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**Lincoln  
University**  
*Te Whare Wānaka o Aoraki*  
AOTEAROA • NEW ZEALAND

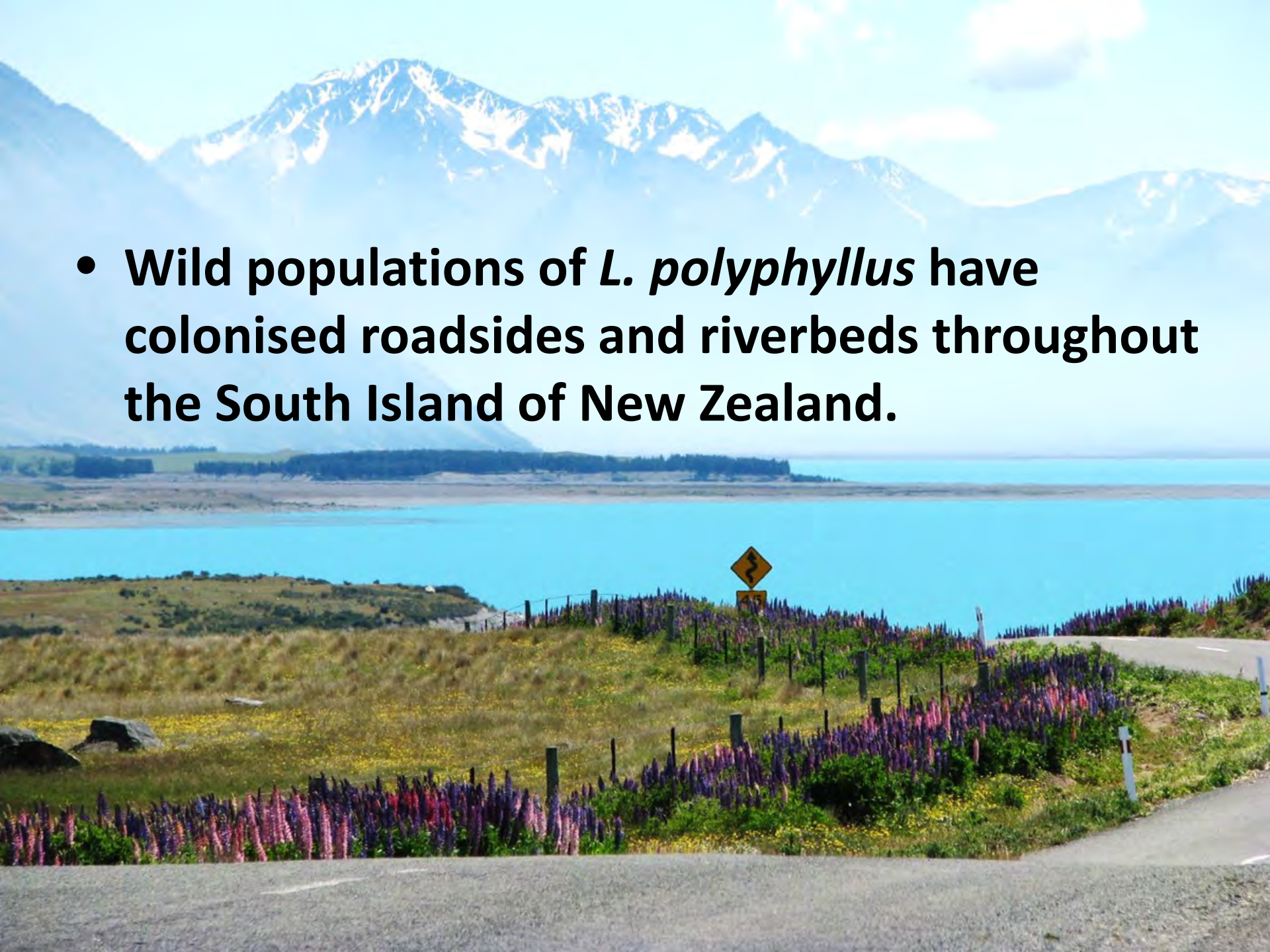


# **Bradyrhizobia with a distinct *nodA* gene nodulate *Lupinus polyphyllus* in New Zealand soils**

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George Hill, Mitchell Andrews

New Zealand's specialist land-based university

- **Wild populations of *L. polyphyllus* have colonised roadsides and riverbeds throughout the South Island of New Zealand.**



***L. polyphyllus* has potential as a forage crop on acidic soils in extensive high country grasslands where other legumes fail to persist.**



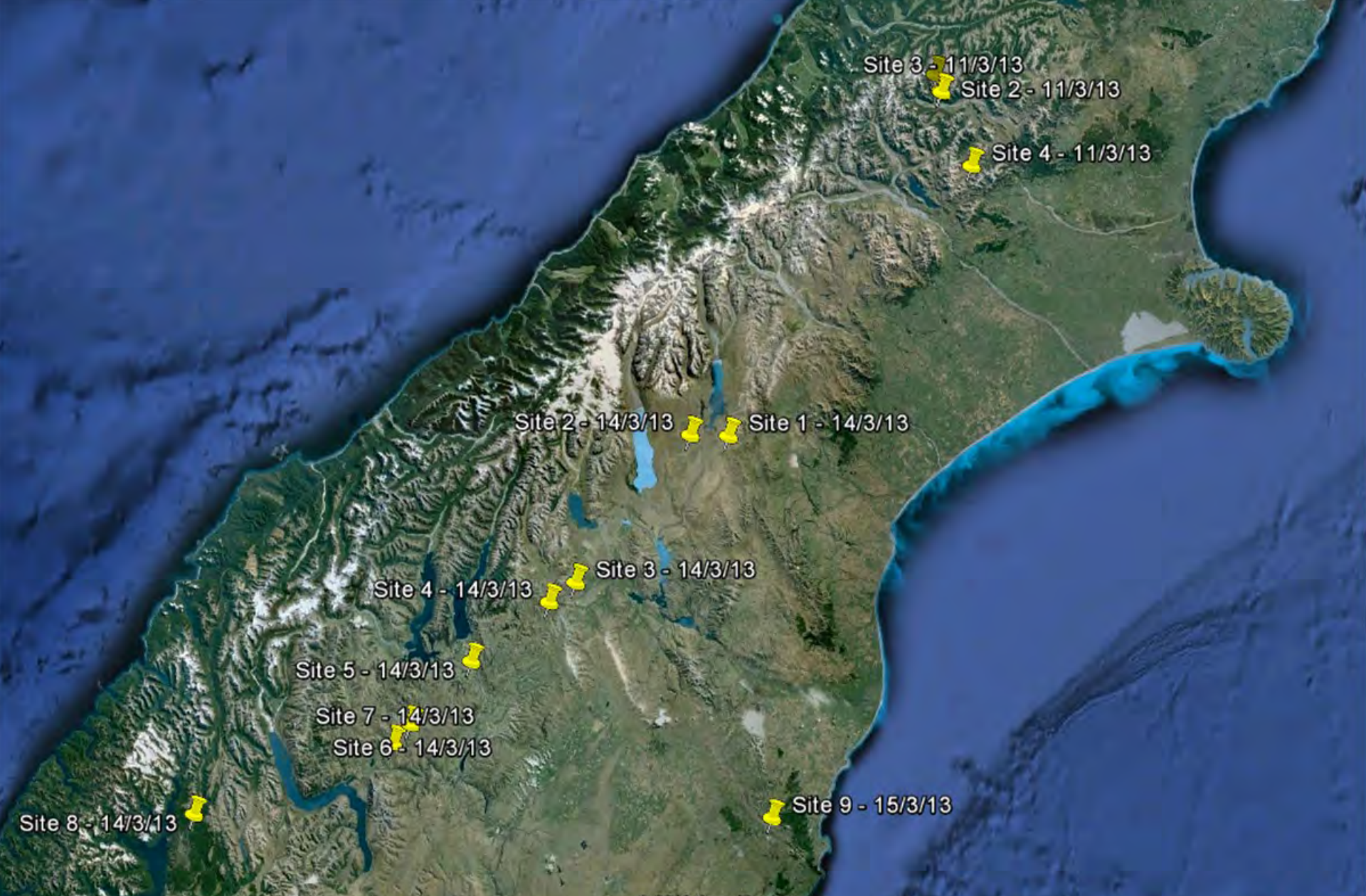




***L. polyphyllus* can fix  $N_2$  via symbiotic bacteria (rhizobia) in root nodules, but its rhizobial symbionts have not been characterised.**

# Objectives

1. Determine if *L. polyphyllus* is nodulated over a wide range of sites throughout the NZ South Island.
2. Genotypically characterise rhizobia that nodulate *L. polyphyllus* based on their 16s rRNA and *nodA* gene sequences.
3. Determine if rhizobia from three other exotic Genisteae weeds (gorse, common broom and tree lucerne) can nodulate *L. polyphyllus*.



**Nineteen rhizobial isolates were obtained from nodules of *L. polyphyllus* plants sampled at field sites across the NZ South Island.**



**All isolates were obtained from wild roadside populations of *L. polyphyllus* except for two obtained from Sawdon Station, Tekapo.**



ROOT NODULE BACTERIA  
STORE IN A COOL PLACE

**Nodulaid® N/T**

A potent inoculant for nitrogen fixation and increased yields  
1 x Nodulaid Rhizobium Inoculant  
1 x Sachet of Nodulating Trigger

GROUP G  
LUPIN

‘Group G’ commercial  
inoculant



*Cytisus scoparius*, common broom



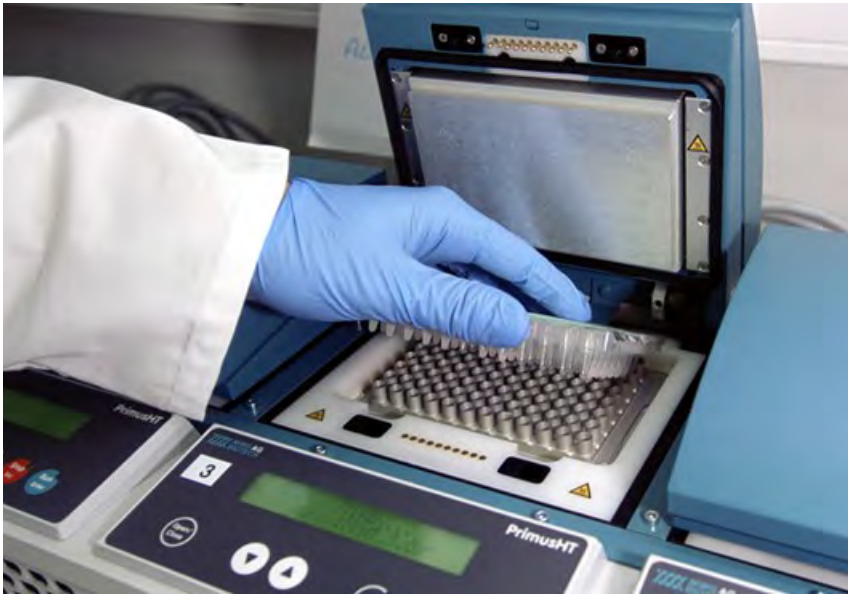
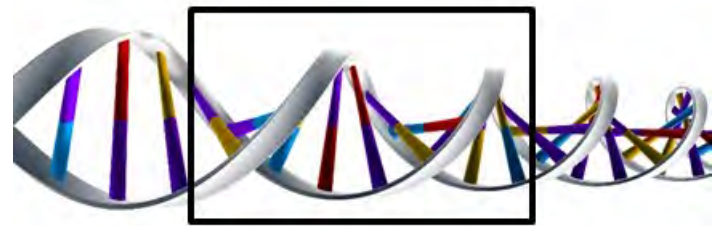
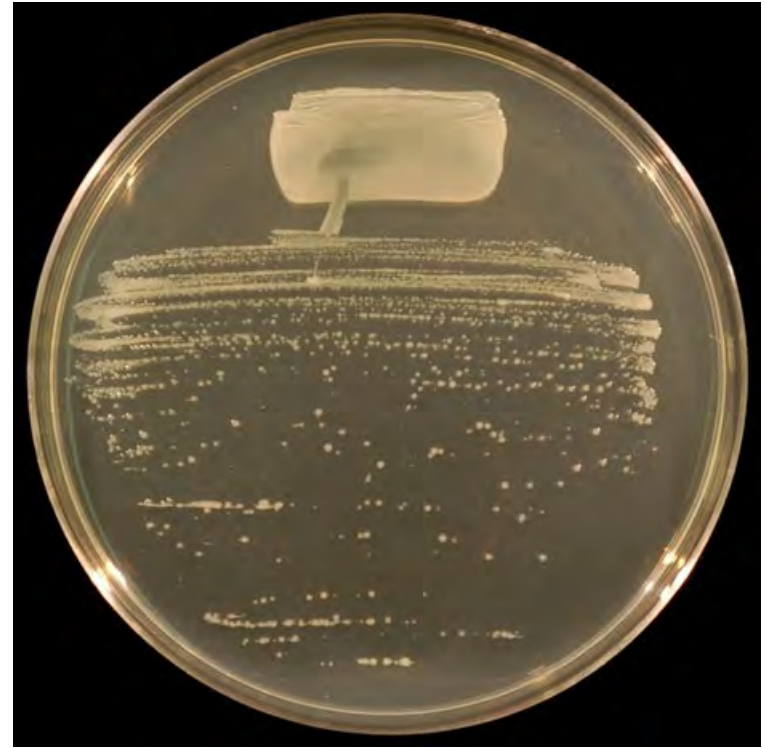
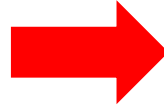
*Ulex europaeus*, gorse



*Chamaecytisus palmensis*, tree  
lucerne

# *Ulex europaeus*, gorse







- All isolates were tested for nodulation and nitrogenase activity on *L. polyphyllus* plants in sterile laboratory conditions.



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# Results



***L. polyphyllus* plants were heavily nodulated from all field sites sampled across the NZ South Island. These nodules were pink inside.**



**Nineteen bacterial isolates from these nodules formed functional nodules on *L. polyphyllus*.**

# Phylogenetic tree of 16s rRNA gene sequences

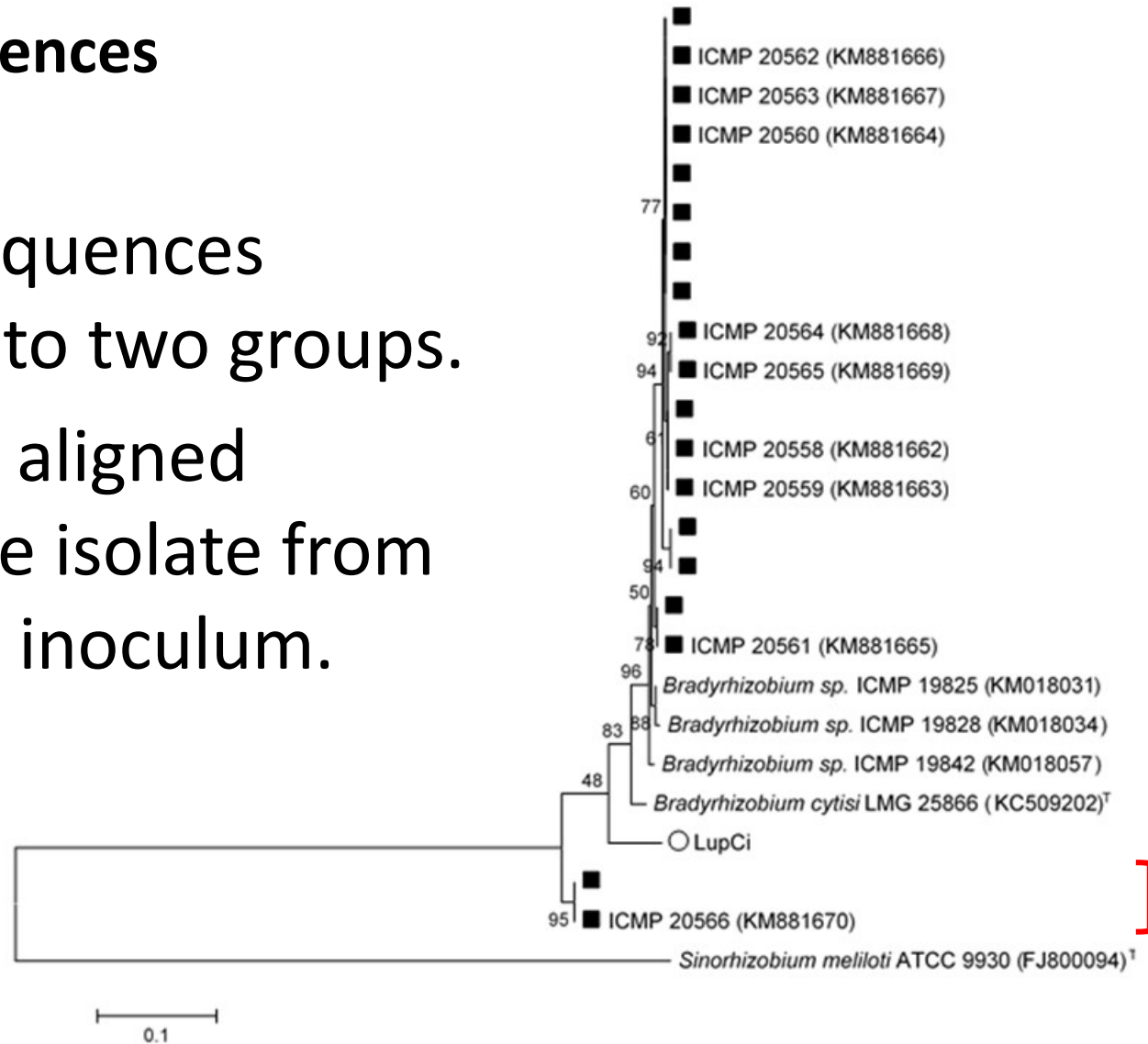
- The gene sequences identified all 19 isolates as *Bradyrhizobium* sp.
- The 16s rRNA gene sequences separated into four groups.





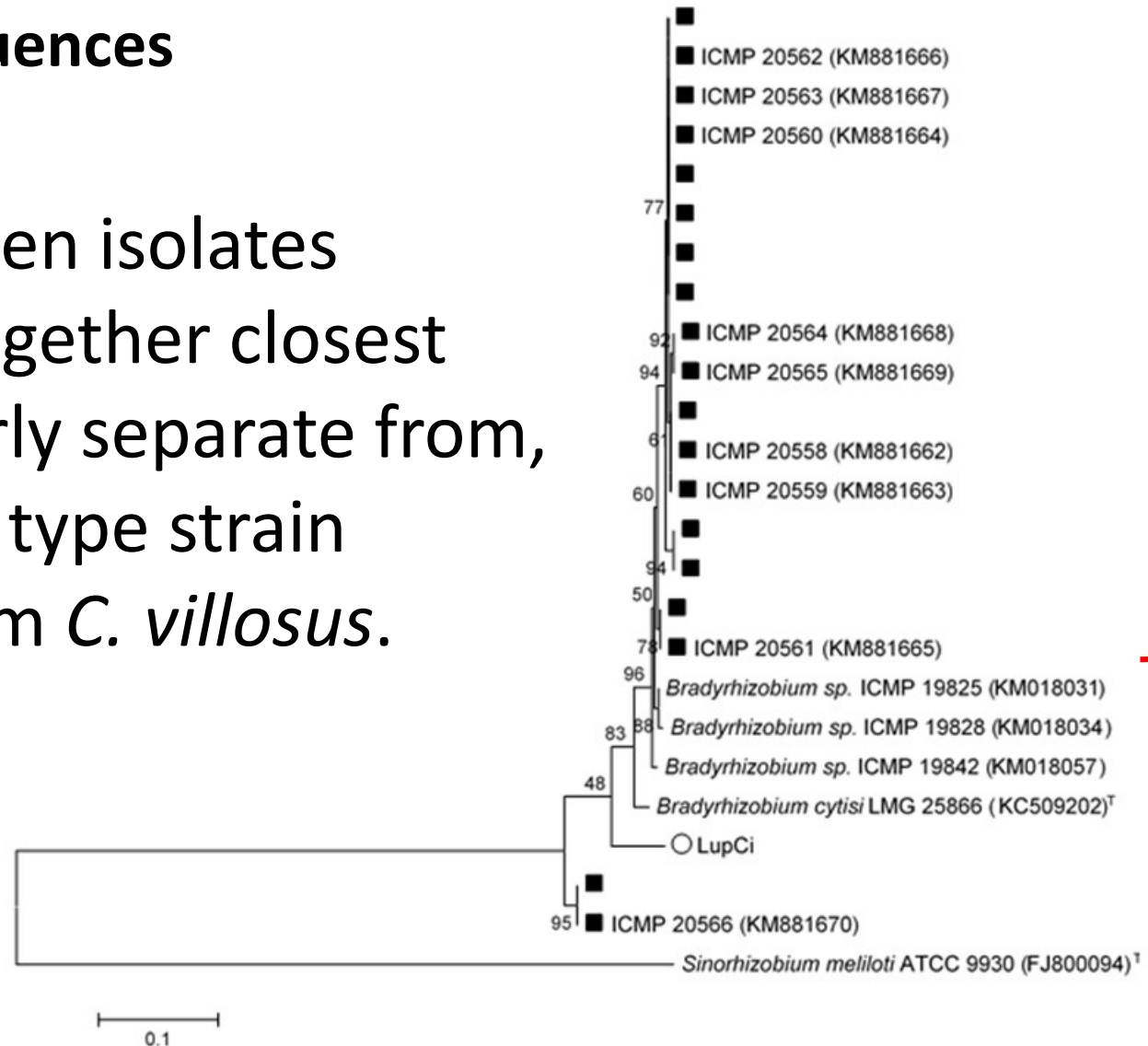
# Phylogenetic tree of *nodA* gene sequences

- The *nodA* sequences separated into two groups.
- Two isolates aligned closest to the isolate from the Group G inoculum.



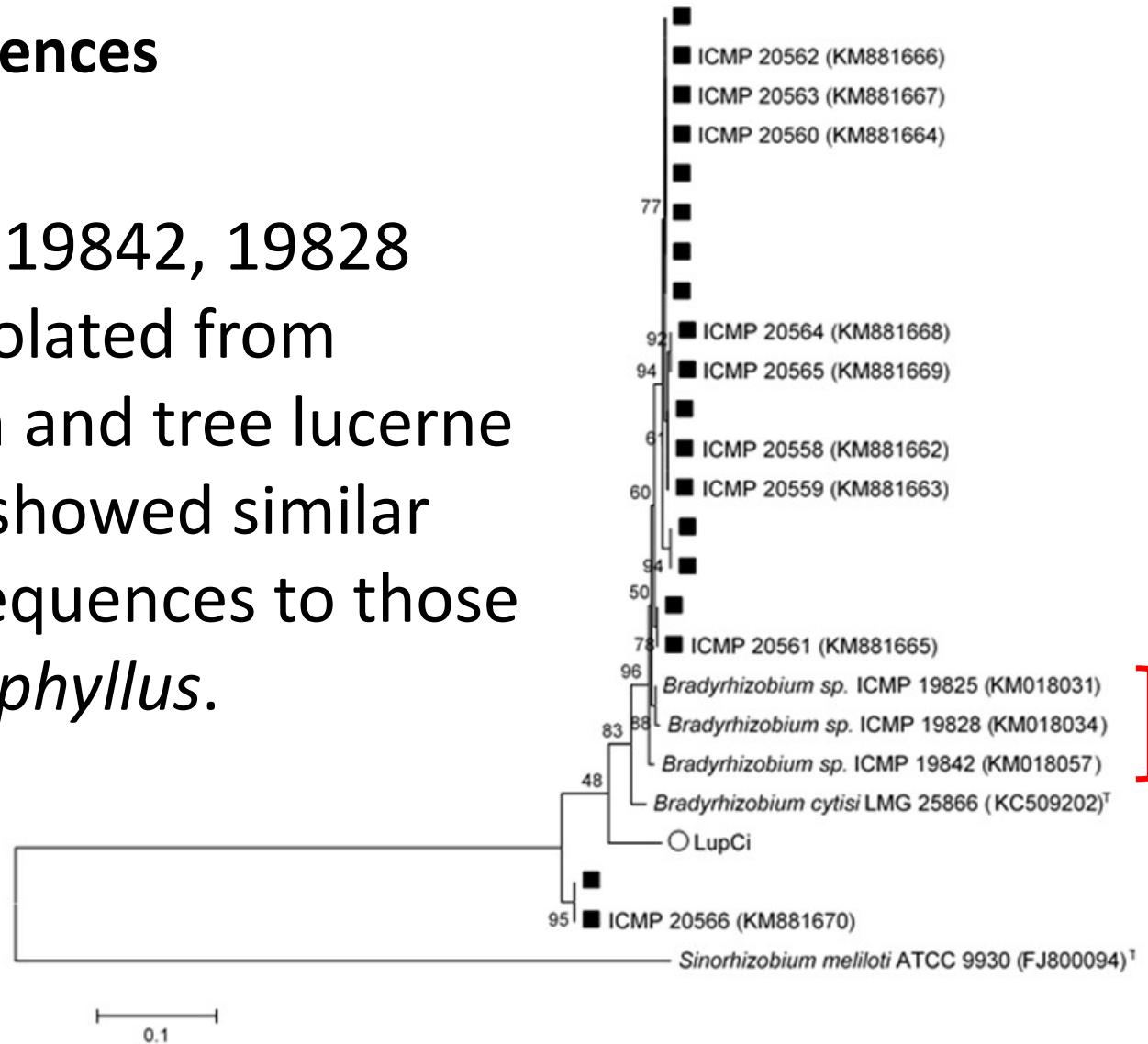
# Phylogenetic tree of *nodA* gene sequences

- But seventeen isolates clustered together closest to, but clearly separate from, the *B. cytisi* type strain isolated from *C. villosus*.



# Phylogenetic tree of *nodA* gene sequences

- Strains ICMP 19842, 19828 and 19825 isolated from gorse, broom and tree lucerne respectively showed similar *nodA* gene sequences to those of the *L. polyphyllus*.



# Conclusions

- *Bradyrhizobium* strains that can nodulate *L. polyphyllus* are widespread in NZ South Island.
- These bradyrhizobia have distinct *nodA* gene sequences.
- It seems likely that *L. polyphyllus*, gorse, broom and tree lucerne share a common pool of bradyrhizobia in NZ South Island.

# Acknowledgements

- NZ Merino Company, Struthers Trust, Sinclair Cummings Trust and Alexander Agribusiness for scholarships received by Ryan-Salter
- Brian Mason Scientific and Technical Trust



# Effect of different rhizobia on common broom



# Effect of different rhizobia on tree lucerne

