus (RSMV) was transmitted together with the reovirus rice gall dwarf virus (RGDV) and the co-infection significantly promoted the propagation and transmission efficiencies of RSMV by leafhopper vector Recilia dorsalis in the field.

However, the underlying mechanism remained elusive. Recently, the team found that RSMV nucleoprotein (N) alone activated complete anti-viral autophagy, while RGDV nonstructural protein Pns11 alone induced incomplete autophagy to promote viral propagation in leafhopper vectors. Interestingly, RSMV exploited Pns11-induced autophagosomes to assemble enveloped virions via N-Pns11-autophagy-related protein 5 (ATG5) interaction in co-infected vectors. Furthermore, RSMV could effectively propagate in Spodoptera frugiperda (Sf9) cells.

Expression of Pns11 in Sf9 cells or leafhopper vectors caused the recruitment of N from the endoplasmic reticulum (ER) to Pns11-induced autophagosomes and inhibited N-induced complete autophagic flux, finally facilitating RSMV propagation. Thus, for the

first time, the team demonstrated a previously unappreciated role of autophagy in the regulation of the direct synergistic interaction during co-transmission of two distinct arboviruses by insect vectors and revealed the functional importance of virus-induced autophagosomes in rhabdovirus assembly.

More information: Dongsheng Jia et al, Autophagy mediates a direct synergistic interaction during co-transmission of two distinct arboviruses by insect vectors, *Science China Life Sciences* (2023). DOI: 10.1007/s11427-022-2228-y

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