

# Accessing natural genetic variation for pod shatter resistance in *Brassica species*

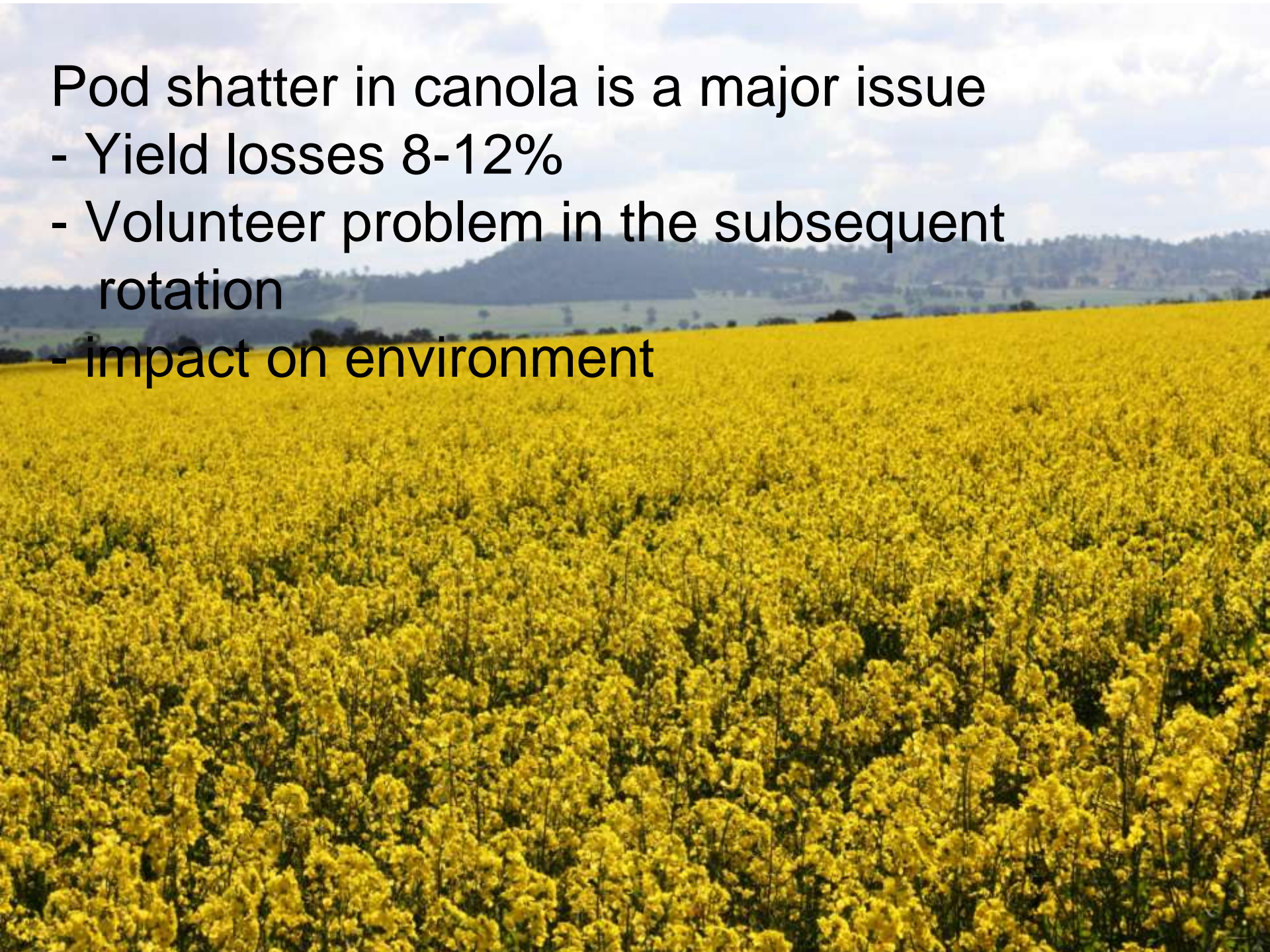
Rosy Raman, Neil Coombes, Yu Qiu, Geoff  
Burrows, Andrzej Kilian and Harsh Raman

Pod shatter in canola is a major issue

- Yield losses 8-12%

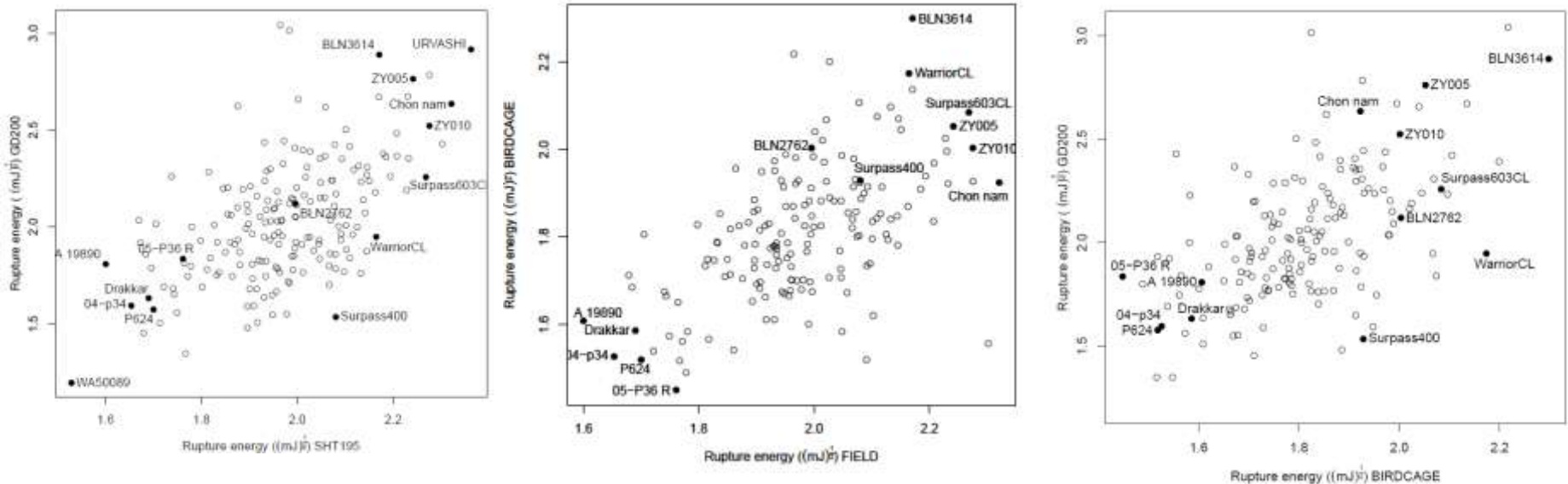
- Volunteer problem in the subsequent rotation

- impact on environment





# Genetic variation for pod shatter resistance in canola



PLoS ONE 9(7): e101673.



# Outline

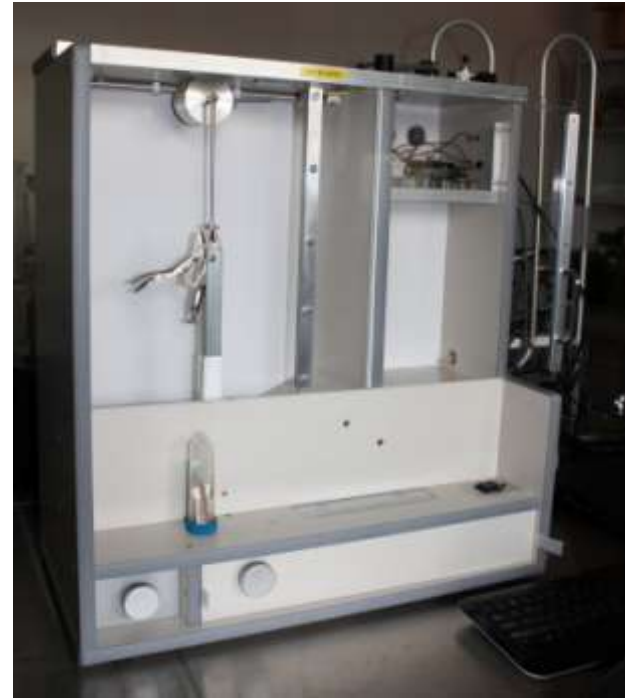
- Determine the extent of genetic variation for shatter resistance in related Brassica species especially *B. rapa* and *B. carinata*
- Identify loci involved in pod shatter resistance

# Accessions evaluated

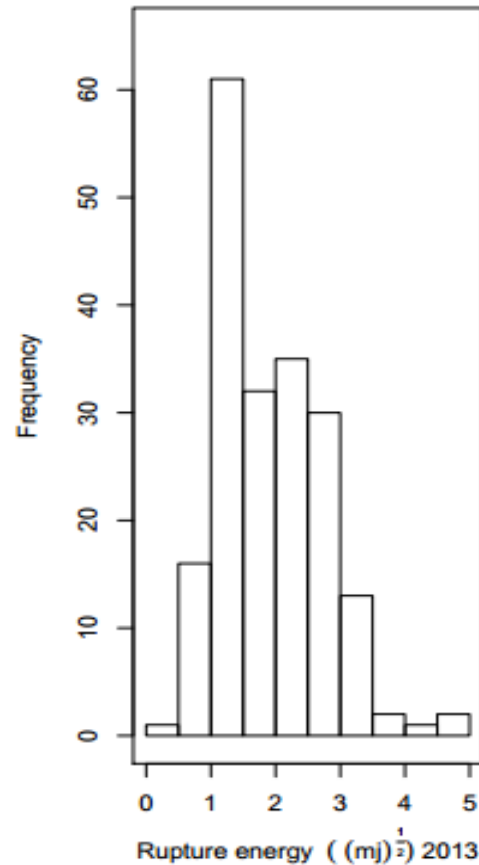
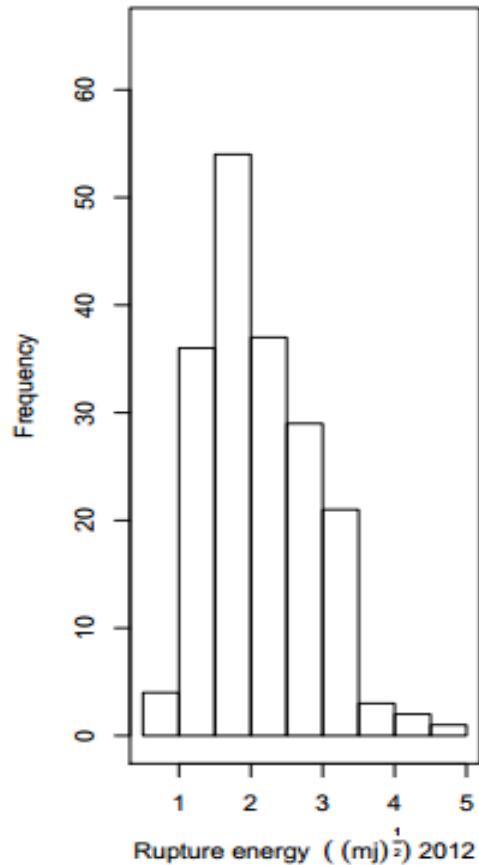
Species	Accession (no.)	Species	Accession (no.)
<i>A. thaliana</i>	2	<i>B. rapa</i> subsp. <i>chinensis</i>	4
<i>B. barrelieri</i>	1	<i>B. rapa</i> subsp. <i>dichotoma</i>	4
<i>B. carinata</i>	83	<i>B. rapa</i> subsp. <i>nipposinica</i>	4
<i>B. deflexa</i> subsp. <i>leptocarpa</i>	1	<i>B. rapa</i> subsp. <i>oleifera</i>	11
<i>B. juncea</i>	1	<i>B. rapa</i> subsp. <i>perkinensis</i>	3
<i>B. maurorum</i>	1	<i>B. rapa</i> subsp. <i>rapa</i>	1
<i>B. napus</i>	2	<i>B. rapa</i> subsp. <i>trilocularis</i>	1
<i>B. nigra</i>	1	<i>B. ruvo</i>	1
<i>B. nigra</i> var. <i>abyssinica</i>	1	<i>B. tournefortii</i>	1
<i>B. oleracea</i> var. <i>gongylodes</i>	1	<i>E. sativa</i>	1
<i>B. oleracea</i>	7	<i>M. longipetala</i>	1
<i>B. oxyrrhina</i>	1	<i>S. alba</i>	1
<i>B. rapa</i>	61	<i>S. arvensis</i>	2
<i>B. rapa</i> subsp. <i>campestris</i>	1	<i>S. erysimoides</i>	1

# Experimental design

- 200 lines
- 2 Reps
- 2012, 2013
- Phenotyping
  - Pendulum test
  - Anatomical structure of developing pods

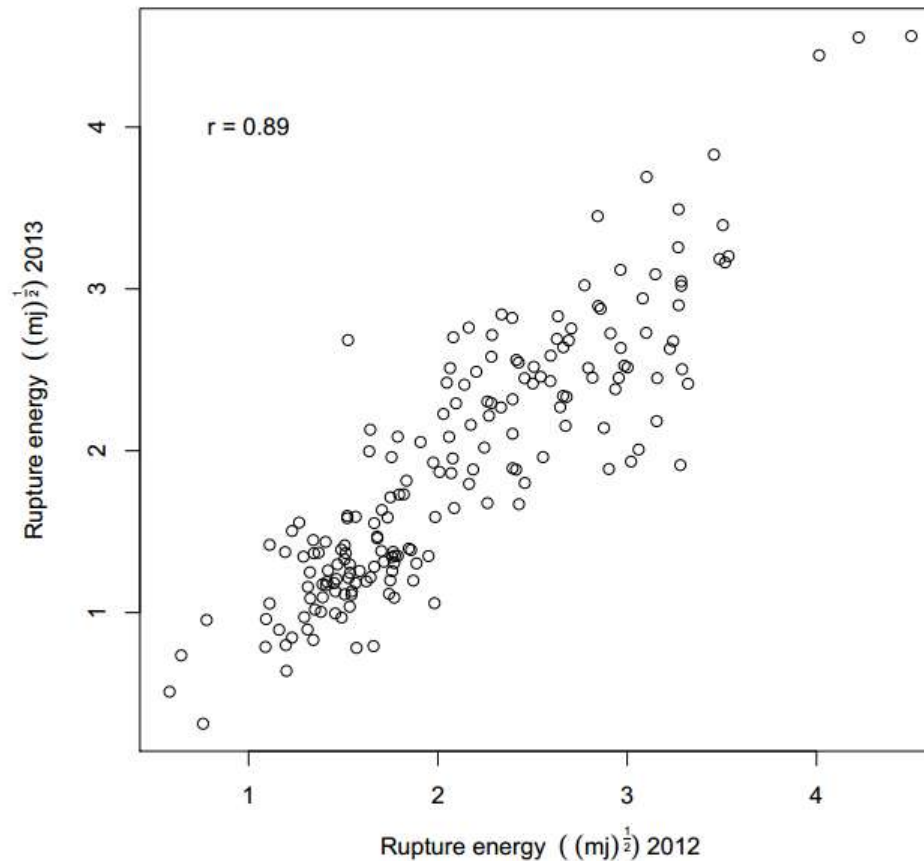


# Phenotypic variation for pod shatter resistance in *Brassicaceae*



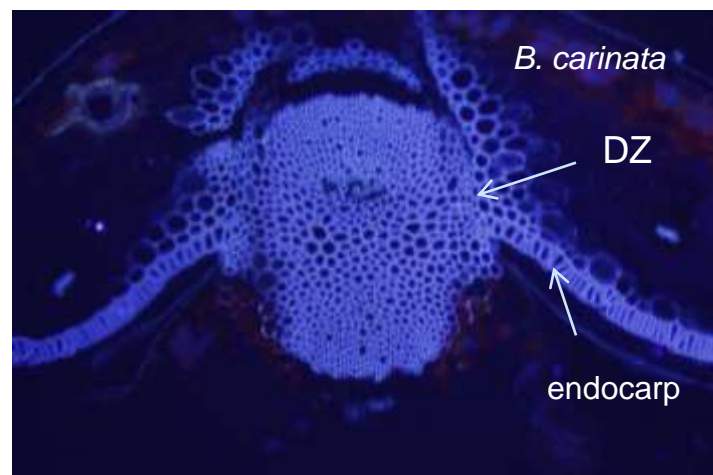
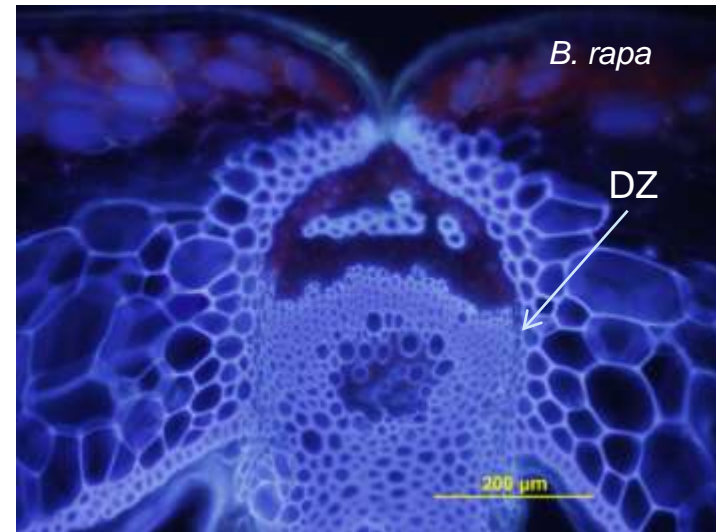
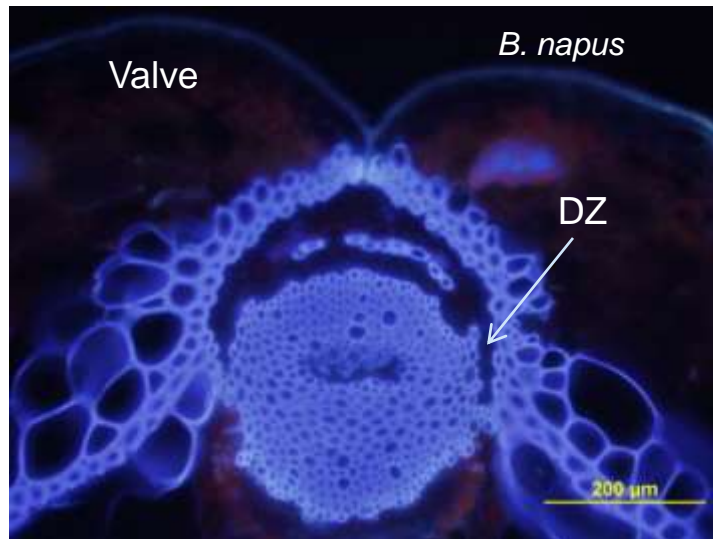
*B. napus* 2.1 to 4.3mJ  
*B. rapa* 0.41 to 9mJ  
*B. carinata* 2 to 20.8mJ

# Correlation between rupture energy in 2012 and 2013 trials

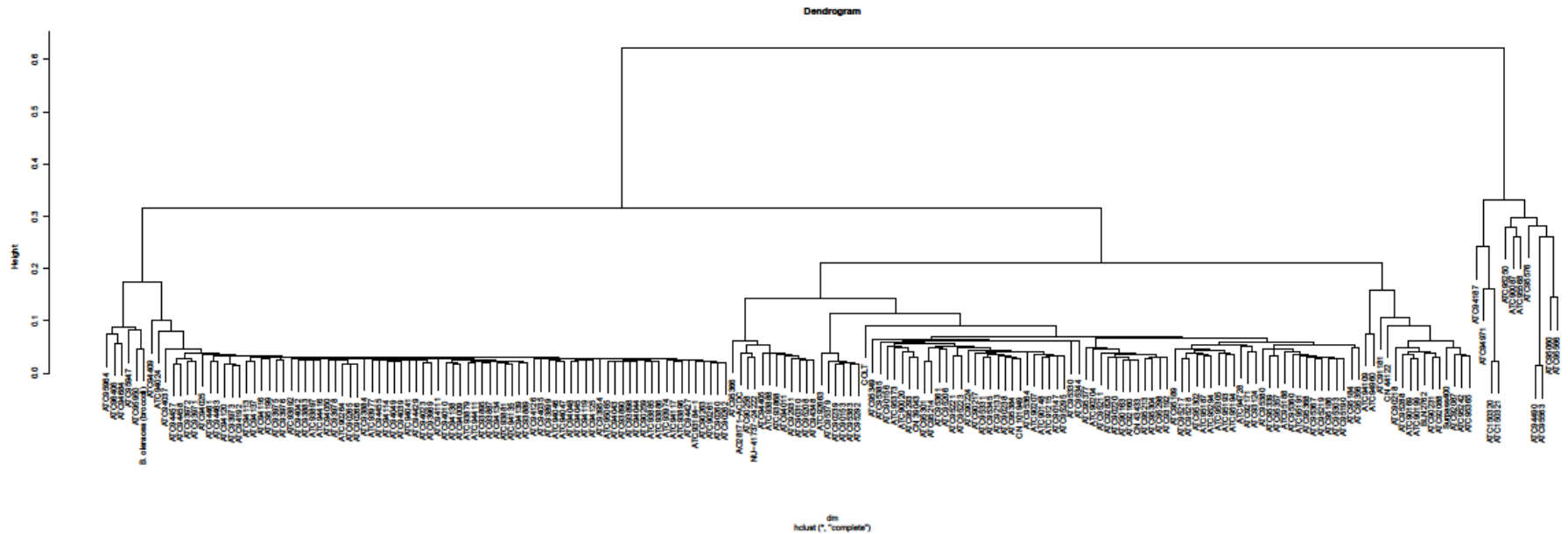




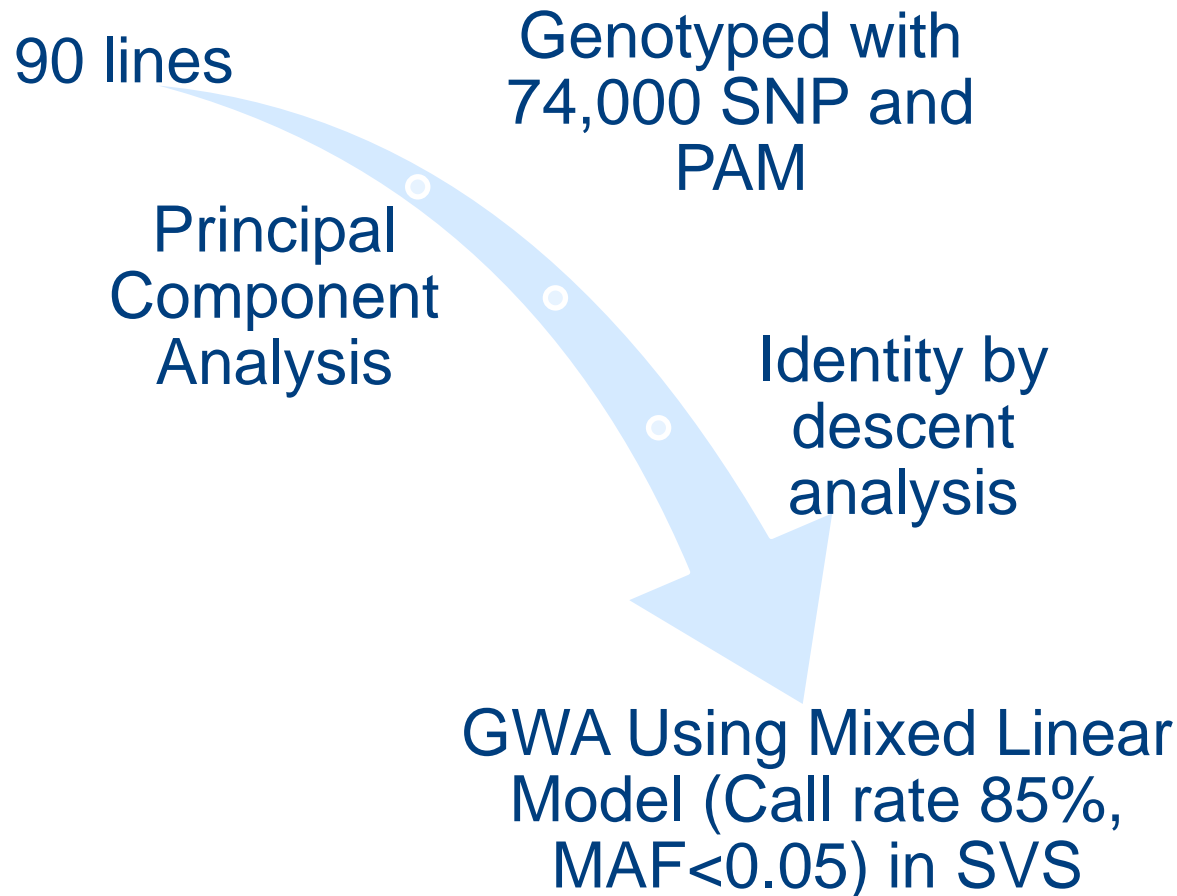
# Variation in Pod Anatomy in *B. napus*, *B. rapa* and *B. carinata*



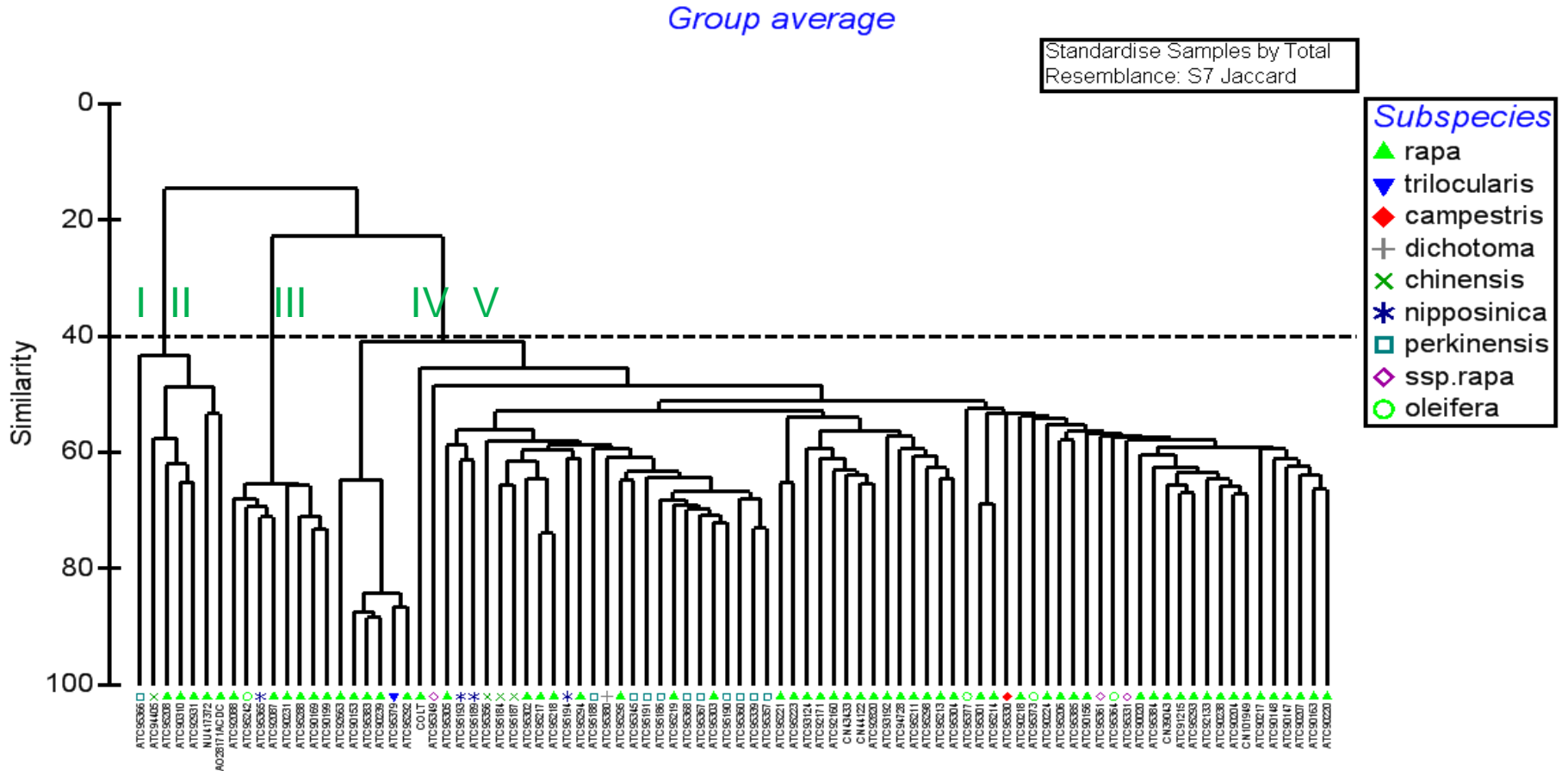
# Molecular diversity in *Brassica* species



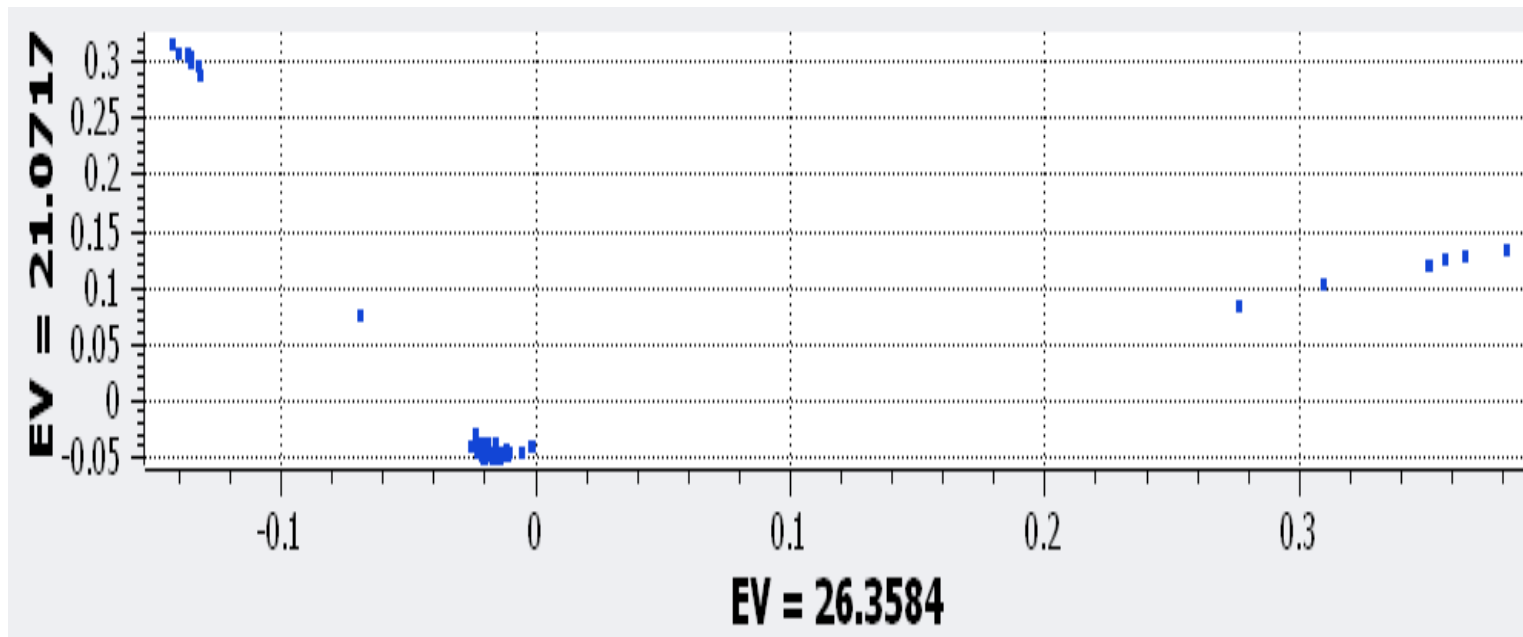
# Genomic regions associated with Shatter Resistance in *B. rapa*



# Cluster analysis of *B. rapa* genotypes based on 10420 GBS markers

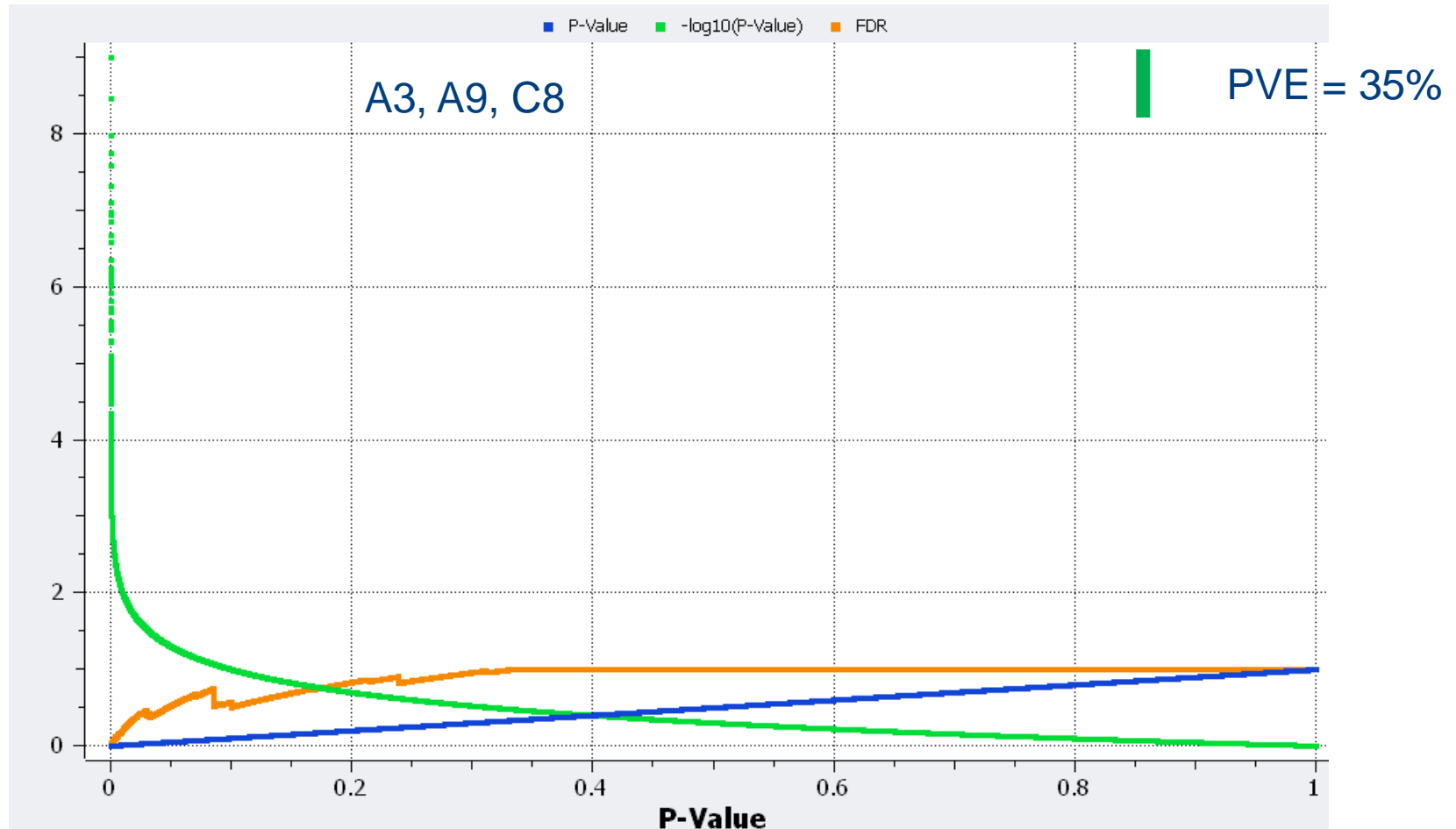


# Principal component analysis of *B. rapa* genotypes

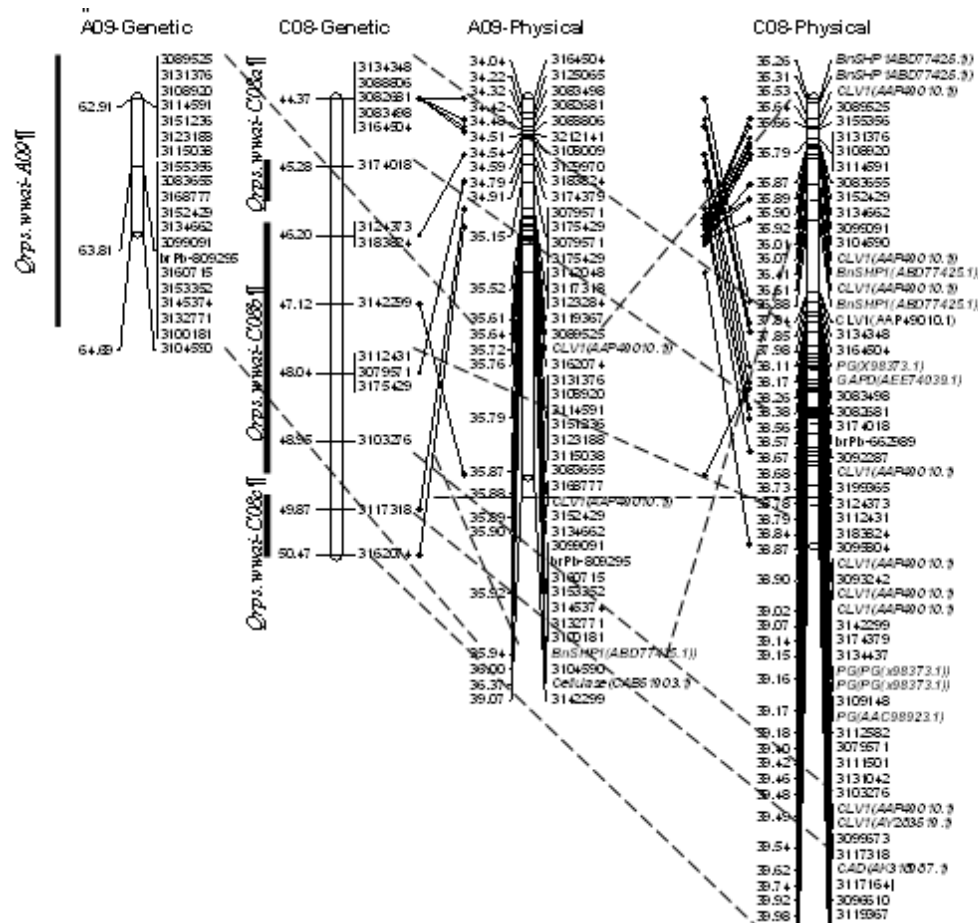




# Genome-wide markers associated with shatter resistance in *B. rapa*

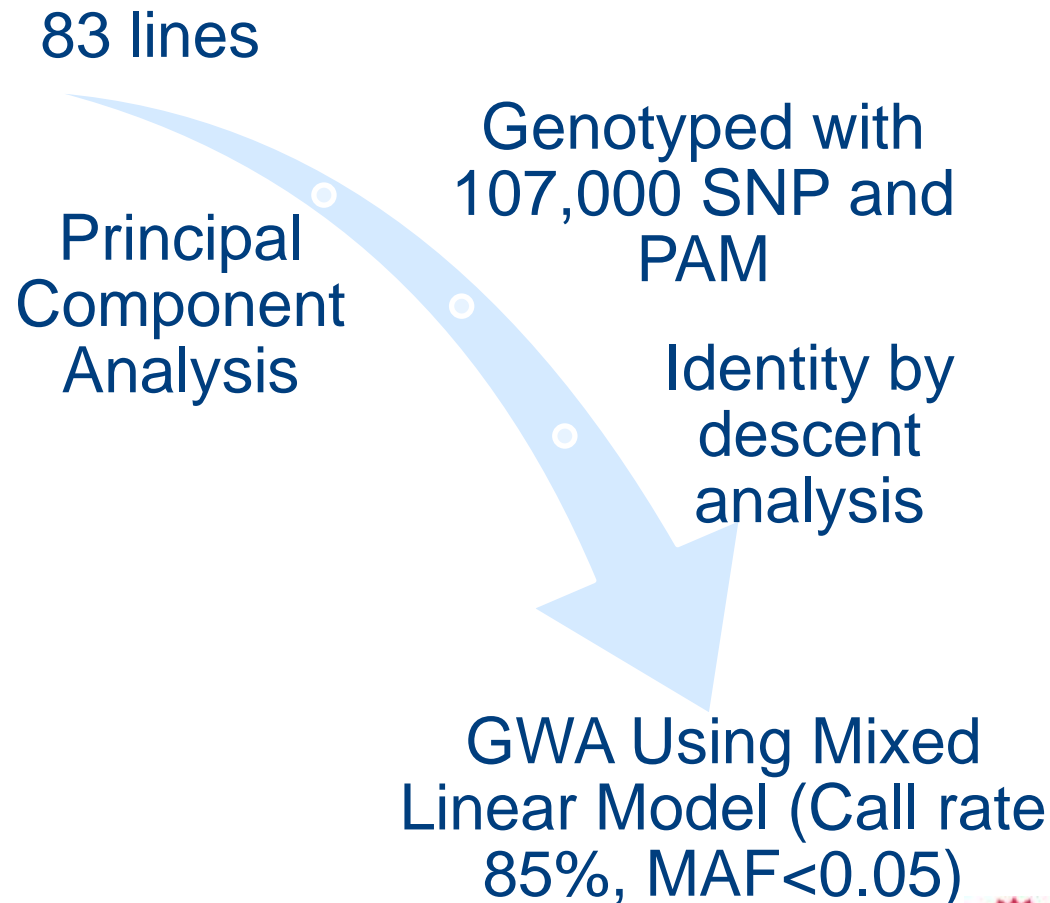


# Some of QTL identified with GWAS are collocated with QTL in BLN2762/Surpass400



GWAS  
- Structure  
Kinship  
Structure+  
Kinship

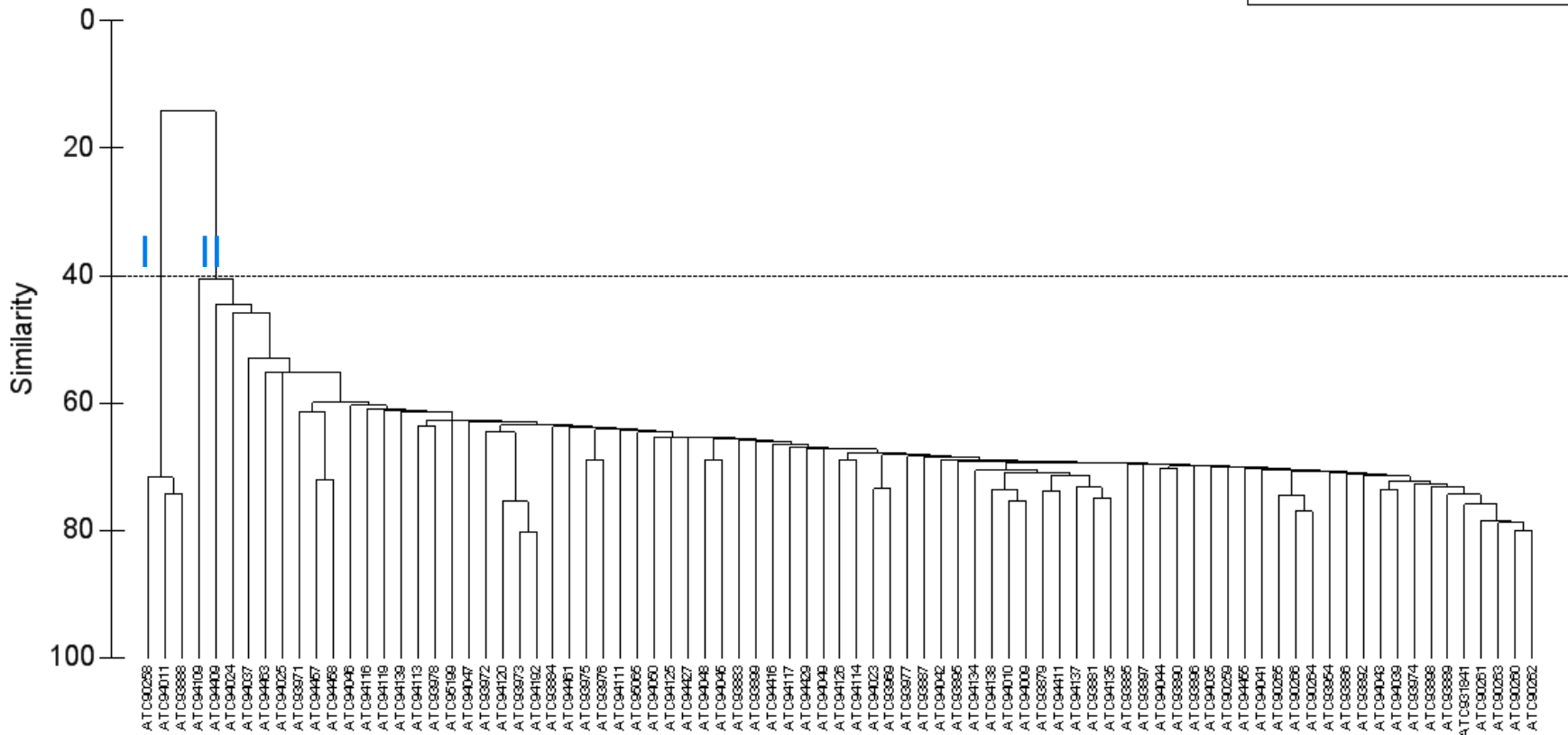
# Genomic regions associated with shatter resistance in *B. carinata*



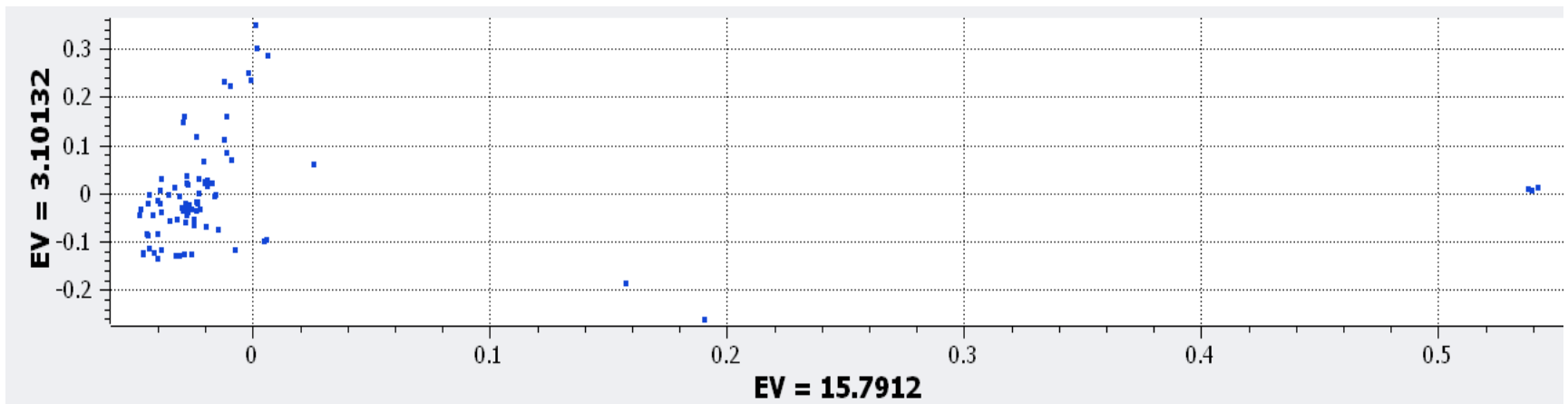
# Cluster analysis of *B. carinata* genotypes based on 10420 GBS markers

Group average

Standardise Samples by Total Resemblance: S7 Jaccard

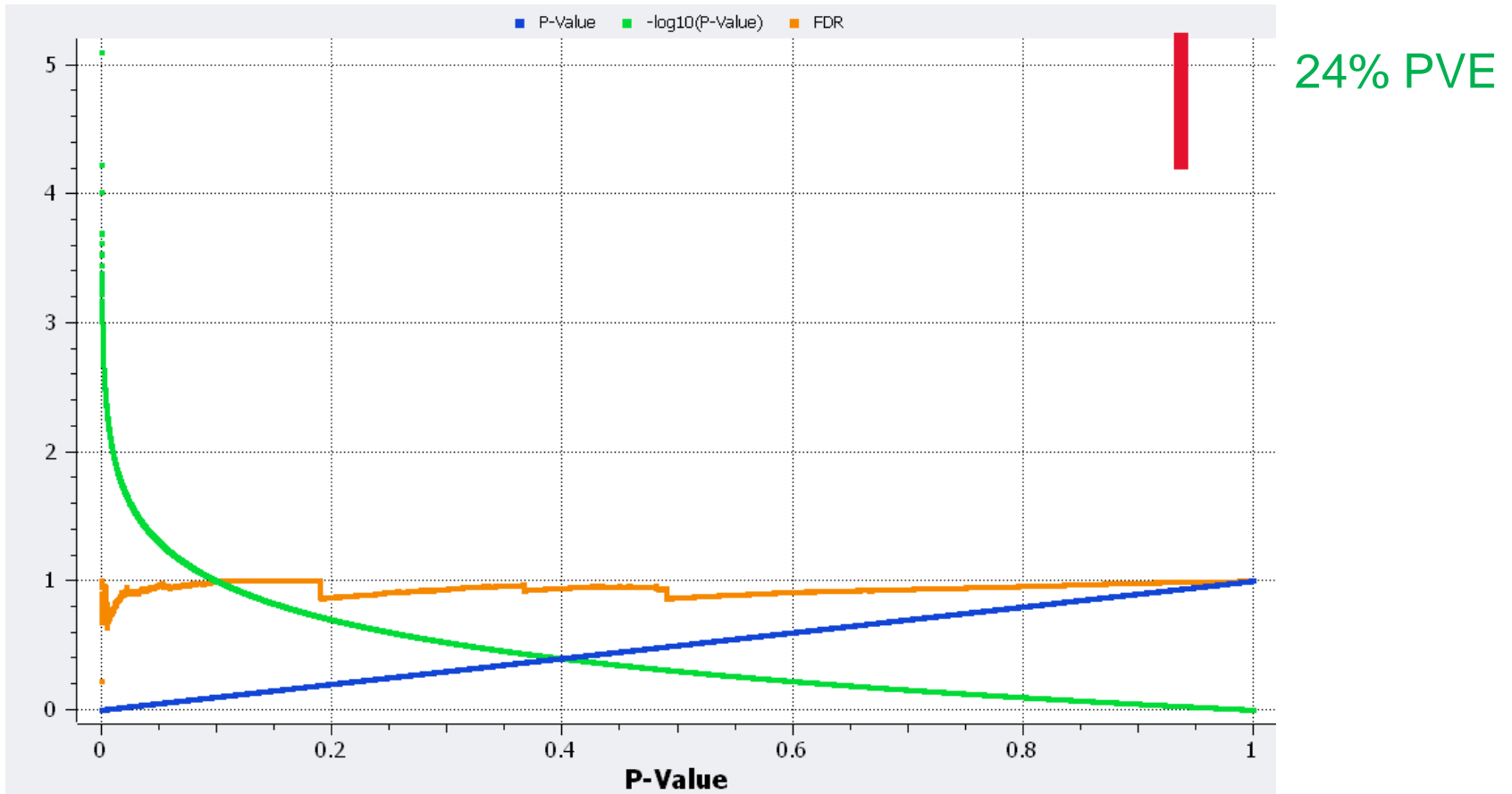


# Principal component analysis of *B. carinata* genotypes





# Genome-wide markers associated with shatter resistance in *B. carinata*



# Summary

- Based on pod strength (high rupture energy) and pod anatomy
  - Identified several accessions of *B. carinata* and five of *B. rapa* less prone to pod shatter
- Evaluating new-type napus ( $A^{r/n}A^{r/n}C^{c/n}C^{c/n}$ ) and *B. napus/B. carinata*, *B. napus/B. rapa* introgression lines
  - China (Dr. Jingling Meng)
  - India/Australia (Dr. Phil Salisbury, UM)
  - Nuseed (Dr. Nelson Gororo)
- GWA signals are being validated in the bi-parental populations
- Identifying candidate genes for pod shatter resistance in *B. rapa* and *B. carinata*

# Acknowledgements

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- Denise Barbulescu
- Nelson Gororo
- Greg Buzza
- Jingling Meng
- Andrew Easton



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