Putting wheat yellow rust to BED: elucidating the relationship between *Yr7*, *Yr5* and *YrSP*

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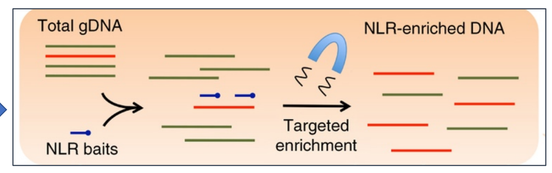
Equivalent of **1/3 of the total UK wheat harvest is lost to yellow rust worldwide**. *Puccinia striiformis* f.sp *tritici* (PST) is the causal agent of yellow rust disease in wheat. Identifying resistance genes allows designing perfect markers to **assist selection for disease resistance in breeding programs** and understanding their mode of action will help **adapting resistance deployment strategies to ensure its durability in the field**.

MutRenSeq enables NLR cloning in hexaploid wheat

Identifying *Yr7* loss of function mutants

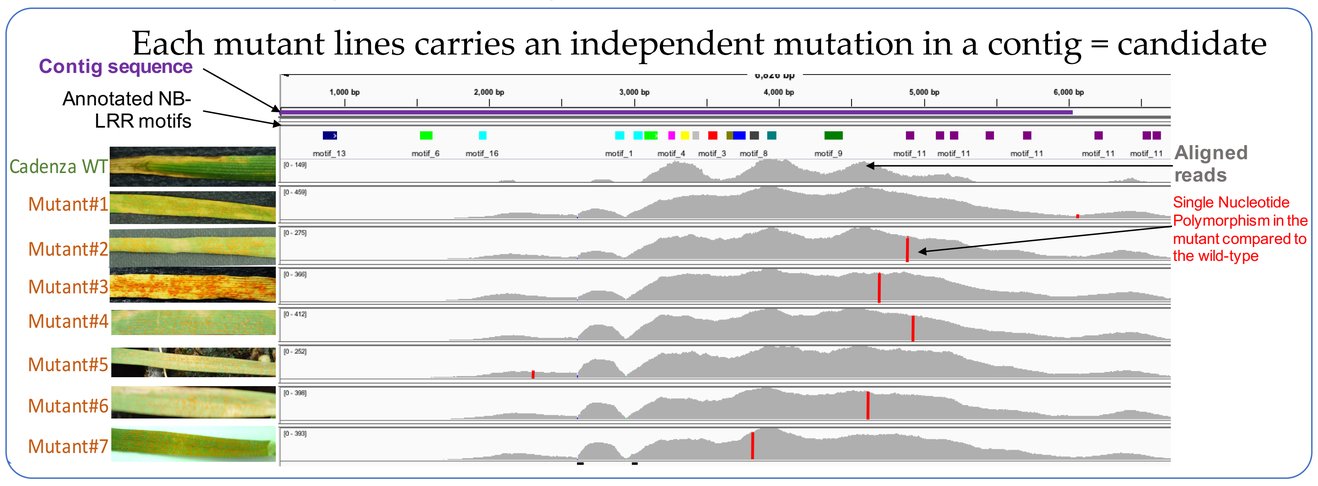
NLR-genes capture, enrichment and sequencing



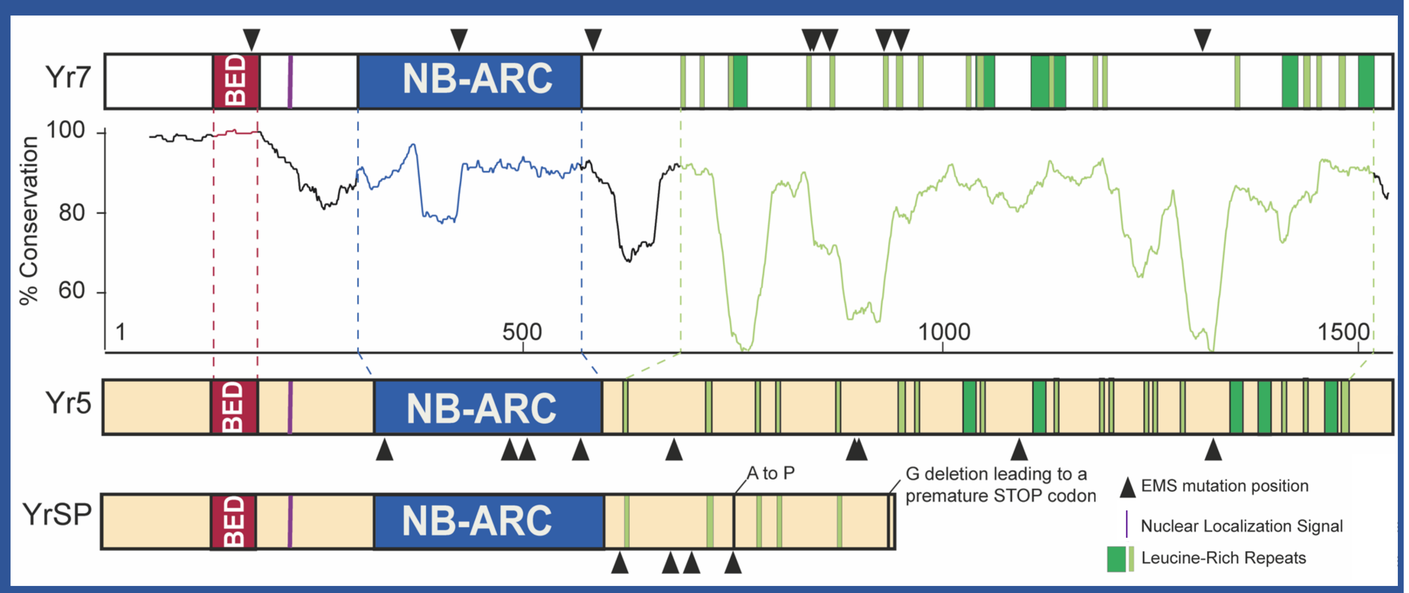
We used a similar approach to clone *Yr5* and *YrSP*
Marchal *et al.*, 2018 Nature Plants

Sequence-based analysis to identify candidates (MutantHunter, Steuernagel et al., 2016)

Each mutant lines carries an independent mutation in a contig = candidate



Yr7, *Yr5* and *YrSP* encode BED-NLRs



Based on sequence analysis and fine-mapping, *Yr5* and *YrSP* are likely to be alleles and closely linked to *Yr7*

BED domain is required for resistance: one point mutation in BED domain is sufficient to disable resistance response in *Yr7*

BED domain does not, or not solely, govern specificity to PST

BED domain is highly conserved

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Yr7-BED:    SPVWEHFTITETTIDGKRSKAKCKYCGNDFNCETKTNGTSSMKKHLEKEHS
Yr5-BED:    SPVWEHFTITETTIDGKRSKAKCNYCGNDFNCETKTNGTSSMKKHLEKEHS
YrSP-BED:   SPVWEHFTITETTIDGKRSKAKCNYCGNDFNCETKTNGTSSMKKHLEKEHS
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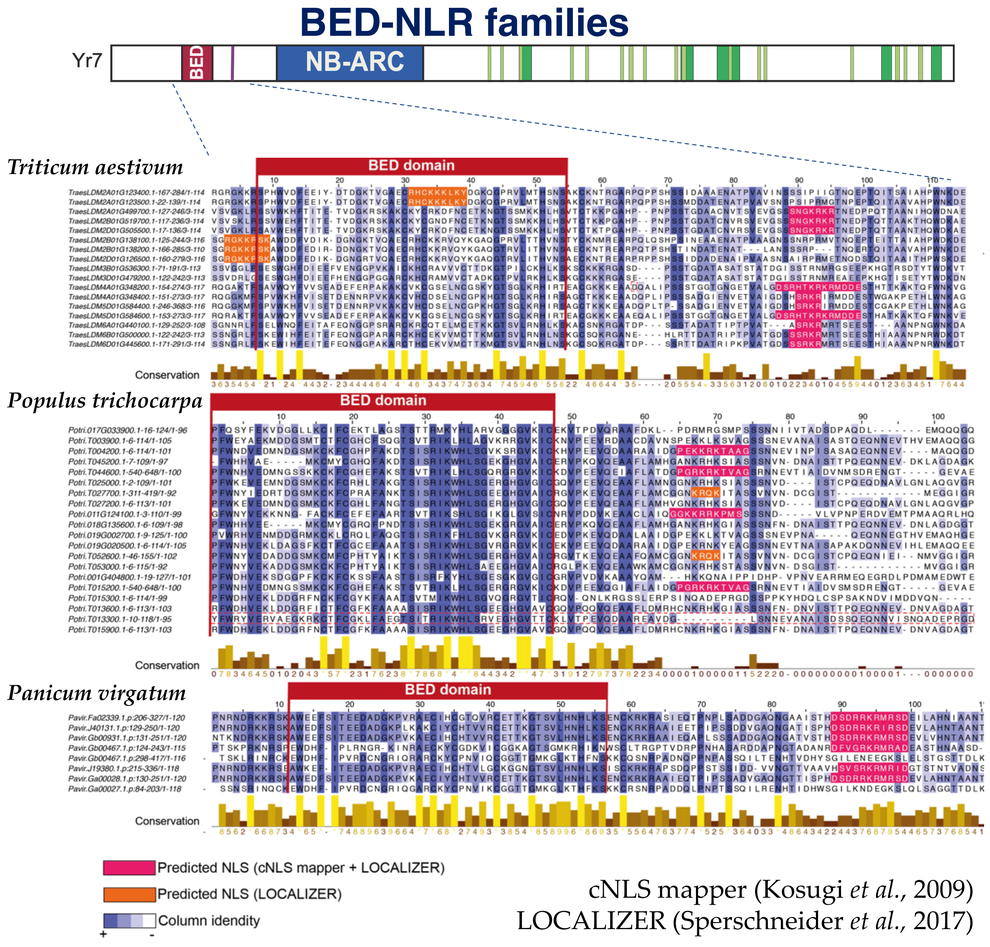
BED-Yr5/BED-YrSP: identical

BED-Yr7/BED- Yr5-SP: one AA change

Yr7, Yr5 and YrSP have **different resistance spectra** to *Puccinia striiformis* f.sp *tritici*

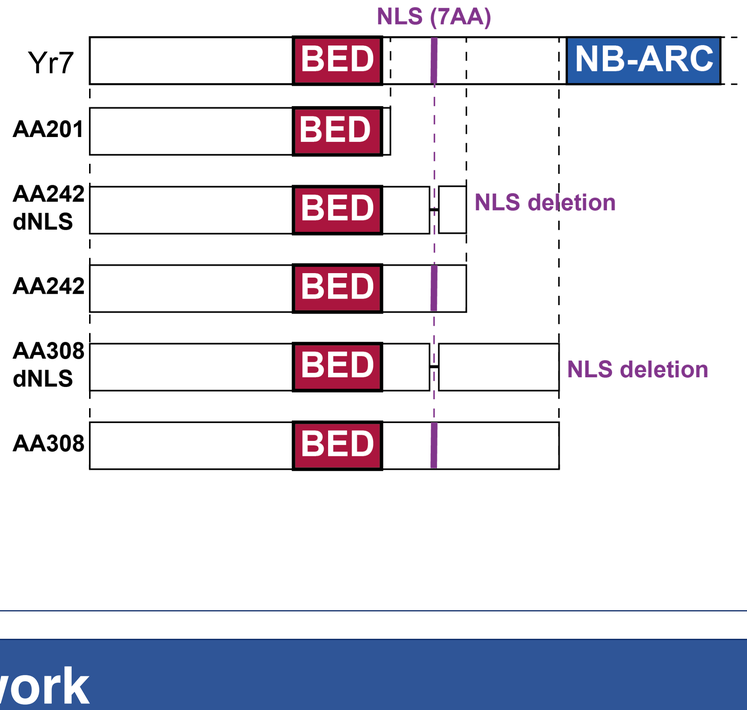
Nuclear Localization Signal (NLS) is found in other BED-NLR families



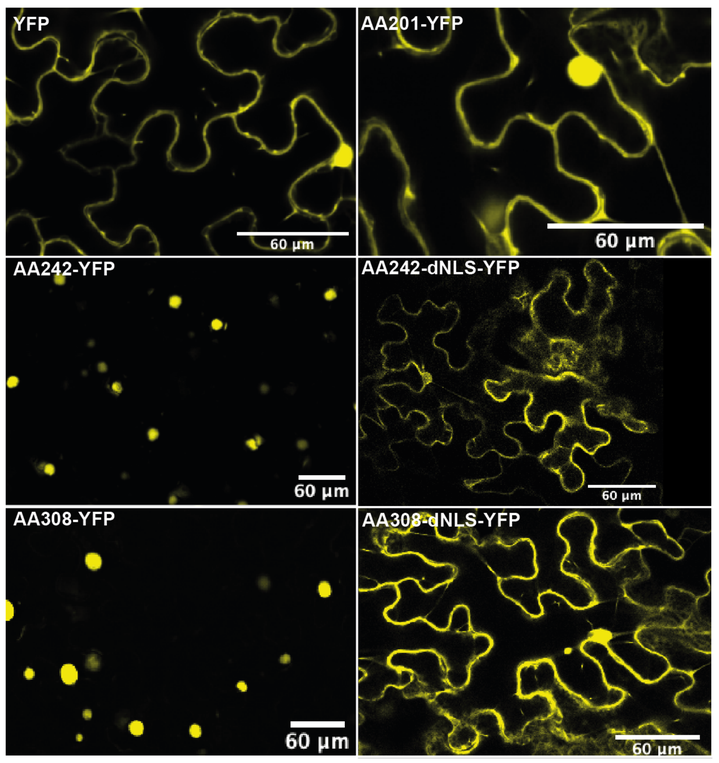
cNLS mapper (Kosugi *et al.*, 2009)
LOCALIZER (Sperschneider *et al.*, 2017)

Is NLS functional?

Generating YFP-tagged truncations in Yr7 with/without its NLS to test for localization in *N. benthamiana*



NLS in Yr7 is functional in *N. benthamiana*



Questions to be addressed in future work

Do BED domains integrated in NLRs share features with BED domains from other proteins?

Is BED domain guarding an effector target?

Is NLS important for Yr7-mediated response in wheat?