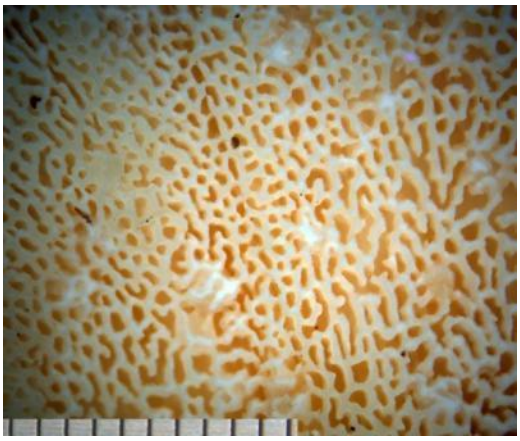
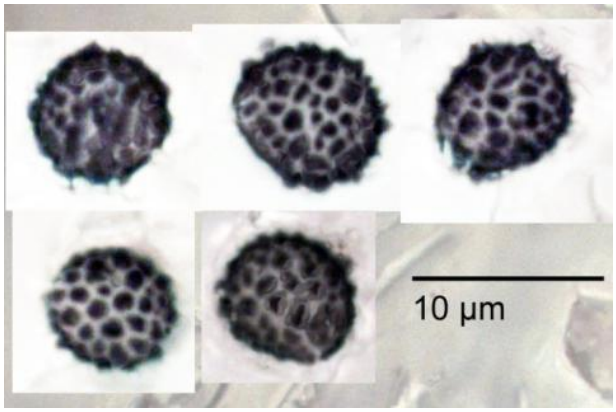
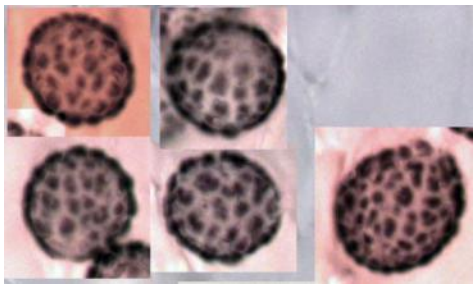
Mycological Notes 9: Bondarzewia – a work in progress

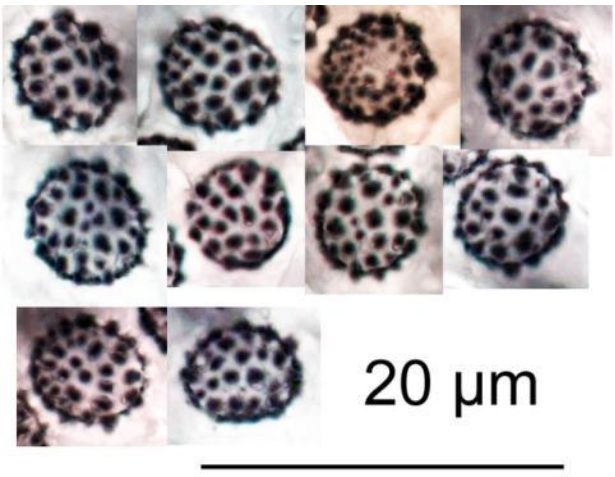
Jerry Cooper, June 2012 [updated Oct. 2012]

I'm not really a bracket person but you can't ignore a *Bondarzewia* when you find one, they are big and colourful. Back in 2009 Paul Kirk, an ex-colleague of mine from (what used to be) the International Mycological Institute, was staying with me for a meeting. For a break I took him to one of my favourite collecting localities, a remnant of beech forest at the Hinewai reserve near Akaroa. Paul spotted the big yellow bracket fungus at the base of a red beech. At first I thought it was *Laetiporus sulphureus* (chicken on the woods) and certainly not something I'd seen before in New Zealand. On cutting the fruitbody it started to exude white latex like a *Lactarius*, so I was puzzled. Looking at material under the microscope it looked even more like a *Lactarius* because the spores were amyloid and ornamented, just like *Russula* and *Lactarius*. It didn't take long to track it down as '*Bondarzewia berkeleyi*', in the order Russulales, and recorded from Japan, Papua New Guinea, Solomon Islands, East North America and China. These days when I see such a broad natural distribution I am immediately suspicious. Increasingly we see molecular data indicating biogeographical and taxonomic complexity; what we considered to be one species if often a number of similar species with more regionalised distribution and interesting biogeographical histories.

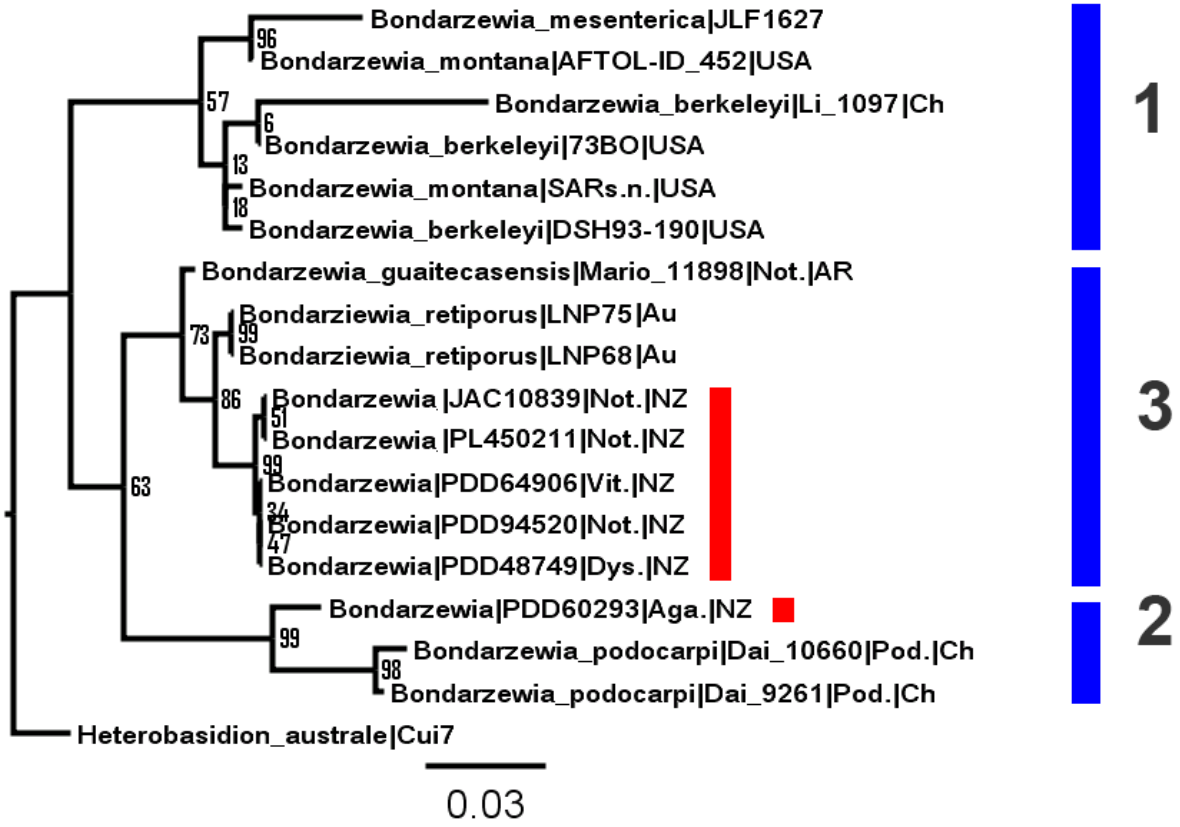
The commonly recorded species in the northern hemisphere are *B. berkeleyi* and *B. mesenterica* (syn. *B. montana*). *B. berkeleyi*, was originally described from North Carolina, USA and in modern treatments is usually described with an affinity for angiosperm hosts, a tan/ochraceous colour, and multi-pileate, imbricate fruitbodies (Nunez 2001). *B. montana* was originally described from *Abies* in France (and *B. mesenterica* from Bavaria), and in modern treatments is usually described with an affinity for gymnosperm hosts, a darker purple or brown colour and less pileate structure. That simple picture is perhaps not so clear-cut as there are descriptions of *B. mesenterica* from North America which differ (e.g. Frank, 2010)

In New Zealand *Bondarzewia* had been recorded growing on a variety of hosts and Buchanan & Ryvarden (2000) drew attention to the need to compare New Zealand material on *Agathis* with *B. montana*, and material on *Nothofagus* with *B. guaitecasensis* from South America. A few months after Paul's collection Pat Leonard mentioned he'd collected material on the west coast, perhaps with a podocarp, and with what looked like differently ornamented spores, and he also drew my attention to a recent paper by Dai et al (2010) proposing *B. podocarpi* for a fungus growing on Chinese podocarp. In Western Australia Matt Barrett, of Western Australia Botanic Garden, was speculating similarly about Australian records of *B. berkeleyi* and the older synonym *Polyporus retisporus* erected by Cooke for Australian material. Certainly the apparent difference in spore ornamentation between collections in New Zealand warranted further investigation and so a number of Australian and New Zealand collections were sequenced. Here's the New Zealand side of the story to date.

 PDD 95307 on *Nothofagus fusca*	 pores, showing exuded latex
 PDD 95307 on *Nothofagus fusca*	Spores 7.1±0.8 x 6.1±0.9, Q=1.2±0.2, in Melzers
 PL450211 on *Nothofagus menziesii*	Spores 6.2±0.4 x 5.4±0.4, Q=1.2±0.1, in Melzers

 PDD 60293 on *Agathis australis*	Spores 6.1±0.3 x 5.2±0.4, Q1.2±0.1

Sequencing



This is an ITS1-5.8-ITS2+LSU PhyML maximum liklihood tree for material from Australia, New Zealand and Genbank sequences of Chinese and North American material. Thanks to Matt Barrett for his, as yet, unpublished sequences of Australian material. A reasonably clear picture is emerging. The well-known species *B. berkeleyi* and *B. montana (mesenterica)* form a separate, but poorly supported group 1 containing North American and Chinese material. However, the positions of both *B. berkleyi* and *B. montana* sensu stricto require confirmation by further analysis of confimed North American and European material. The Chinese *B. podocarpi* is confirmed in group 2. The New Zealand material of *Bondarzewia* growing with *Agathis australis* (Pinales-Araucariaceae) segregates with *B. podocarpi* growing with *Podocarpus imbricatus* (Pinales-Podocarpaceae) in this group. So, our *Bondarzewia* on

Agathis is clearly a related but different species to *B. podocarpi*. By contrast New Zealand material associated with *Nothofagus* (Fagales–Nothofagaceaea), *Vitex lucens* (Lamiales-Lamiaceae) and *Dysoxylum spectabile* (Sapindales-Meliaceae) are closely related (variations of a single taxon). The Australian material, (on *Nothofagus or Eucalyptus*?) from Lammington Park in Queensland is a different species again, as is the South American *B. guaitecasensis*, but all form a related group 3.

There are three clear groups here, but how to recognise the taxa? If we ignore *B. berkeleyi* and *B. montana* then we can speculate an angiosperm/gymnosperm split between 2 & 3. But that is the same split between *B. montana* and *B. berkeleyi* in group 1. Neither is there a clear north/south or east/west geographical division. Does morphology tell us anything? Apart from their hosts *B. montana* and *B. berekelyi* are recognised by the former having a darker colour and forming fewer pilei and both with spores having a ridged amyloid ornamentation. Currently I cannot see any similar morphological distinction between groups 2 & 3 but perhaps we need to look harder. At first Pat & I speculated that spore ornamentation was telling something as some material appeared to have an amyloid reticulation, whereas other material had amyloid spines, or blunt tubercles. Unfortunately a closer study of NZ material indicates these features can all be present in the same material corresponding to spores of different maturity. Clearly more work is required to make sense of the taxonomy. What is clear from the current evidence is that is that the name *B. berekelyi* should not be used casually for Australian or New Zealand material. The variation in *Bondarzewia* in Australia requires further work. What was Cooke's material from Daintree Park growing on? That is critical because there is probably a similar gymnosperm/angiosperm split of *Bondarzewia* within Australia and that needs clarification to determine the correct application of the name *P. retisporus*. If you are in New Zealand and the host is a gymnosperm then it is best called '*Bondarzewia'* (*Polyporus*) *proprius*, and if it is on an angiosperm host then it doesn't yet have a name. I'll get around to it when the picture is clearer.

The history of Australasian 'Bondarzewia' names

Polyporus zealandicus Cooke [nom. illegit., non Cooke 1879], Grevillea 16(80): 113 (1888).

Cooke established name for material collected by Thomas Kirk (Kirk 309) on an unidentified tree. It is likely to have orignated in the Auckland area and thus probably associated with a non-*Nothofagus* host. The name is illegitimate so in the context of our discussion it can be safely ignored

Polyporus laetus Cooke, sensu Colenso, Trans. Proc. N. Z. Inst. 23: 393, 189 1.

The New Zealand misapplication just refers to 'decaying trunks' North island.

Polyporus proprius Lloyd, Mycological Writings 7: 1328 (1924).

Lloyd established this for material sent to him by Rev. James Mitchell from the Christchurch region. The host was not mentioned. According to Stevenson and Cash the type material is not in Lloyd's herbarium, now at Beltsville. Neither is it at Kew (P.M. Kirk, pers. comm..) However there is material from Wellington Botanic Gardens associated with *Dacrydium cupressinum* (Pinales-Podocarpaceae), 1927, which Cunningham declared a neotype (Cunningham #2144 in Cunningham 1948. He separated this from *B. berkeleyi* on basis of sessile fruitbodies. It seems sensible to apply this name to New Zealand material associated with gymnosperm hosts.

Polyporus retiporus Cooke, Grevillea 12(no. 61): 15 (1883)
This was described from Daintree River, Victoria, Australia but without reference to the host.

As an amusing aside it is worth reproducing what Lloyd said about one of Cooke's Australian polypores …

It is the first specimen I have received although I saw at Kew several specimens from Australia, it having been determined mostly by Cooke, as Polyporus portentosus, Polyporus stipticus and Polyporus retiporus, three species that have no resemblance to each other and no resemblance to

this. If there is any other subject on earth that had as little truth, or is as inaccurate as Cooke s work on polypores, I do not know what it is unless it is Leveille's or Kalchbrenner's. And Cooke is the author of the only text-book published on Australian fungi, a book that has about as much truth in it as is in Gulliver's Travels. (C.G. Lloyd, Mycological Writings v4,Letters no 58, p5, 1915)

Sooner or later Lloyd would say similar things about most mycologists who crossed his path.

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