How useful is bark thickness in distinguishing *Podocarpus totara* (lowland or true totara) from *P. hallii* (mountain or Hall's totara)?

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In Otago and Southland, there are two canopy tree species of *Podocarpus* (*P. totara* and *P. hallii*). *P. totara* occurs from sea level to c. 600 m, as does *P. hallii*, but *P. hallii* is more common at altitudes above 480 m (Salmon 1980). In the Southland region, the two *Podocarpus* species are often found together at low altitudes (e.g., Norton 1996, Johnson 1988). Various morphological features may be examined to distinguish the two *Podocarpus* species (see the identification hints below).

In the field, bark is probably the easiest feature to examine. It should be easy to distinguish the two species given the typical bark features as shown in the plates. However, when there are trees with intermediate (or hybrid) bark features, identifying the two species from the bark surface features is difficult. Seed length is another feature easily examined in the field, but it is only possible with mature female trees.

As part of my MSc thesis in the Botany Dept at Otago University (Matsui 2000) I made an attempt to identify the two species by examining bark thickness. I studied totara forests on the southern coast of Otago and Southland: Otatara and Sandy Point in Invercargill, Waikawa Harbour and Cannibal Bay in the Catlins coast. These forest remnants have been reported to contain either: (1) only *P. totara*, (2) only *P. hallii*, and (3) a mixture of *P. totara* and *P. hallii* (and possible hybrid).

In these forests, bark thickness and dbh (diameter at breast height) of totara trees were examined to see trends of the two variables (Matsui 2000). It was assumed that given the same dbh, the bark thickness of *P. totara* would generally be thicker than *P. hallii*.

A linear relationship was found between bark thickness and dbh, i.e., the larger a tree the thicker the bark up to c. 20 mm in bark thickness. The slopes of these linear relations were different between sites. Sites which have previously been considered to be dominated by *P. totara* showed steeper regression slopes, that is thicker bark for similar dbh than sites which have been considered *P. hallii* forests. At the sites where a high proportion of individuals with intermediate bark features have been reported, the slopes of linear regression were between the highest and the lowest slopes. Therefore, even after measuring bark thickness, the identification of the two species was not readily possible (i.e., it was hard to split into two groups using the bark thickness-dbh relation) when the bark surface showed intermediate features. This suggests intermediate-bark individuals are most likely hybrids of *P. totara* and *P. hallii*, as hybridisation between *P. totara* and *P. hallii* has been reported (Poole & Adams 1994, Webby *et al.* 1987).

Molecular study is necessary to confirm this view. Data collection from other sites where only *P. totara* or *P. hallii* occur is also necessary to confirm that the highest and lowest regression slopes at the study sites show the same degree of steepness with regression slopes from other sites.

In conclusion, measuring bark thickness can be the easiest way of collecting quantitative data in identifying *P. totara* and *P. hallii* in the field. However it would be wise to check other characters such as length and shape of seeds or leaf characters.

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Some key features for distinguishing *Podocarpus totara* and *P. hallii*.

1. Bark

P. totara

thick, furrowed and stringy bark (Plate A; Poole & Adams 1994, Salmon 1980).

P. hallii

thin papery bark (Plate B; Poole & Adams 1994, Salmon 1980).

2. Seed

P. totara

ovoid and 4-5 mm long (Poole & Adams 1994);
average 5 mm in length (Bergin & Ecroyd 1987);
rounded at the apex (Allan 1961, Dallimore *et al.* 1966, Kirk 1889, McEwen 1988, Salmon 1980).

P. hallii

6-7 mm long with a short broad beak (Poole & Adams 1994);
average 7.6 mm in length (Bergin & Ecroyd 1987);
obtuse, and abruptly narrowed at the apex (Allan 1961, Dallimore *et al.* 1966, Kirk 1889, McEwen 1988, Salmon 1980).

3. Leaves

P. totara

blunt at the tip and more spirally arranged (West C. J., pers. comm.).

P. hallii

pungent (pointed at the tip), and juvenile leaves of *P. hallii* are arranged in a plane (West C. J., pers. comm.);
has an obvious, depressed leaf midrib when viewed from the top and the leaf has slightly rolled margins in contrast to *P. totara* (Norton, D.A., pers. comm.).

4. Branches of young trees

P. totara

Branches of young *P. totara* are stiff and rigid (Kirk 1889).

P. hallii

Branches of young *P. hallii* are often pendulous (Kirk 1889).

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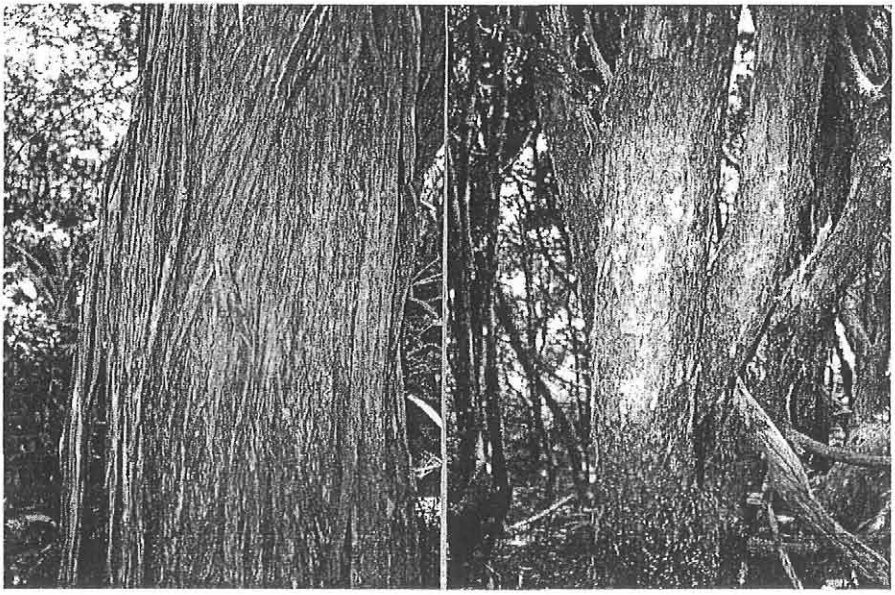

Plate Bark features of *Podocarpus* spp. trees at Otatara and Sandy Point, Invercargill: (A) an example of the thick-barked individuals (presumably *P. totara*) and (B) an example of the thin-barked individuals (presumably *P. hallii*).