Developing restoration techniques for northern rata: a once-common hemiepiphyte

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Hemiepiphytes

- 1° hemiepiphyte - Plants that begin life as an epiphyte then send roots to the ground.
- 2° hemiepiphyte - Begin life as a terrestrially-established seedling that secondarily becomes epiphytic by severing all links to the ground.
- Estimated to be 823 species of 1° and 649 species of 2° hemiepiphyte from 59 genera (Williams-Linera and Lawton 1995)
- Almost all are tropical (except for NZ)



Some ecological questions

1. Epiphytic establishment and host specificity

   Are hemiepiphytes non-random in their choice of host (species/size) and tree position and what mechanisms drive this choice?

2. Life as an epiphyte

   How do hemiepiphytes cope with low water and achieve mechanical support as an epiphytic seedling?

3. 'Metamorphosis'

   What changes occur in plant physiology and growth rates when arboreal roots reach the ground?

Metrosideros robusta

- Northern rata
- Distribution – North Island forests, northwest Nelson, North Westland
- Hemiepiphytic and terrestrial growth forms
- Canopy emergent and forest dominant
- Important nectar source
- High epiphyte loads itself

Early impressions

The Rata Valley – Karori tree myrtle
William Fox 1850

Rata Tree, Wellington
Charles Gold 1850

Was it common?

Cheeseman (1906)
M. robusta – "abundant in forests from North Cape southwards to Marlborough, Nelson and Westland"

Cockayne (1928) recognised "northern rata forest" as one of the major broad-leaved tree communities.

Zotov et al. (1938)
Tararuas – "..rata found in abundance in the wet western area." Dominant canopy tree is northern rata or rimu.

McKelvey and Nicholls (1957):
Recognised 73 forest types in North Island. 25 (34%) of these had *M. robusta* as a major "physiognomic prominent"

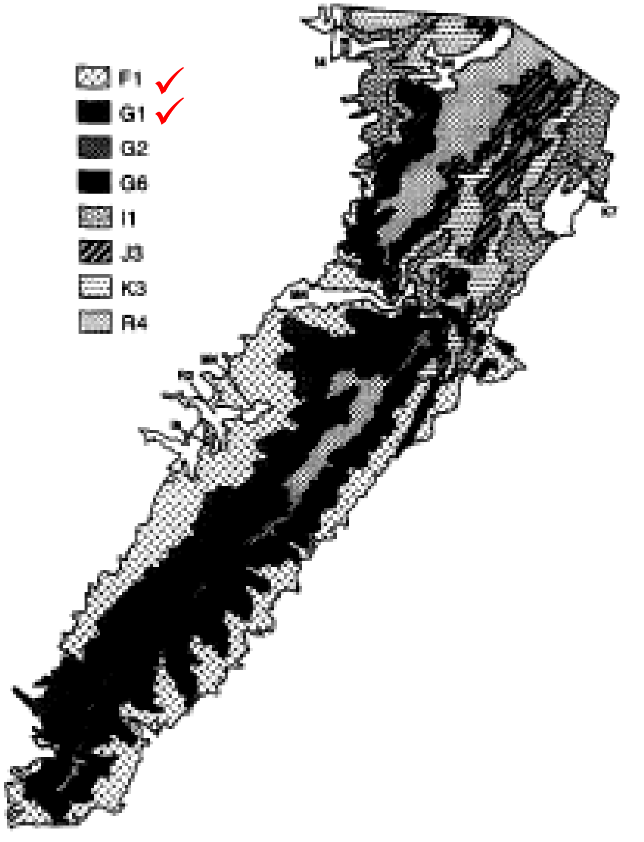
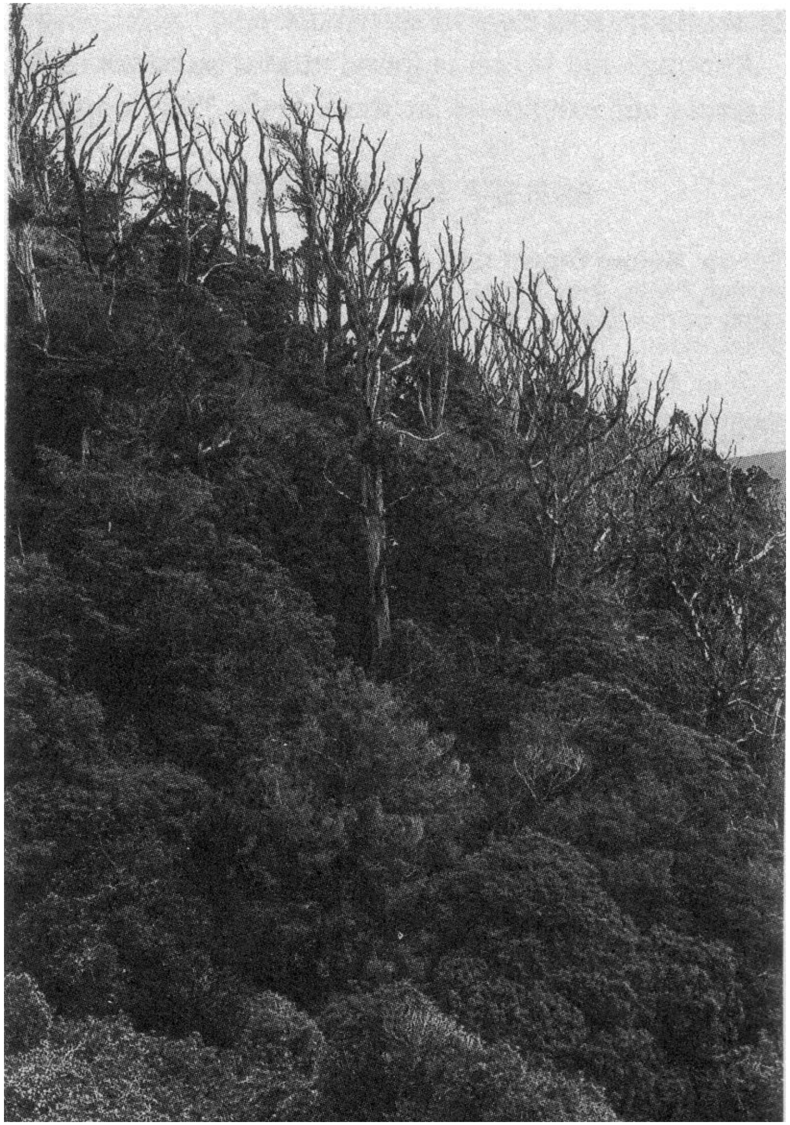


Fig. 2. Distribution of forest types (see Table 1) in 1946 in the southern Ruahine Range (after McKelvey & Nicholls, 1957; Nicholls, 1976; J. L. Nicholls, personal communication).

(Rogers and Leathwick 1997)

Decline



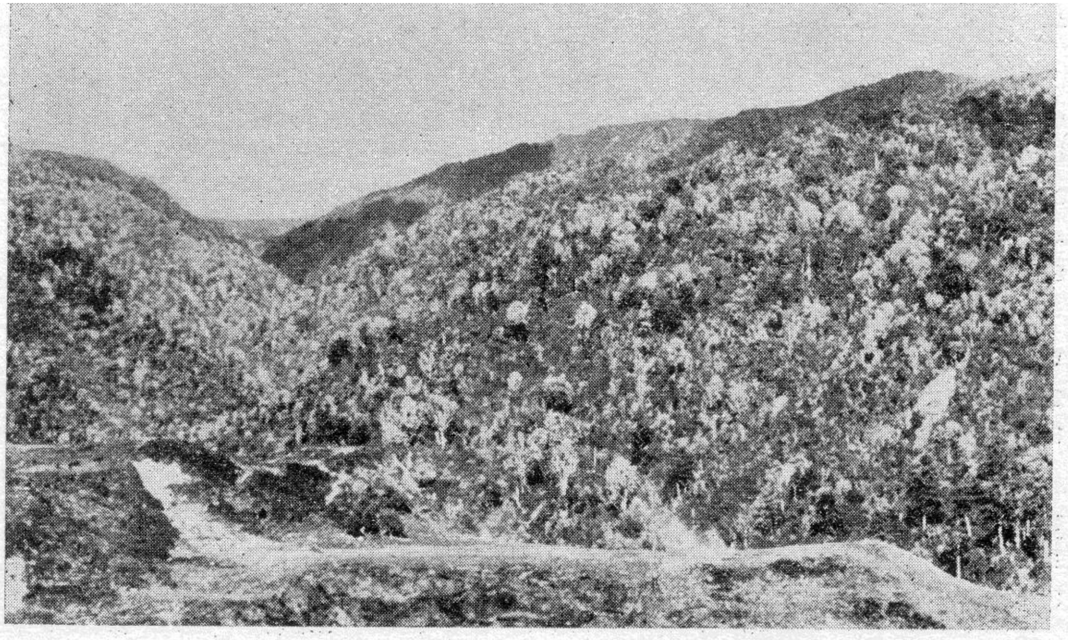


Fig. 4.—Dead trees on northerly faces above junction of Pohangina River and Piripiri Stream, western Ruahines.

Ruahines 1958

Orongorongo Valley
Trees died 1930-1950

Possums as the cause

- Northern rata foliage highly palatable to possums
- Possums severely browse trees
- Dieback events have broadly followed spread of possums through New Zealand
- Trees that are protected from possums recover

Restoration?

- Attempt only where possums absent or under sustained control (e.g.,sanctuaries)
- Terrestrial or epiphytic?
- If epiphytic:
  - on what hosts and establishment sites?
  - how to get roots into the ground?
  - how to accelerate growth?

Restoration trial at Karori Wildlife Sanctuary

Now possum free
Previously northern rata a forest dominant

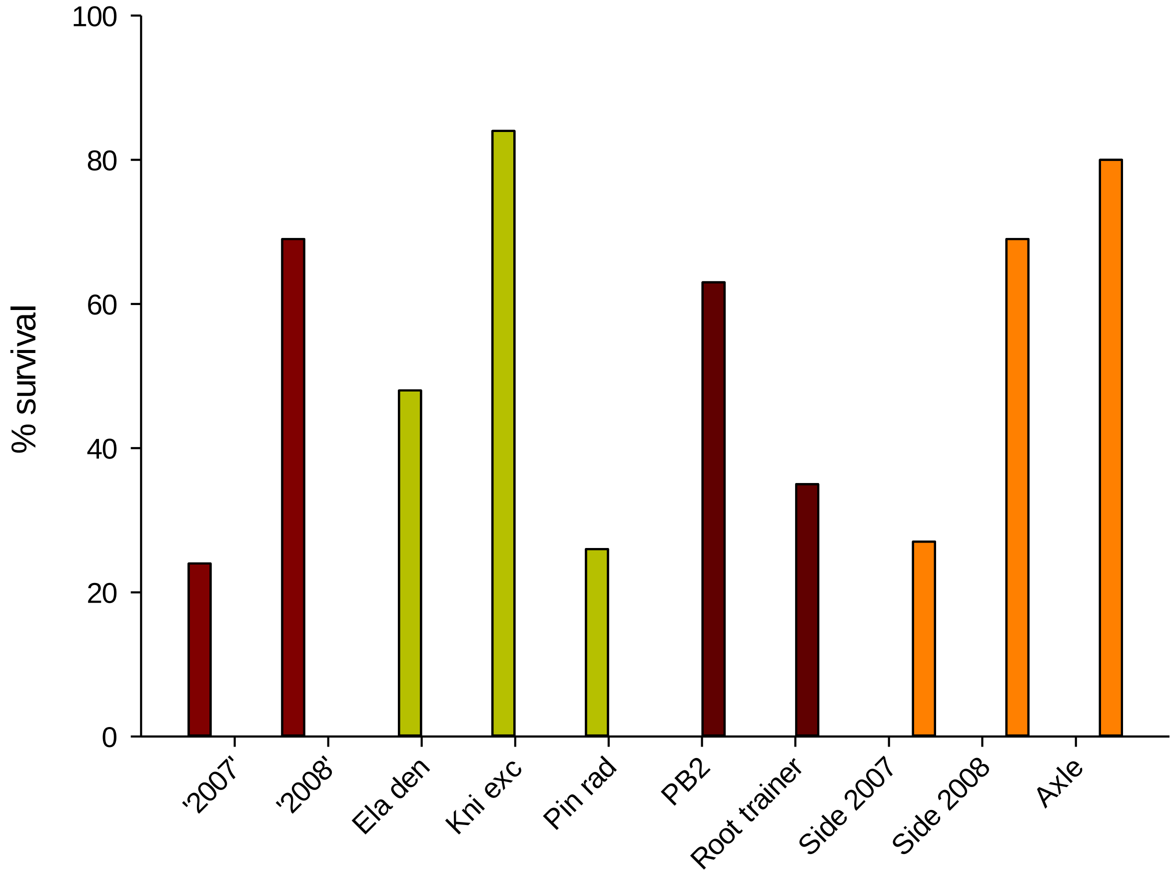
How to establish northern rata epiphytically?
Key environmental factors – water, light, bark type?

200 seedlings planted in July 2007
189 seedlings planted in July 2008

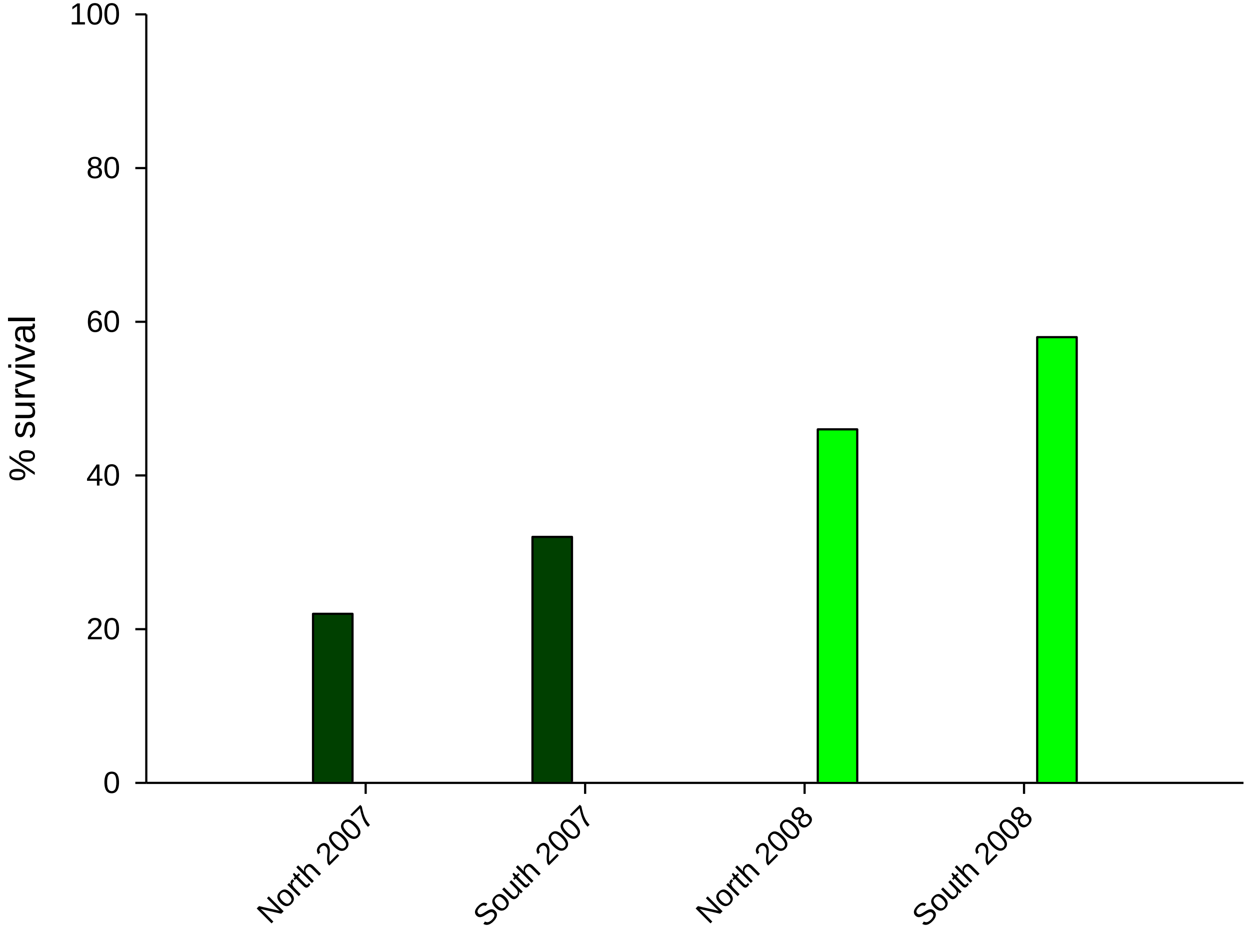
Factor:
1. host (*Pinus radiata, Elaeocarpus dentatus, Knightia excelsa*)
2. rooting volume (PB2 versus root trainers)
3. aspect (north versus south)
4. position on trunk – (side versus axle)

Zealandia - Karori Wildlife Sanctuary

Survivorship over 3 years of northern rata seedlings at Karori (2007-2010 or 2008-2011)

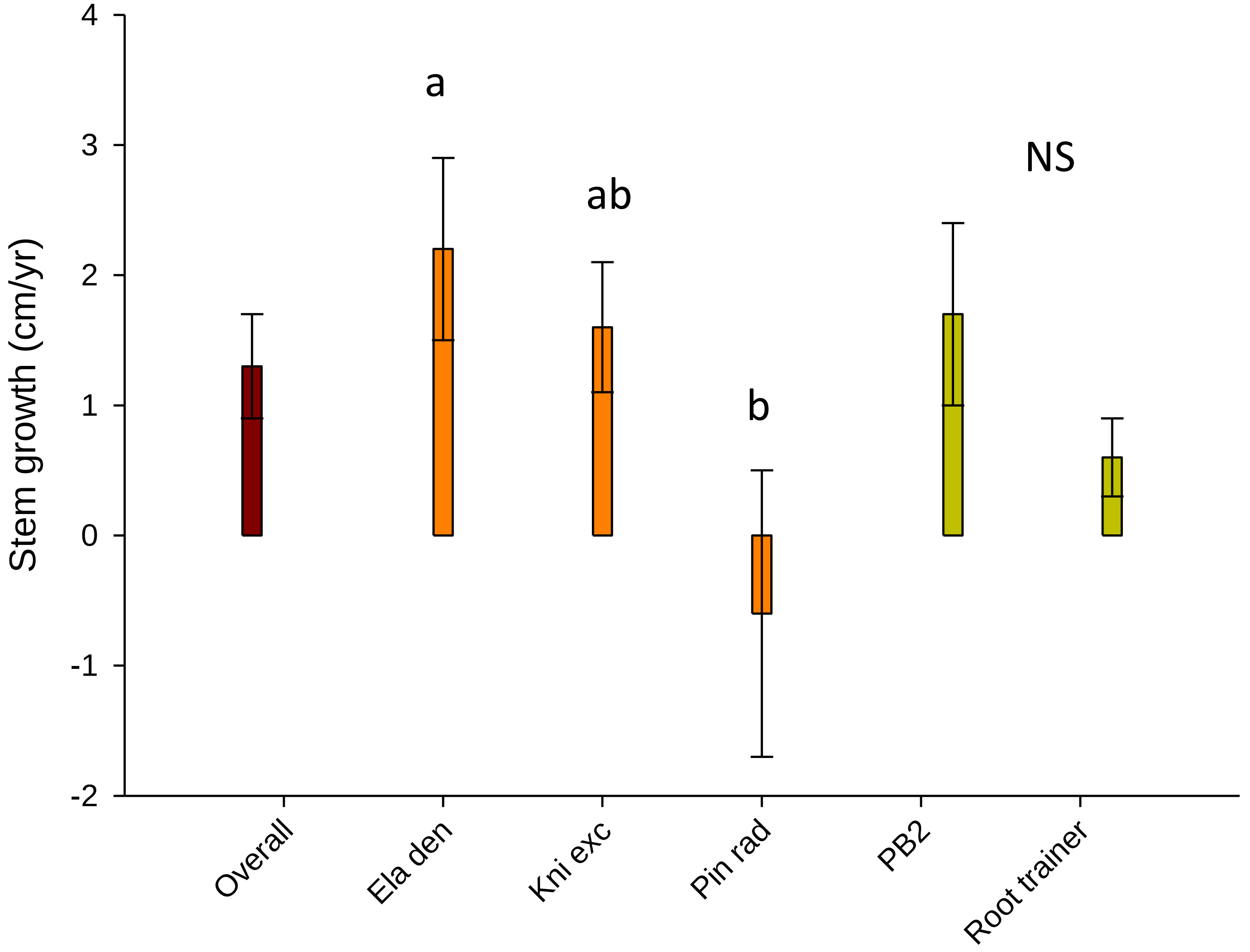


Aspect



100
80
60
40
20
0
% survival
North 2007
South 2007
North 2008
South 2008

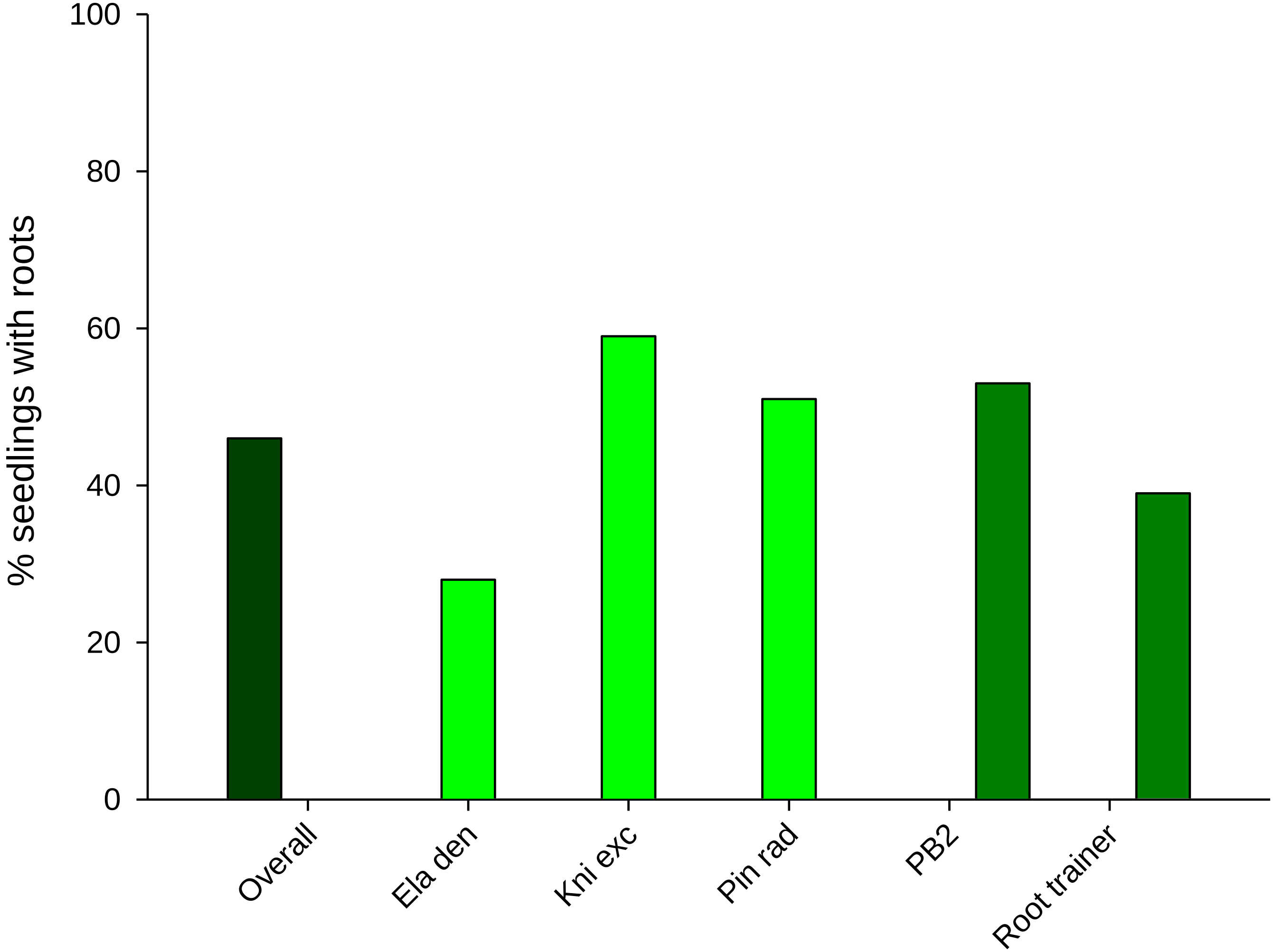
Stem growth rates



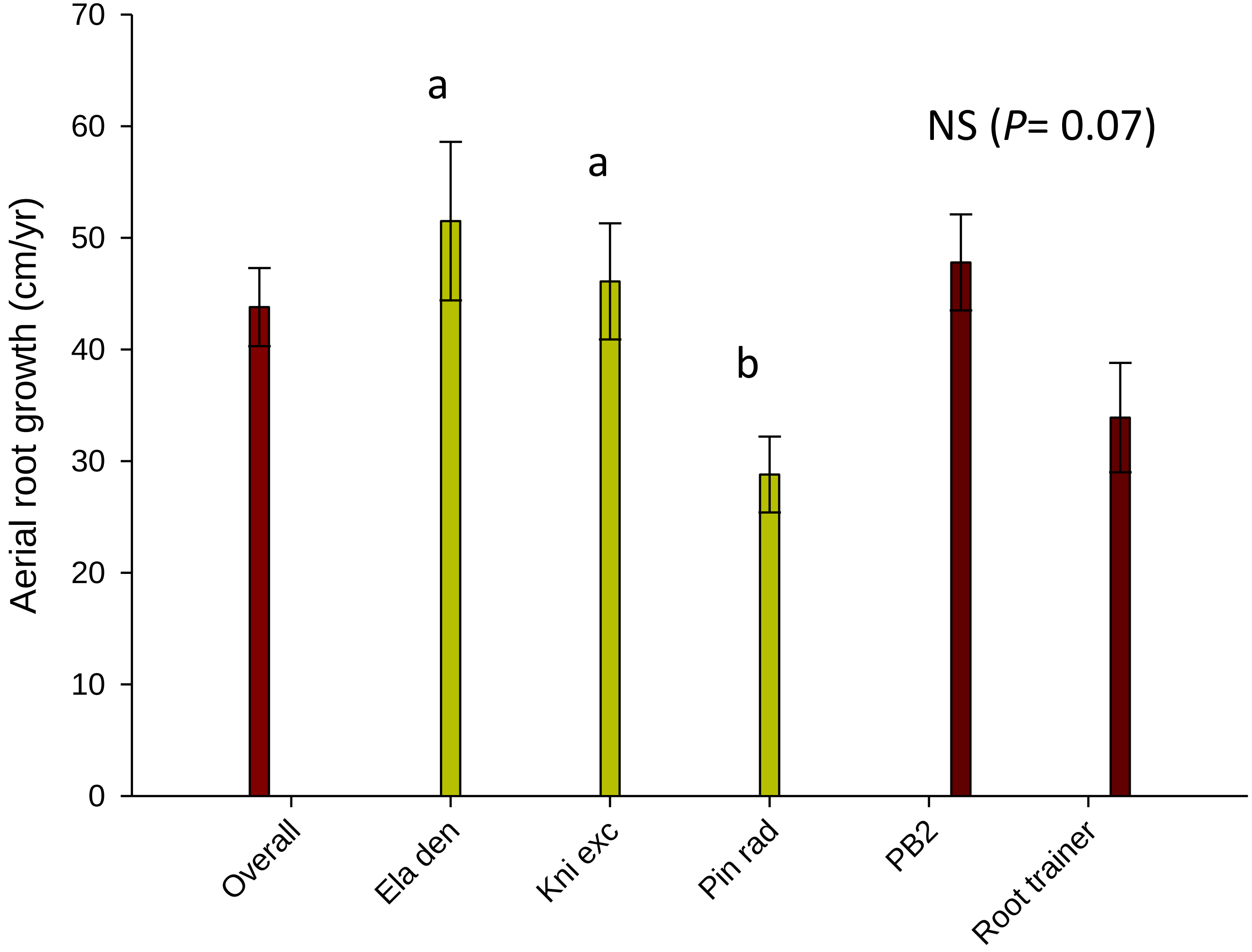
Hinau

Pine

Aerial root initiation (3 years)



Root growth rate



Max. root growth rates

Ela den	158 cm/yr
Kni exc	167 cm/yr
Pin rad	58 cm/yr

Next steps…

- Analyse survivorship and growth by light levels and other environmental factors
- Compare physiology and growth of epiphytic seedlings versus those with roots to ground.
- Compare root and shoot growth of seedlings artificially watered versus control
- Germination trials with northern rata seed and effects of different bark types

Host species and establishment sites

Knightbridge and Ogden 1998

- surveyed 58 ha over 7 sites for northern rata
- occurred more commonly on large host trees (>50 cm diameter) than expected
- 21 tree species acted as hosts (podocarps, puriri, pukatea, and dead trees preferred)
- Establishment sites
  - Horizontal branches 44%
  - Primary branch forks 31%
  - Sides of trunks 27%

Host preference Waipoua