The N-terminal MADA motif in the CC-NLR immune receptors is functionally conserved across distantly related plant species

Kamoun Lab @ TSL
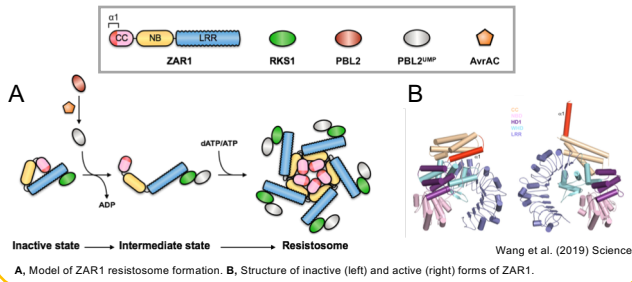
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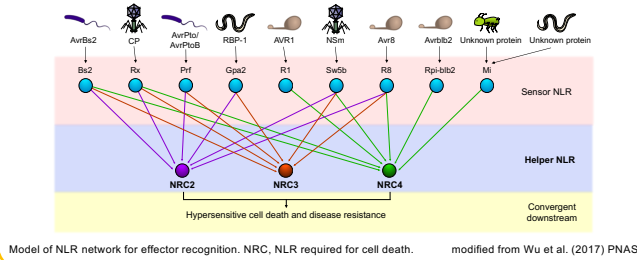
[1]The Sainsbury Laboratory, University of East Anglia, Norwich Research Park, Norwich NR4 7UH, UK. [2]Imperial College London, Department of Life Sciences, London, UK.
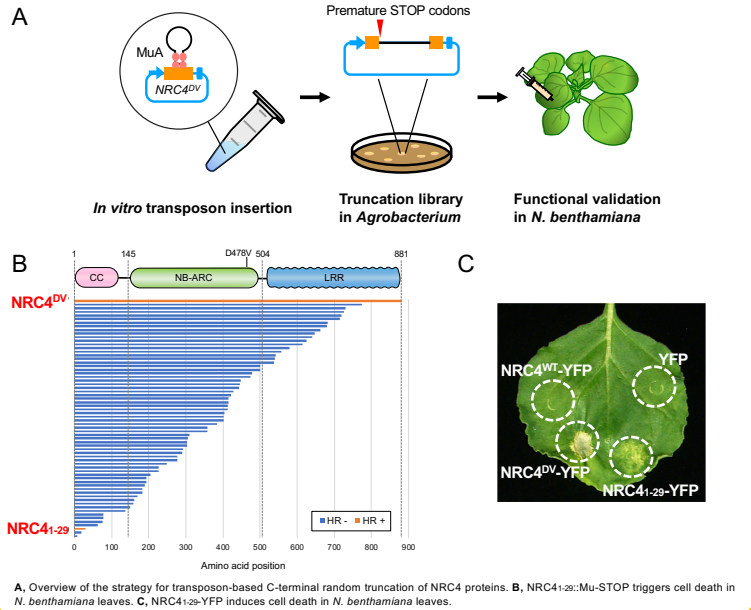
Adachi et al. (2019) bioRxiv

1. Plant CC-NLRs form resistosome "death switch"

A, Model of ZAR1 resistosome formation. B, Structure of inactive (left) and active (right) forms of ZAR1.

Wang et al. (2019) Science

2. NLRs form a receptor network composed of functionally specialized "sensor" and "helper" NLRs

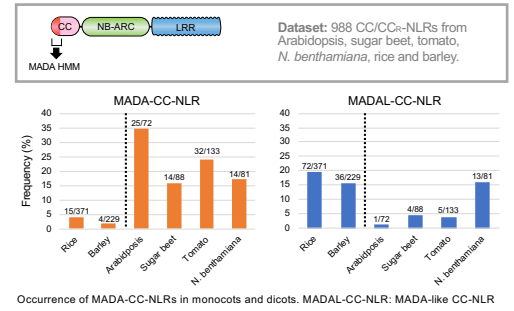Model of NLR network for effector recognition. NRC, NLR required for cell death.

modified from Wu et al. (2017) PNAS

3. Transposon-based truncation mutagenesis reveals 29 amino-acid region sufficient for NRC4-mediated cell death

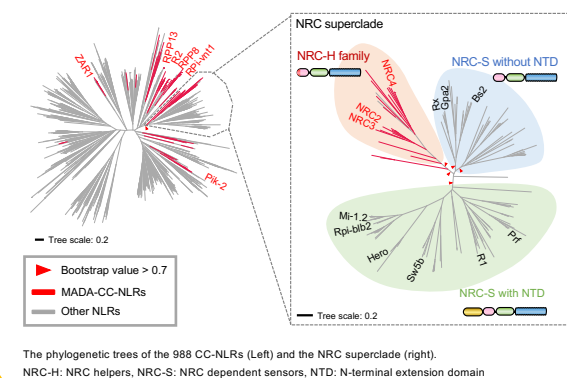A, Overview of the strategy for transposon-based C-terminal random truncation of NRC4 proteins. B, NRC4₁₋₂₉::Mu-STOP triggers cell death in N. benthamiana leaves. C, NRC4₁₋₂₉-YFP induces cell death in N. benthamiana leaves.

4. The MADA motif is conserved at the N-terminus of NRC4 and ZAR1

A, Clustering N-terminal domain of CC-NLRs by Tribe-MCL analysis. B, The consensus sequence pattern of the MADA motif identified by MEME.

NRC4 1 MADAVVNFLVENLLQLLTDNV 21
ZAR1 1 MVDAVVTVFLEKTLNILEEKG 21
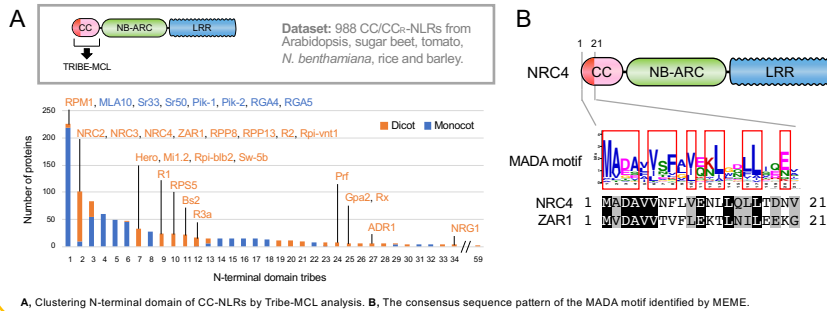
5. The MADA motif is present in ~20% of CC-NLRs

Occurrence of MADA-CC-NLRs in monocots and dicots. MADAL-CC-NLR: MADA-like CC-NLR

6. NRC sensors do not have the MADA motif

The phylogenetic trees of the 988 CC-NLRs (Left) and the NRC superclade (right).
NRC-H: NRC helpers, NRC-S: NRC dependent sensors, NTD: N-terminal extension domain

7. The MADA motif is functionally conserved for HR cell death and Rpi-blb2-mediated resistance

A, Alignment of the N-terminal region of the MADA-CC-NLRs. B, Schematic representation of NRC4 MADA motif chimeras with MADA motifs from other CC-NLRs. C, Cell death phenotypes induced by the NRC4 chimeras. D, Disease and resistance phenotypes on NRC4/Rpi-blb2-expressed leaves
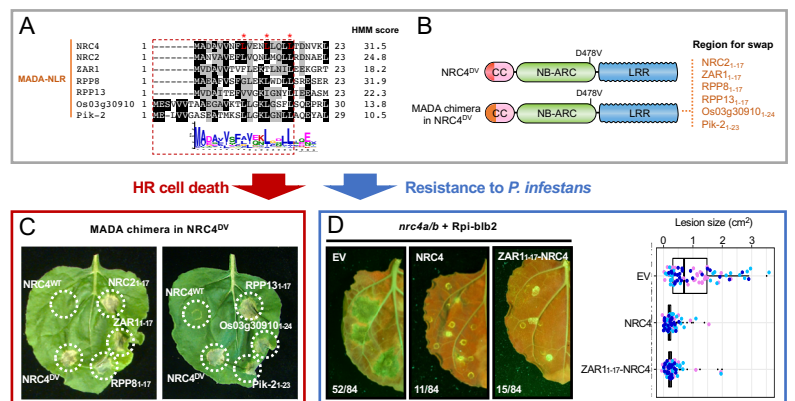
8. Evolution of NLRs from singletons to networks

Structure homology model of NRC4 on ZAR1 resistosome.

9. ACKNOWLEDGMENTS