

Anthracnose resistance breeding in yellow lupins

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**Grains
Research &
Development
Corporation**



Department of
Agriculture and Food



Outline of the talk

- Importance of yellow lupin in WA
- Challenges faced by yellow lupin
- How we found sources of resistance to anthracnose
- What we have achieved so far and
- Implications of this finding to yellow lupin breeding program

Importance of yellow lupin (*Lupinus luteus*)

- Higher protein content, >38%
- Excellent feed for aquaculture
- Resistant to brown spot and Pleiochaeta root rot
- Adapted to highly acidic soils (pH below 4.5) with high level of Al
- Can extract P from phosphate fixing soils
- Tolerates transient water logging conditions
- Potential area in WA ~300,000 ha

Challenges for expansion of yellow lupin industry

- Low yield
- Aphid susceptibility
- Anthracnose susceptibility
- Being a native from relatively high rainfall area in Iberian Peninsula, it is easily affected by drought

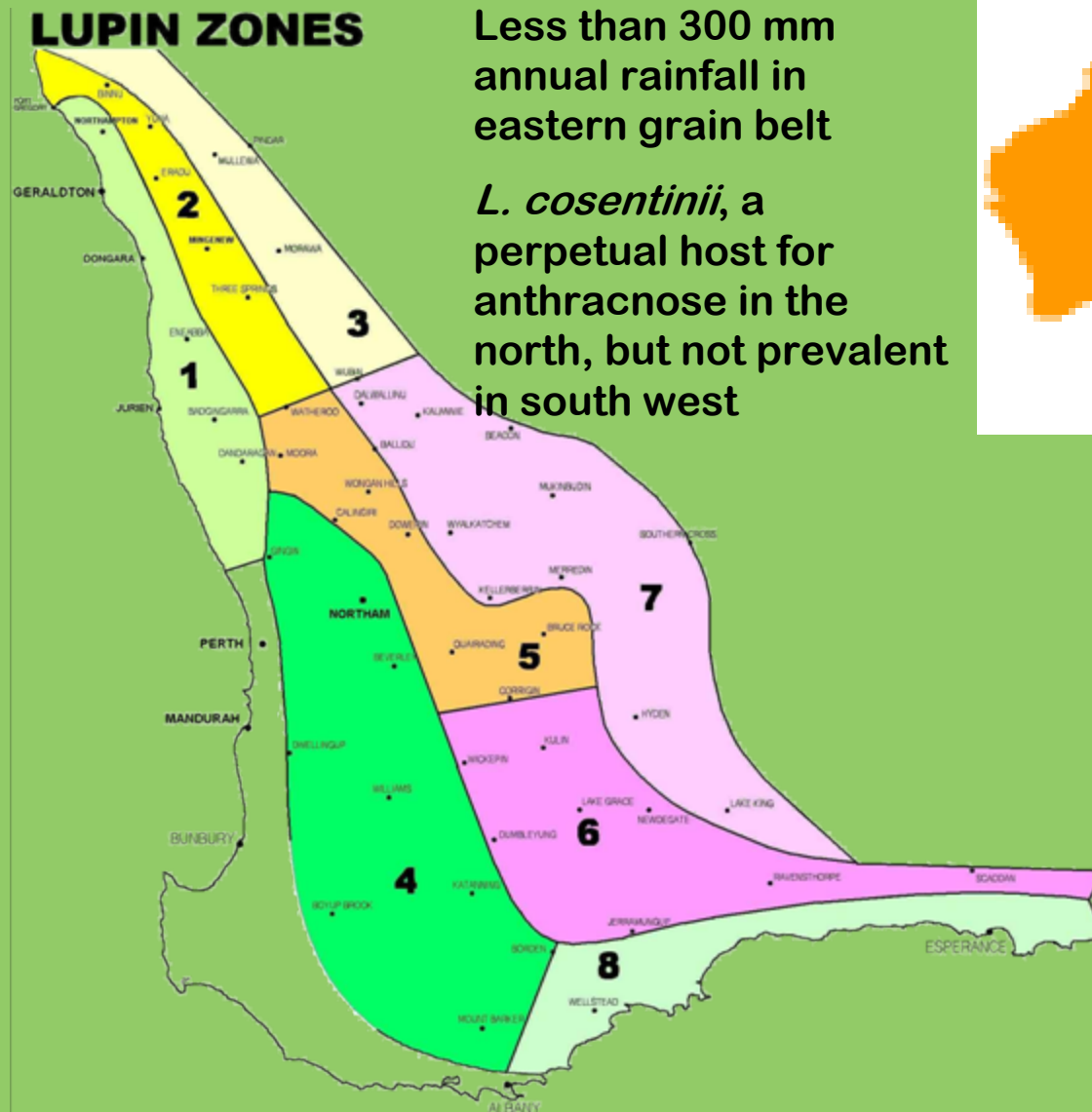


Important diseases of yellow lupins in WA



- Anthracnose (*Colletotrichum lupini*)
- Cucumber Mosaic Virus, controlled by a single dominant gene (*Ncm1*)
- Phomopsis (*Diaporthe toxica*), not prevalent in broad-acre farming area and caused by a pathotype separate from that infecting *L. angustifolius*

Cropping area in Western Australia



Less than 300 mm
annual rainfall in
eastern grain belt

L. cosentinii, a
perpetual host for
anthracnose in the
north, but not prevalent
in south west



Finding a source of anthracnose resistance



- Screened >200 lines in New Zealand disease nursery in 1996/97
- Screened additional 100 *luteus* and 40 *hispanicus* lines from WA germplasm bank in 2000
- Literature indicated a resistance in USDA collection
- USDA germplasm introduced, screened and one line PI168539 (P28716) was found with some resistance in 2001
- Immediately crosses were made, progeny advanced and F6 and F7 progenies tested against anthracnose

Field screening method



Finding a source of anthracnose resistance



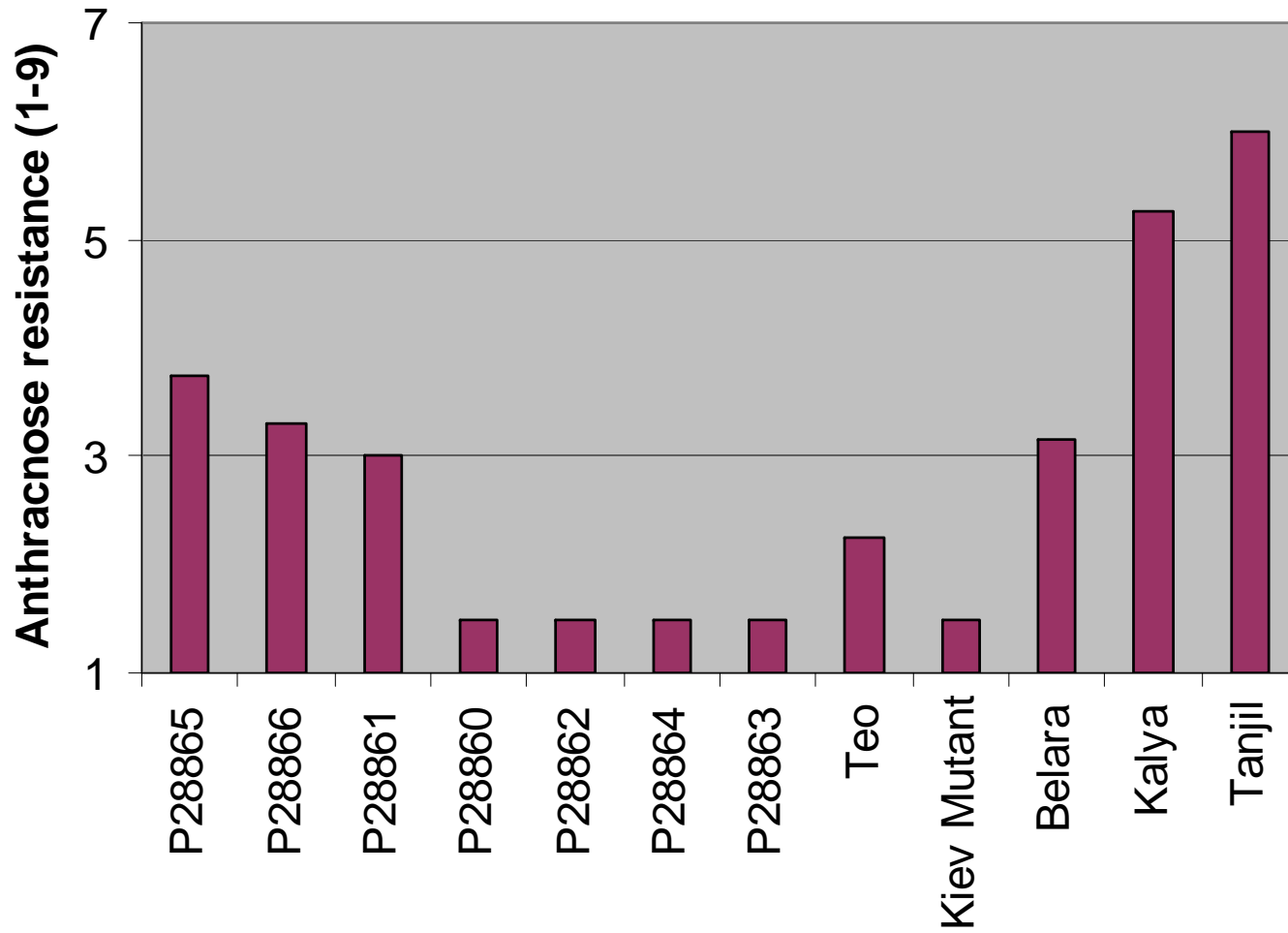
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Finding a source of anthracnose resistance

- Overseas work in Poznan, Poland from 2001-03, some resistance found, but not adequate
- Literature indicated resistance in Russian germplasm from Bryansk
- Germplasm from RLRI, Bryansk, Russia imported and screened in 2004
- We continued screening WA breeding population

■ Results

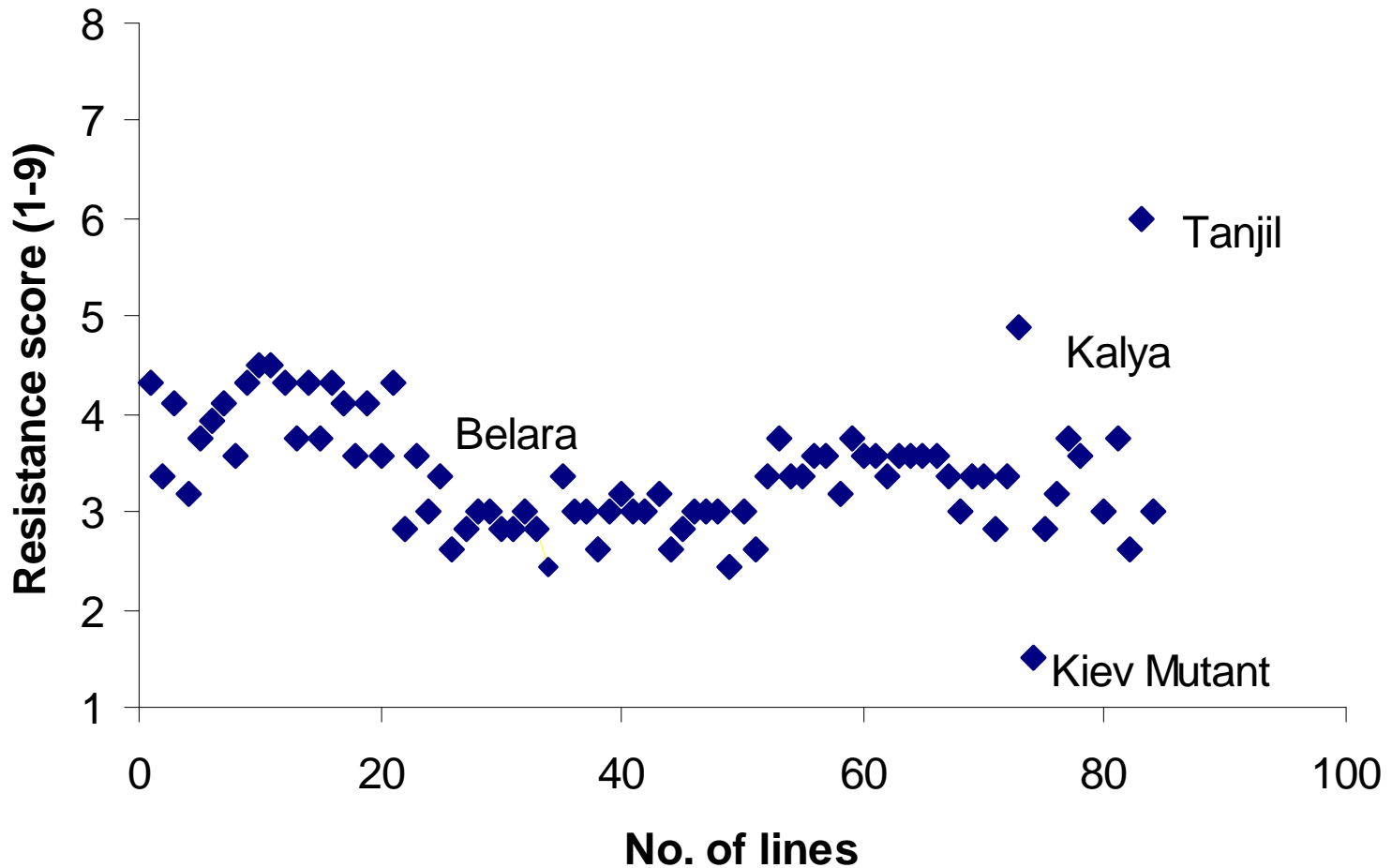
Anthracnose resistance of Russian lines



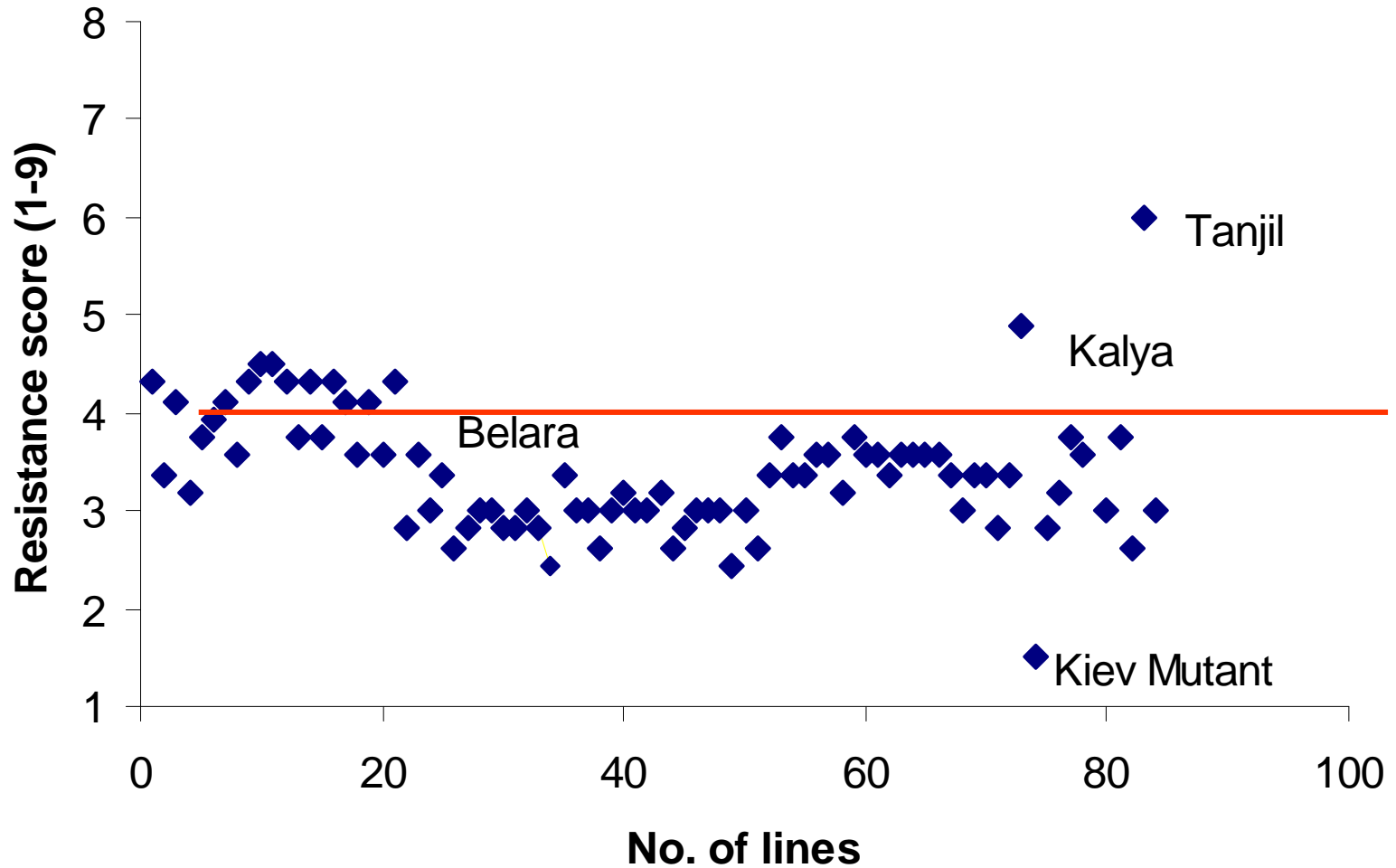
**Anthracnose resistance in crossbreds
derived from a cross involving a
Hungarian cv Gyulatanya (P20856)**



Anthracnose resistance in *L. luteus* lines derived from P28716 (USDA source)



Anthracnose resistance in *L. luteus* lines derived from P28716 (USDA source)



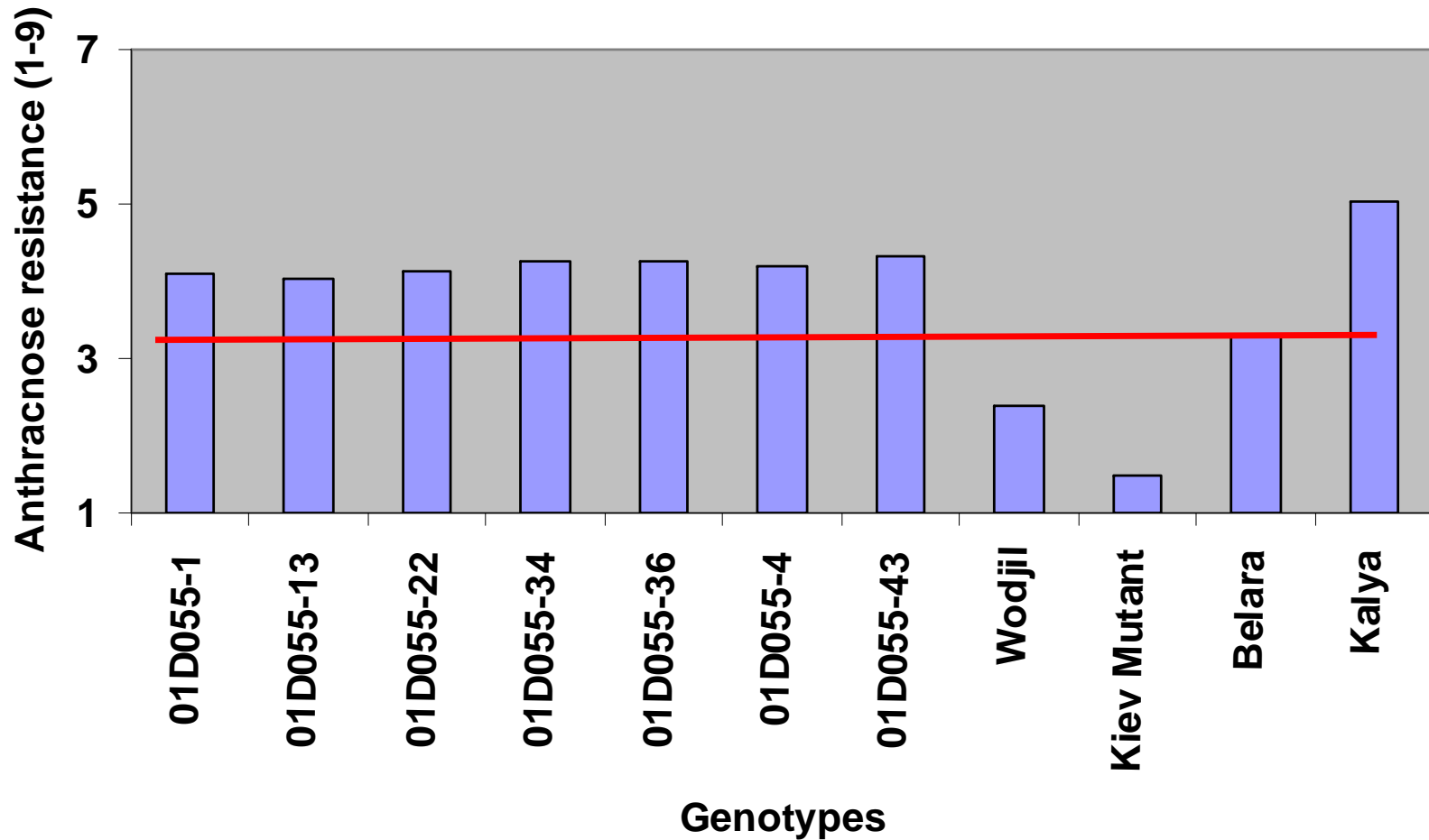


A resistant crossbred,
01D055-1



Wodjil

Selected anthracnose resistant lines



Inheritance studies _ F2 progeny test

| Crosses | Pedigrees | Parent type | % plants with MS |
|--------------|-------------------------|-------------|------------------|
| 06D029 | P28865/97D002-26-16 | Res x Res | 53.4 |
| 06D027 | P28865/01D055-36 | Res x Res | 47.8 |
| 06D006 | 01D055-36/94D016-6-4 | Res x Sus | 37.5 |
| 06D013 | 97D002-26-16/94D016-6-4 | Res x Sus | 20.2 |
| 01D055-36 | 98D013-2/PI168539 | Res parent | 64.9 |
| P28865 | | Res parent | 43.5 |
| 97D002-26-16 | P20856/Wodjil | Res parent | 32.8 |
| 94D016-6-4 | Teo-101/Juno | Sus parent | 13.6 |
| Belara | | | 36.2 |
| Kalya | | | 87.1 |
| SED | | | 8.7 |

Summary

- Three sources of resistance found
- Resistance is highly heritable
- The resistance from P28716 > Russian lines > Hungarian line
- The level of resistance is good enough to grow yellow lupins in southwest of WA where *L. cosentinii*, perpetual host is absent
- Higher resistance required in high rainfall area of northern agricultural region of WA

Acknowledgements

- GRDC for financial support
- Clarice Coyne from USDA and Ana Yakasheva from Russian Lupin Research Institute, Bryansk, Russia for supplying germplasm
- Lupin breeding team for logistic and technical assistance