

*USING NEW TECHNOLOGIES TO DELIVER ROBUST RESISTANCE*  
*H1, GPA5 AND H3*



Ingo Hein

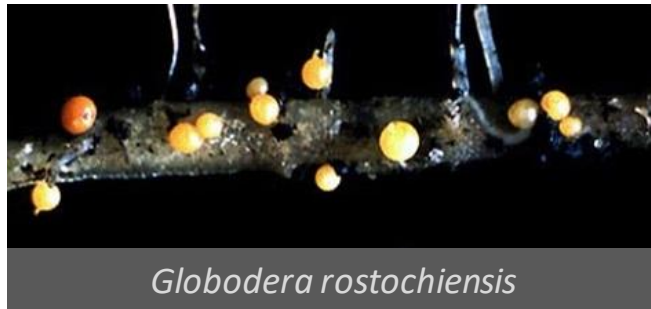
(Xinwei Chen, Micha Bayer, Glenn Bryan, Thomas Adams, Vanessa Young, Drummond Todd)

17<sup>th</sup> January 2023

Develop genetic markers for the most useful PCN resistances to enable fast-tracking of breeding



*Gpa5* and *H3*



*H1*

- Identify candidate genes for the resistance
- Convert candidate genes into specific markers
- Assess the markers in breeding programs

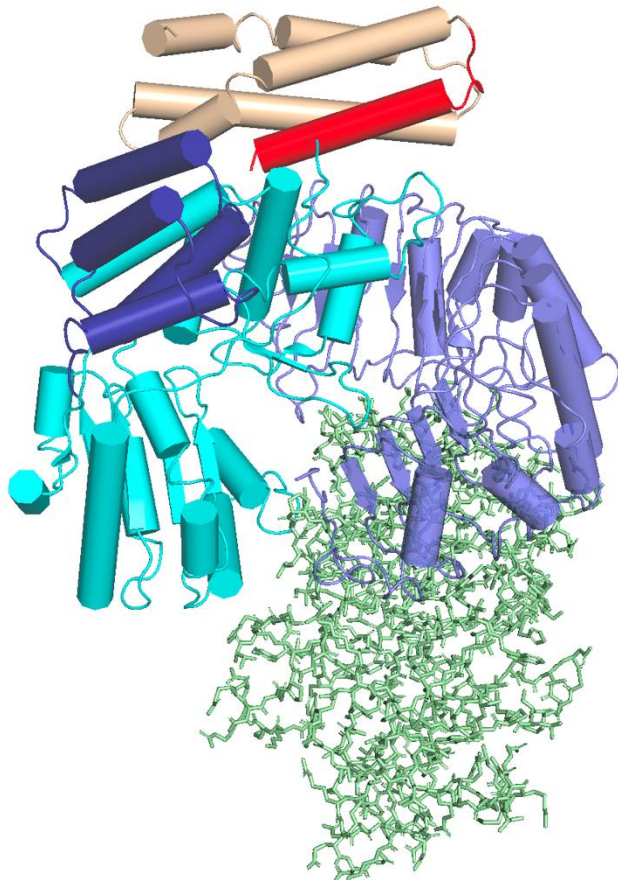
# FUNCTIONAL NB-LRR RESISTANCE (NLR) GENES

## CONTROL DIVERSE PATHOGENS



Effective against diverse and taxonomically unrelated pathogens

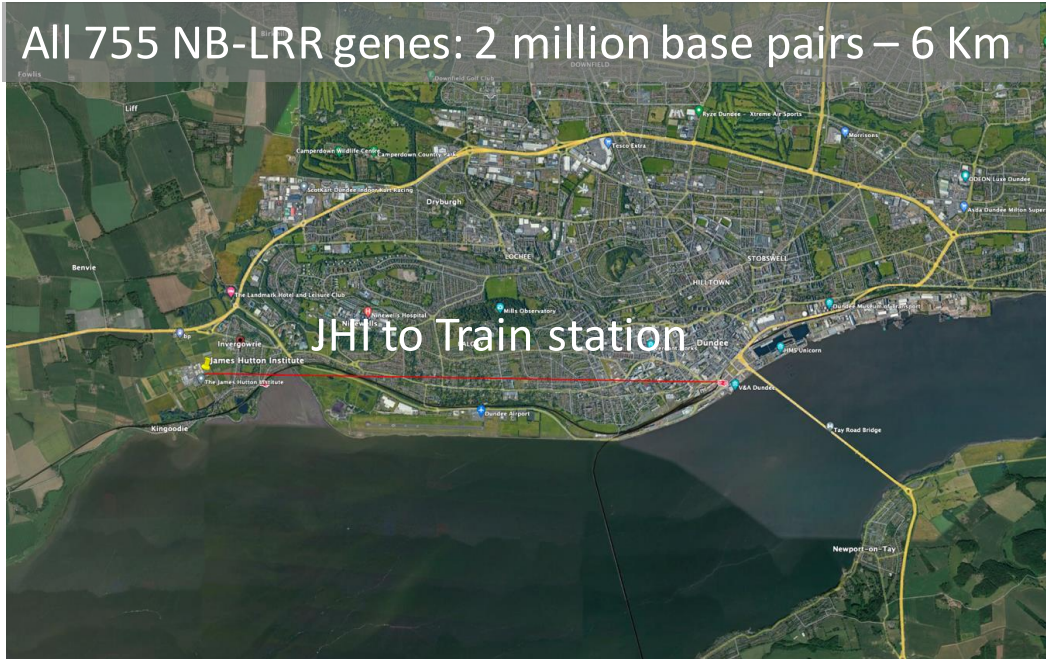
- Bacteria
- Viruses
- **Nematodes**
- Insects
- Filamentous fungi
- Oomycetes (including field resistances; Rui *et al.*, 2018 JXB)



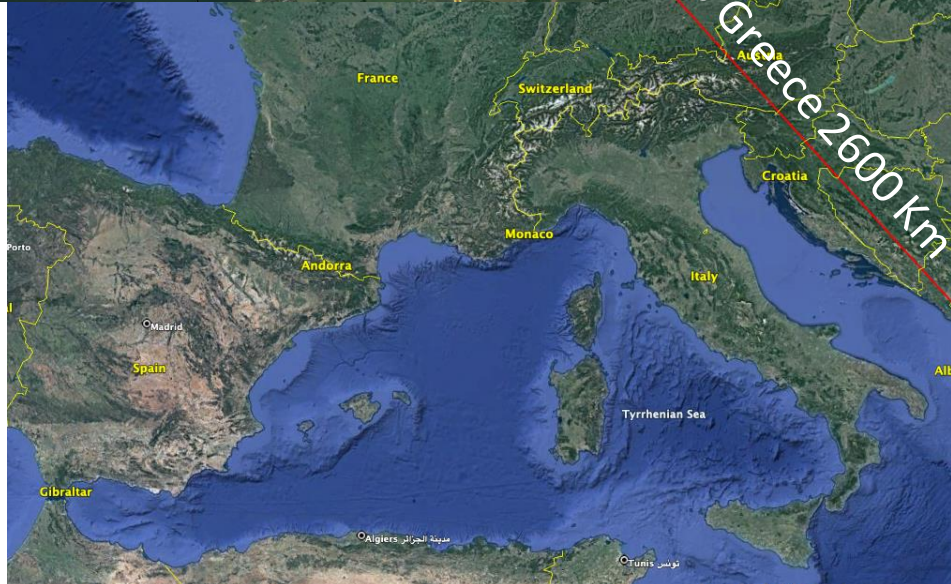
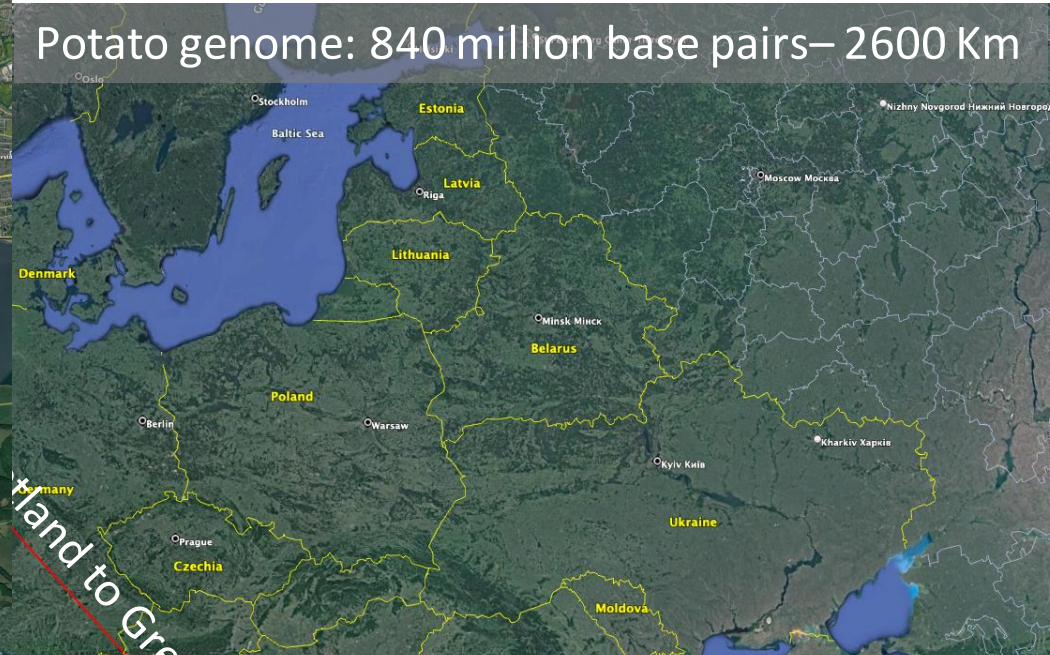


# RENSEQ – A GENOME REDUCTION TOOL

All 755 NB-LRR genes: 2 million base pairs – 6 Km



Potato genome: 840 million base pairs – 2600 Km

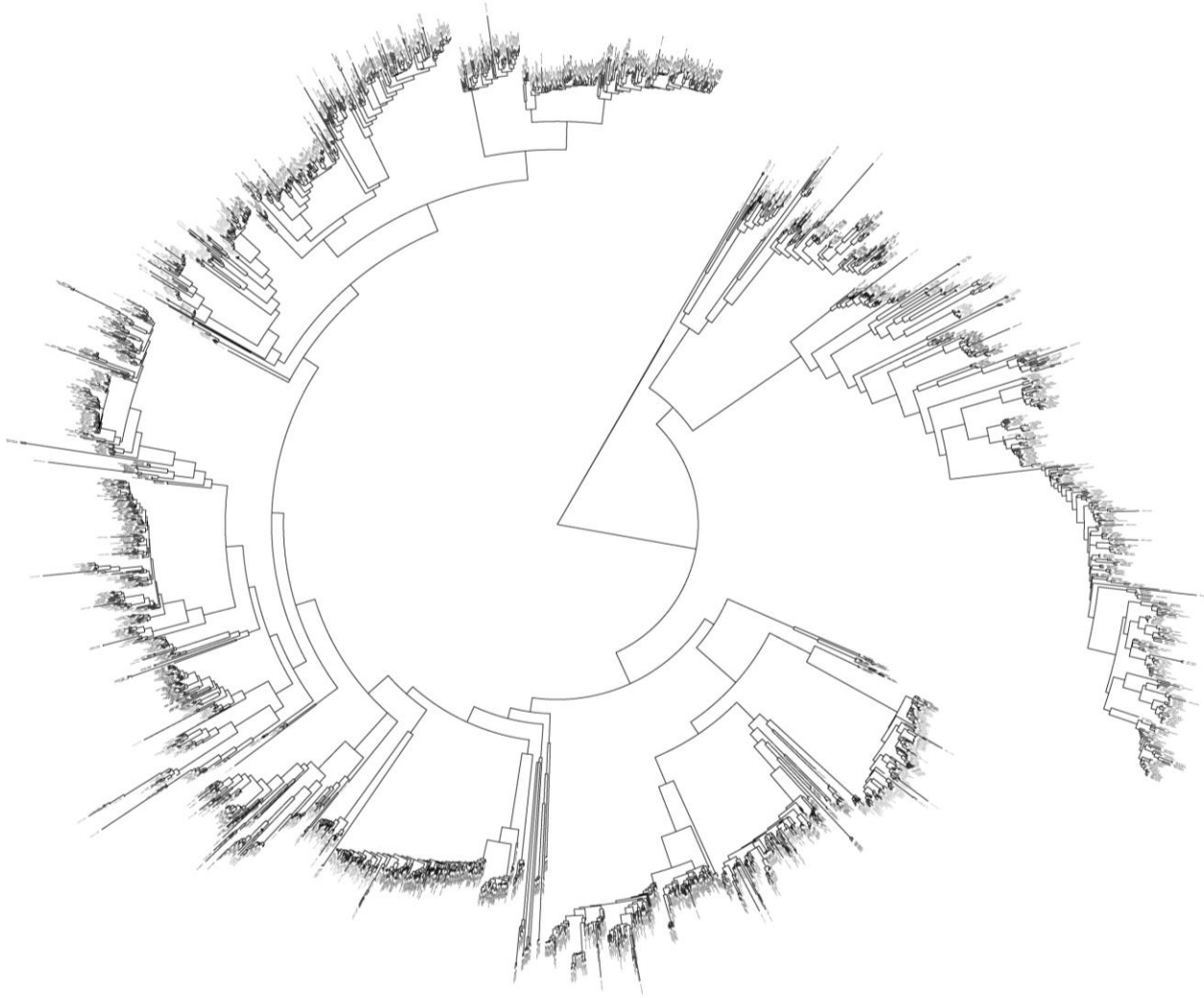


Single NB-LRR : 0.0027 million base pairs – 8.4 m



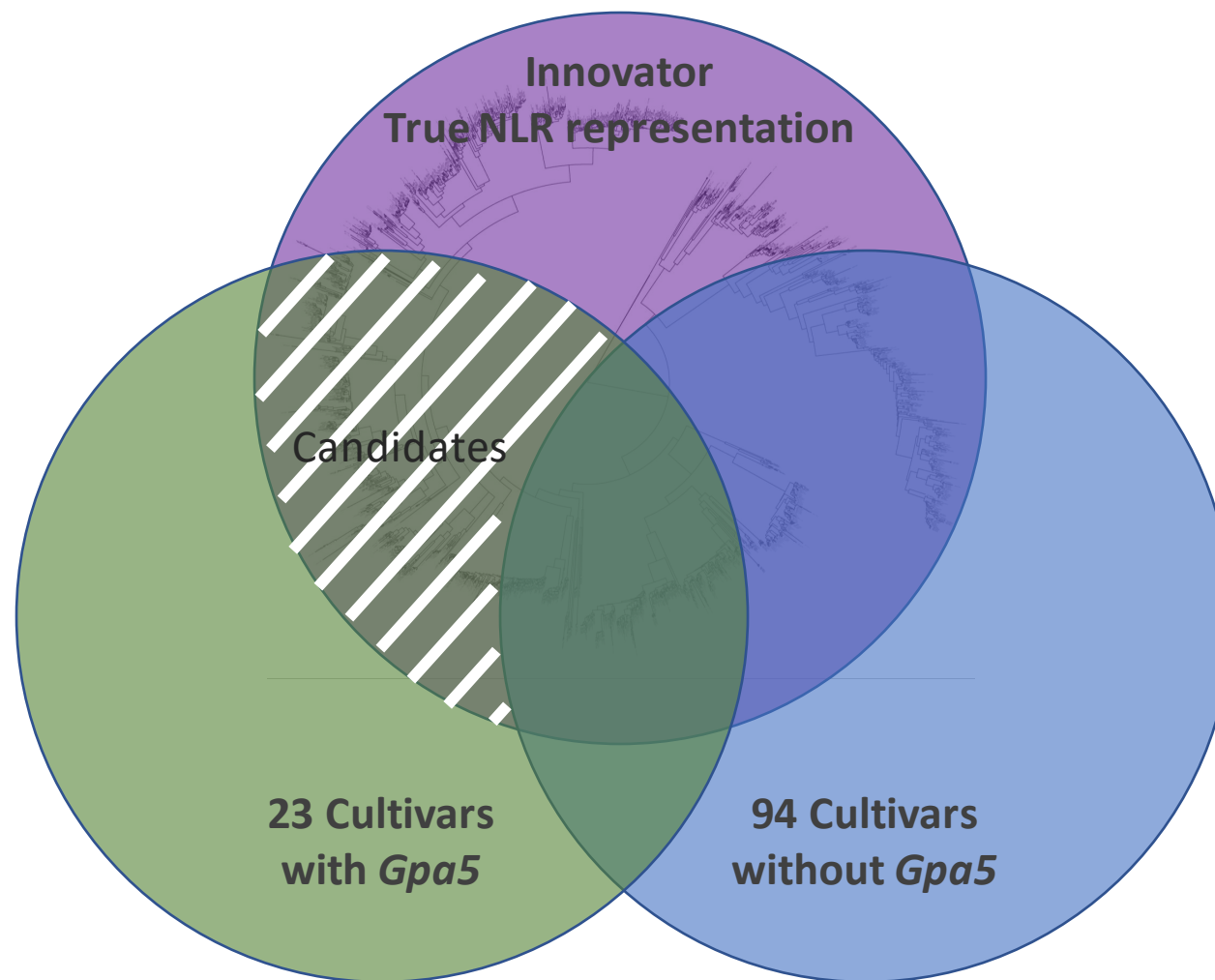


## POTATO CULTIVARS HAVE OVER 2000 NLRs

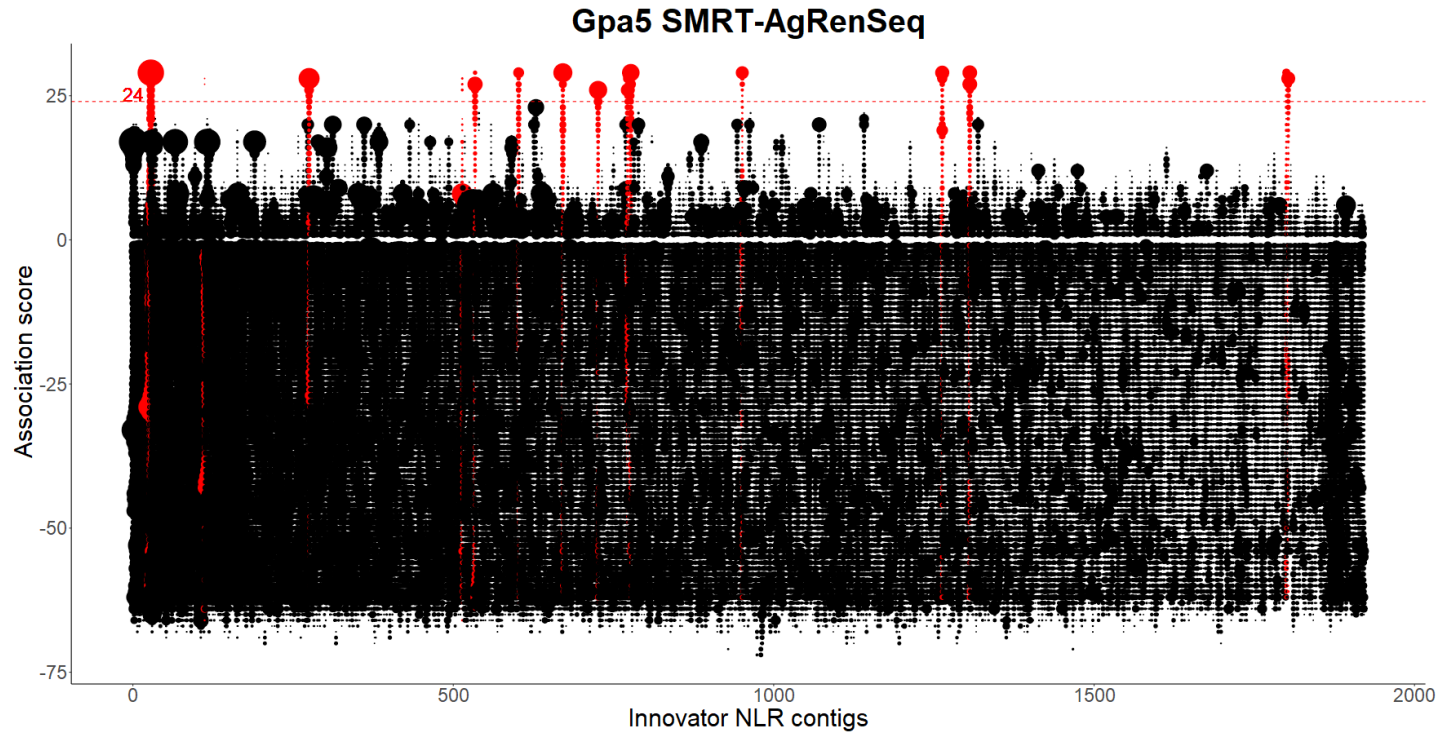


- More than 2400 NLRs in Innovator (*Gpa5*) / Alouette (*H1*)
- Distributed over all Chromosomes (4x12)
- Highly similar in their sequence

# AGRENSeq: RENSeq-BASED ASSOCIATION GENETICS (*Gpa5*)



## *WE HAVE SUCCESSFULLY IDENTIFIED CANDIDATES FOR GPA5*



We have eight strong candidates for *Gpa5*  
Next: KASP marker development

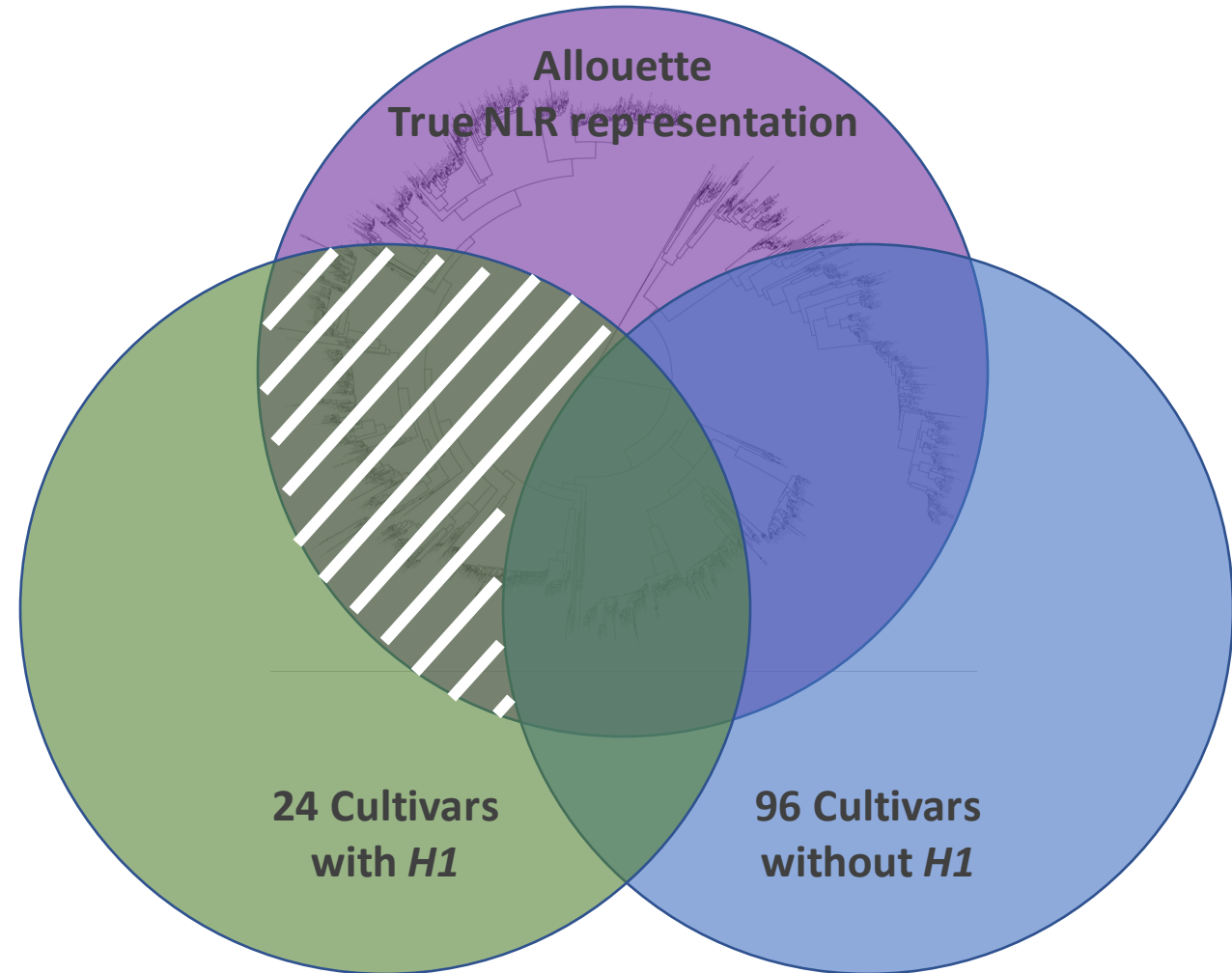
[illegible]

## AgREnSEQ – RENSEQ-BASED ASSOCIATION GENETICS (H1)



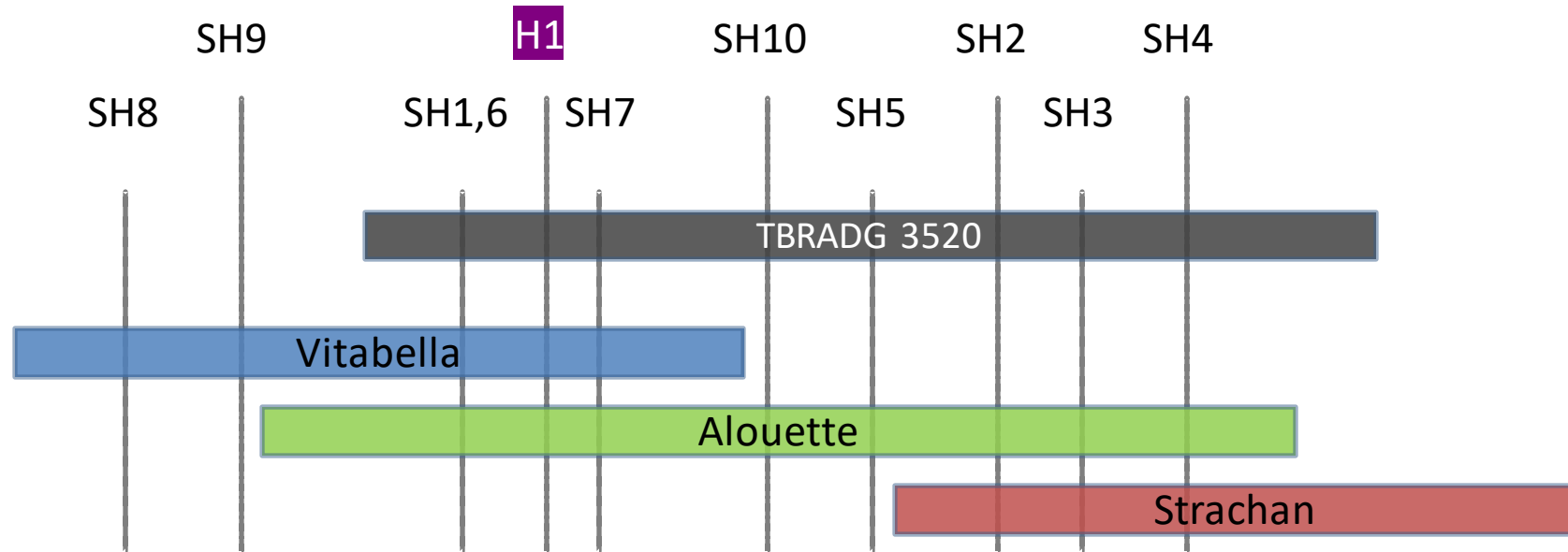
TBRADG 3520

*S. tuberosum* ssp. *andigena*  
accession CPC 1673





# OUR UNDERSTANDING OF THE H1 LOCUS

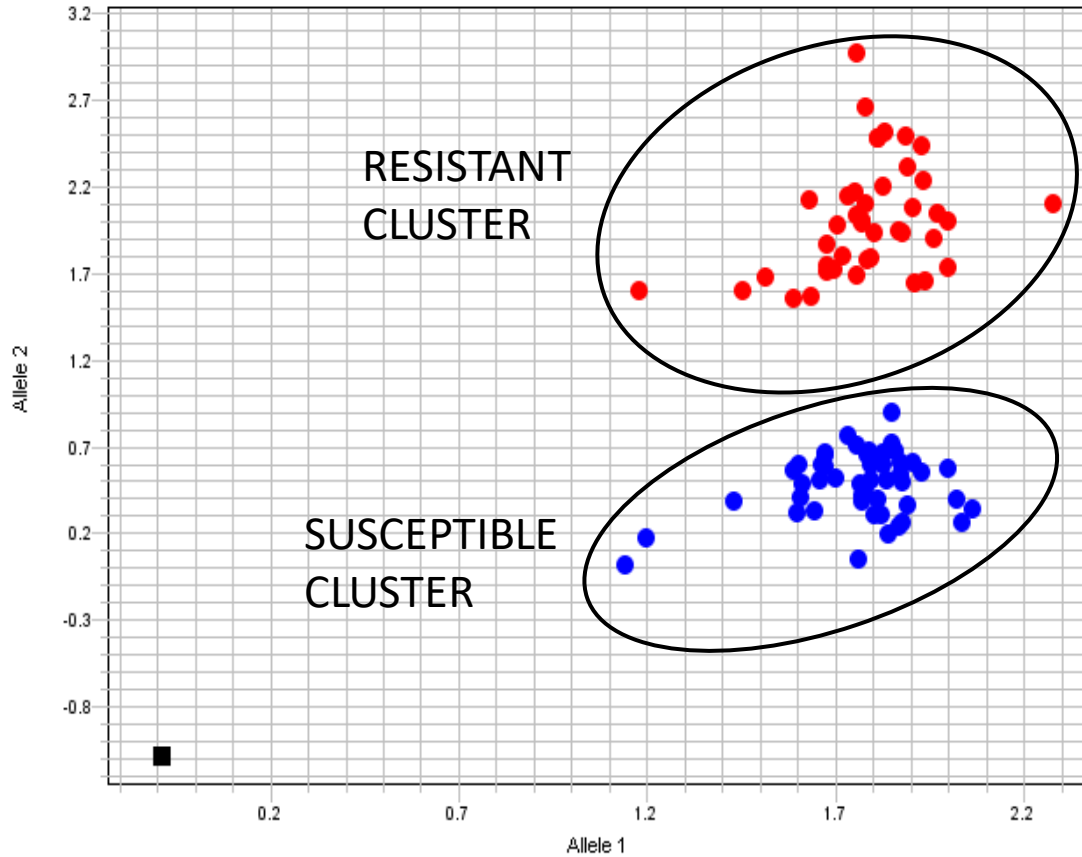


| tig00000645               | tig00000625               | tig00001423               | tig00001019               | tig00001984 |
|---------------------------|---------------------------|---------------------------|---------------------------|-------------|
| tig00000645_3<br>2,573 bp | tig00000625_1<br>3,480 bp | tig00001423_7<br>3,068 bp | tig00001019_5<br>3,692 bp | partial     |
| tig00000645_4<br>3,632 bp |                           |                           |                           |             |

# NEW H1-KASP MARKER IN BREEDING PROGRAMS

## H1 GENE KASP ASSAY

Allelic Discrimination Plot



## ORIGINAL H1 GENE PCR/GEL BASED ASSAY (57R MARKER)



- Successfully validated on 200 varieties
- Unlike the 57R marker, there is 100% correlation between the KASP marker and the resistance
- The KASP marker is quicker to run and easier to analyse than standard PCR assays.

## PROGRESS FOR H1, GPA5 AND H3



*H1*



*Gpa5*



*H3*





*MANY THANKS*

