Divaricating plants - defence against toothless browsers?

Review of AGM talk.
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William Bond's namesake, James, liked his martinis "shaken but not stirred". William, as guest speaker at the Botanical Society of Otago's Annual General Meeting (14 February), both shook and stirred (as well as amused and fascinated) his audience.

Divaricating shrubs are characterised by small leaves, wide branch angles, and interlacing branches that produce a cage with fewer leaves on the outside of the shrub than within. There are two main hypotheses on the evolution of divaricating plants: the first is the moa-browsing hypothesis and the second is climatic. The browsing hypothesis cites the absence of mammalian browsers and their substitution by ratite birds (moa) and the relatively high frequency of divaricate forms (from a variety of plant families) in New Zealand. It further notes that the mature foliage of trees with divaricate juvenile forms is produced above moa height.

The climatic theory explains the divaricate form as a response to a cold and windy environment, with the bush producing a favourable microclimate within the interlacing network of branches. The change to a mature form is explained as a response to the warmer air above a colder inversion layer that is 2- 3 metres deep. Avid supporters of each hypothesis tend to be resolutely unshaken but active in stirring: theories abound, but experiments are relatively few.

We were treated to some experimental findings. Divaricating shrubs were presented to mammalian (goat) and avian (emus) browsers. The examples showed us that goats eat anything and everything: divarication offered no protection at all. Not all of the proffered divaricates were resistant though, some common ones (e.g. *Coprosma propinqua*) could be effectively browsed by emus by a stripping action. The ones that were most resistant were the wiry (fili-ramulose) divaricates with zig-zag stems - when they were grasped in the emu's beak they sprang back as soon as the hold was relaxed. This explains how some divaricate plants may have been resistant to browsing by moa, but what about the rest? Is there still hope for the climate hypothesis?

As physiological ecologist, I am drawn to the climate hypothesis, but William Bond counts me as an ally, as he reckons that my (and my students') work has offered more support to the browsing hypothesis than that of any other proponent of the climate hypothesis. Nutrient-rich cryptic dwarf mistletoes on divaricating shrubs mimic their hosts, so they would tend to be overlooked by the moa, whereas non-cryptic mistletoes on the same shrubs are nutrient-poor and likely to be avoided. Mistletoes on trees above moa height tend to be as nutrient-rich as their hosts are. Divaricate juvenile forms of trees are not consistently more frost resistant, and tend to lose water more readily, than their mature forms.