

Mycological Notes - 34

New Zealand Physalacriaceae

Jerry Cooper, December 9th, 2016

The Physalacriaceae contains the important tree pathogen *Armillaria* and other genera with a variety of forms. A number of *Marasmius*-like fungi are now placed in the Physalacriaceae. These usually have pileocystidia and non-dextrinoid tissue, unlike true Marasmiaceae. A number of genera are recognisable microscopically because they possess characteristic 'tibboniform' cystidia with a swollen but flattened apex. So far there are relatively few undescribed species encountered in this family, and the following text/keys are mostly rather hastily assembled extracts from existing revisions.

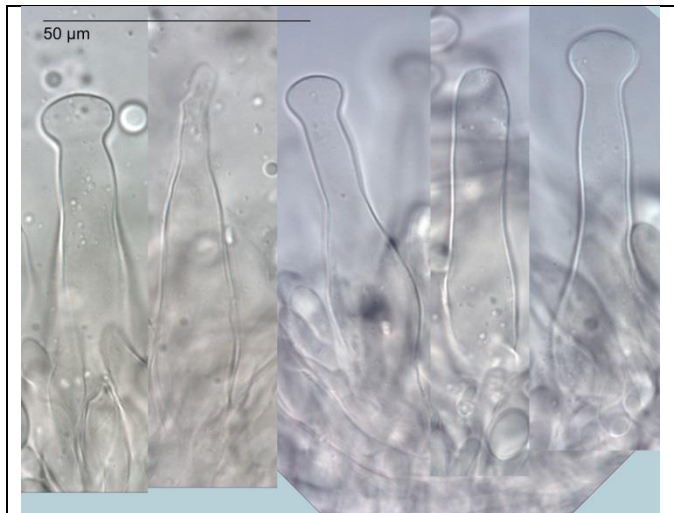


Fig. 1. Tibboniform cheilocystidia of *Hymenopellis mundroola*

Key to the NZ genera of Physalacriaceae

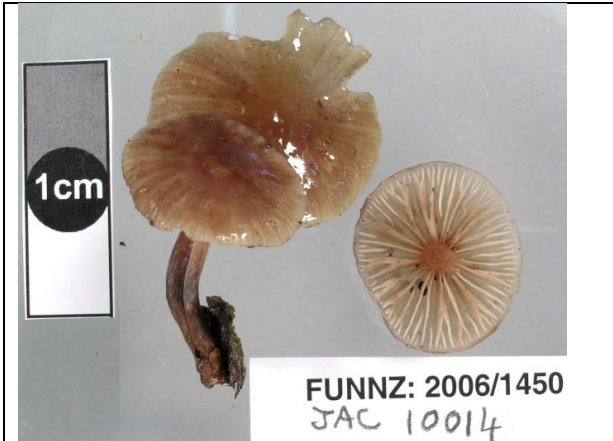
1	Frb agaricoid, medium sized (> 4cm)	2
1	Frb small (< 1cm), marasmioid, reduced or resupinate	6
2	Frb on soil and rooting (sometimes attached to fragments of buried wood)	<i>Hymenopellis</i>
2	On wood	3
3	Stem with a ring	<i>Armillaria</i>
3'	Stem without a ring	4
4	Spores large, > 14µm diam.	<i>Oudemansiella</i>
4	Spores < 10µm diam.	5
5	Gills white. Stem and cap floccose	<i>Cyptotrama</i>
5'	Gills yellow/orange. Stem pruinose	<i>Flammulina</i>

6	Frb resupinate, white.	Cylindrobasidium
6'	Frb not resupinate	7
7	Frb a minute hollow white stipitate erect pouch	Physalacria
7'	Frb not a stipitate pouch	8
8	Cap with rotalis-type broom cells	Cryptomarasmius
8'	Cap without rotalis-type broom cells (Without pilocystidia = Gen. nov., see also Cryptomarasmius).	Gloiocephala

Armillaria

Considering that indigenous *Armillaria* species have become important pathogens in pine plantations you would think the morphological features that separate NZ species would be well worked out. It isn't so. Sequencing has shown the colours of the various species are variable and stem texture variable. In the past both characters have been used to separate species, but are unreliable. *A. limonea* can look very much like *A. hinnulea/aotearoa*, as demonstrated by PDD 97076 which looks like the latter, with pinkish brown dominant tones but has sequences which clearly indicate it is *A. limonea*. *A. limonea* is most common in North Island and the top of the south. *A. novaezelandiae* is more widely distributed and can have cap colours from pale cream to dark brown to olivaceous tan but always has signs of grooves on the cap and viscid in wet weather. *A. novaezelandiae* is generally smaller in stature than the other species and the relatively spindly stem darken to black with age towards the base. *A. hinnulea* seems to be restricted to the north west of South Island and the very similar looking *A. aotearoa* is reported from Taupo and Canterbury. However, nearly all records of these two species, unless proven by sequences, require verification. I suspect some will turn out to be records of *A. novaezelandiae* and *A. limonea*. Conversely many collections of *A. novaezelandiae* will likely be one of the other three species. More morphological data, backed by sequenced collections, is required. *Armillaria limonea* was recently discovered to have bioluminescent gills (material from St Arnaud) and it is surprising this character has not been previously noted.

1	Cap viscid when young, with radial grooves, especially towards perimeter.	<i>Armillaria novaezelandiae</i>
1'	Cap not viscid when young. Cap without radial grooves	2
2	Cap usually lemon yellow but can be pinkish/brown [PDD 97076] (but then always with yellowish pigmentation somewhere).	<i>Armillaria limonea</i>
2'	Without yellow colours anywhere, usually pinkish brown	3
3	Cap with hygrophanous zone towards perimeter when fresh. Spores 6-8.5 x 4-6	<i>Armillaria aotearoa</i>
3'	Cap without hygrophanous zone towards perimeter when fresh. Spores 7.5-9.5 x 5-7	<i>Armillaria hinnulea</i>



Armillaria novaezelandiae. PDD 87113 = JAC10014



Armillaria novaezelandiae. PDD 87529 = JAC10619



Armillaria novaezelandiae. PDD 95405 = JAC10949



Armillaria limonea. PDD 97076 = JAC 12977



Armillaria limonea. PDD 95542 = JAC 11091



Armillaria aeoteoroa. PDD 91742



Armillaria hnnulea (Scion)



Armillaria hnnulea (Scion)

Cryptomarasmius

Cryptomarasmius was previously considered to form *Marasmius* section *Hygrometrici*, usually with dark brown pleated caps and a hymeniderm pileipellis with a rotalis structure (a Bart Simpson haircut – see Notes 35). Macroscopically they do indeed look like typical *Marasmius* and yet phylogenetically they clearly fall within the *Physalacriaceae* and not the *Marasmiaceae*. Preliminary sequence data suggests some pale capped *Marasmius* species also belong here.

In their treatment of *Marasmius* in New Zealand Horak & Desjardin (1997) placed *M. unilamellatus*, *M. sphaerodermus*, *M. fishii*, *M. exustoides*, and *M. micraster* in section *hygrometrici* they were all subsequently all transferred to *Cryptomarasmius* (Jenkins et al., 2014) except *M. unilamellatus*. Of these *M. sphaerodermus* was originally described from Argentina and also known from Hawaii. *M. micraster* was originally described from Sri Lanka and also known from Singapore and Malaysia. However, it should be noted that Genbank contains two versions of *M. micraster* (e.g. JN601436 versus FJ431258) with different phylogenetic placement. The New Zealand taxon under this name has sequences closer to JN601436 but is not identical. The other NZ taxa with overseas names will probably also show differences when material is sequenced.

In their treatment of NZ species *M. rhopaaostylidis* was placed by Horak & Desjardin in section *epiphylli/epiphyloidea* which has paler caps and possess leptocystidia on cap, in addition to rotalis cells. A collection conforming to the description was sequenced and also found to sit within *Cryptomarasmius* (PDD 87065) for both ITS/LSU. This result suggests some species in section *epiphylli/subsection epiphyloidea* might also be considered as members of *Cryptomarasmius*. In NZ this includes *Marasmius meridionalis* and *M. rhombisporus*. However, a sequenced collection of material identified as *M. meridionalis* is clearly within *Gloiocephala*! In addition, some species without emergent pilocystidia appear separately in phylogenies, and so far includes *Marasmius perpusillus* (Section *epiphylli/epiphyllini*) and *Gloiocephala phormiorum*. These two species potentially belong to an undescribed genus. Much more work is required to confirm these findings and to confirm the combination *Cryptomarasmius rhopalostylidis*.

See also the treatments of *Marasmius* NZ. In addition to the pale capped species mentioned above the collared species *M. pallenticeps* and *M. rosulatus* are probably not *Marasmius* sensu stricto and may turn up here.

It is worth noting the host plant should not be used to differentiate species. Collections of the same species on multiple hosts indicate it is not a reliable character.

The key adapted from Horak & Desjardin (1997) and includes species discussed in addition to *Cryptomarasmius* sensu stricto.

1	Stipe absent. Gills 1 (or few). Frb cream	<i>Marasmius unilamellatus</i> (<i>Cryptomarasmius</i> ?)
1	Stipe present	2
2	Stipe not wiry, white/cream. Frb without gills	3
2	Stipe wiry, black/dark brown, at least towards base. Frb gills or not	5
3	Pileus without cystidia. Hymenium with tibiiform cystidia.	<i>Marasmius perpusillus</i> (gen.


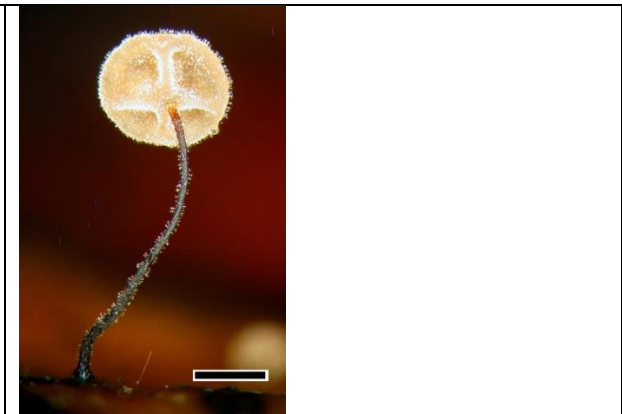
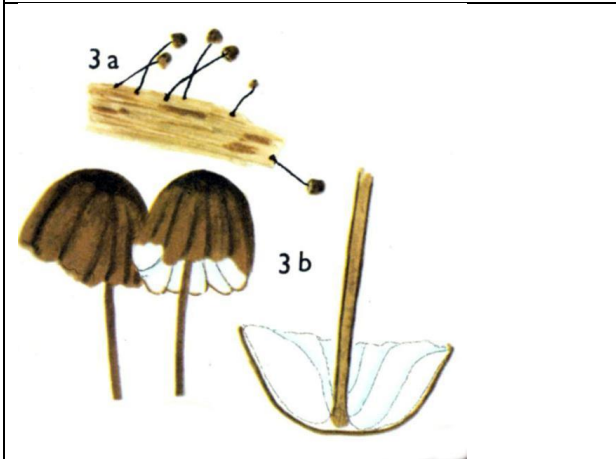

	(See also <i>Gloiocephala phormiorum</i> with a few fold-like gills).	nov?)
3'	Pileus with cystidia	4
4	Pilocystidia not rotilis, just projecting leptocystidia. Hymenial cystidia not tibiiform. (see also <i>Gloiocephala tibiicystis</i> with capitate pilocystidia)	<i>Marasmius pusillimus</i>
4	Pileus with rotilis cells and projecting leptocystidia . Hymenial cystidia tibiiform	<i>Marasmius meridionalis</i> (<i>Gloiocephala</i> ?)
5	Pileus with rotilis cells and leptocystidia	6
5	Pileus with only rotilis cells	7
6	On leaves of <i>Pseudopanax</i> . Spores > 13um long. Stipe black	<i>Marasmius rhombisporus</i> (<i>Cryptomarasmius</i> ?)
6'	On leaves of <i>Rhopalostylis</i> . Spores < 12um long. Stipe black.	<i>Cryptomarasmius rhopalostylidis</i>
7	Gills absent or not well-formed gills	<i>Cryptomarasmius sphaerodermus</i>
7'	With well-formed gills	8
8	Spore Q < 2 . Stipe black	<i>Cryptomarasmius fishii</i>
8'	Spore Q > 2.2	9
9	Pileus with projecting smooth cells with resin fragments, in addition to similarly shaped rotilis cells. Stipe black	<i>Cryptomarasmius exustoides</i>
9	Pileus of just rotilis cells. Stipe black	<i>Cryptomarasmius micraster</i>



Marasmius perpusillus. PDD 86925 = JAC9815.
Scale = 2mm



Gloiocephala phormiorum. PDD 87023 = JAC 9921. Scale = 2mm

	
<p>Marasmius meridionalis PDD 95832 = JAC11368</p>	<p>Cryptomarasmius rhopalostylidis. PDD 87065 = JAC9962. Scale 2mm</p>
	
<p>Cryptomarasmius fishii</p>	<p>Cryptomarasmius micraster. PDD 87330 = JAC10241. Scale 2mm. ('Travis' is a synonym)</p>

Cylindrobasidium

Cylindrobasidium generally forms a pale cracked crust on dead wood. As such it is similar to a number of 'corticoid' genera, like *Hyphoderma*. Microscopically it can be distinguished by large fusiform leptocystidia and hyphae with oil drops. There was no hint this genus might be related to agaricoid fungi until it was sequenced. *C. laeve* was not recorded in New Zealand until relatively recently, but its presence is confirmed from sequences. In addition there are several sequenced collections of a closely related species with smaller spores. It seems very likely these records are of *C. coprosmae* and it has a broader host range than *Coprosma*.

1	Spores 5-6 x 2.5-3 um	<i>C. coprosmae</i>
1'	Spores 8-10 x 4-5 um	<i>C. laeve</i>

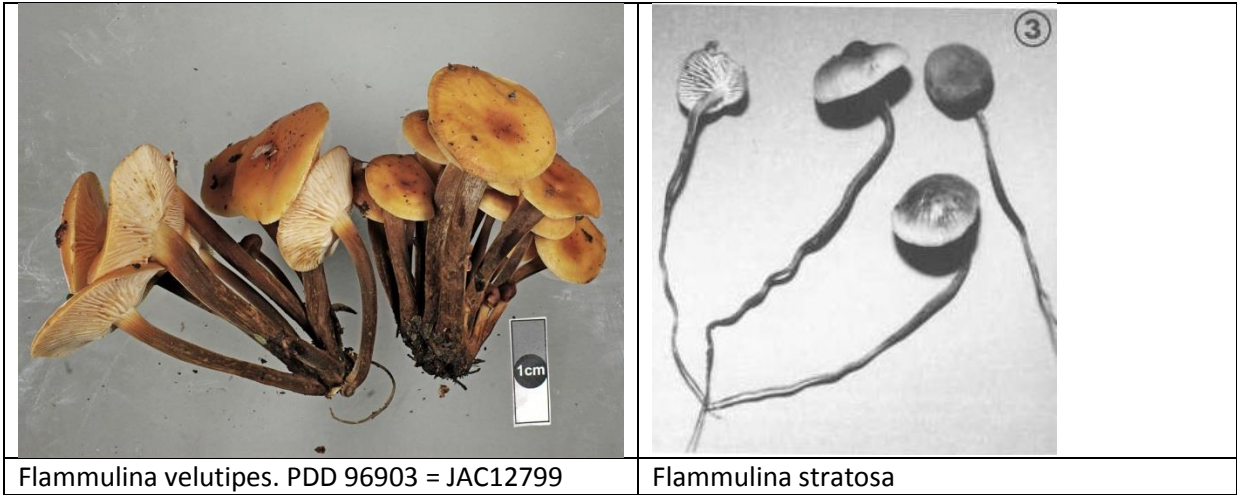


Flammulina

Flammulina velutipes occurs on wood in both natural and modified habitats in NZ, but it is much more common in the latter. Horak (1971) considered NZ material (presumably from natural habitats) to represent a different and indigenous species. *F. velutipes* can be very variable in form. A common form in NZ usually smaller and without the dark stipe appears on Tree Lucerne and it is tempting to consider varieties such as *F. velutipes* var. *lupinicola* and *Flammulina velutipes* var. *cytiseicola*. However mating studies and RFLP have shown that the former variety and NZ isolates of *F. velutipes* all represent a single species *F. velutipes*. This conclusion is supported by sequence data indicating that material from beech forest and on *Sophora* both fall within the same clade and all essentially identical. This clade has many representatives from Europe and so the most likely explanation is that NZ *F. velutipes* is an introduction. Sequence data from around the world indicate there is a separate closely related species, also currently tagged *F. velutipes*, which is represented by material from Argentina and Canada. This has not been formally recognised as a separate species and the differences are unknown. It may be present in NZ.

In addition to *F. velutipes* New Zealand also has *F. stratosa*, also growing on wood. This rare species is known from just two collections, the type from St Arnaud, and another collection by Egon Horak from Peel Forest in South Canterbury. From the description it has a similar colouration and texture to *F. velutipes* but is very small and has a long thin radicating stipe. Phylogenetically it is basal to all *Flammulina* species.

1	Stipe thin, < 2mm, long and radicating. Spore Q < 1.5	<i>F. stratosa</i>
1'	Stipe thicker, > 4mm, not radicating. Spore Q > 2	<i>F. velutipes</i>



Cyptotrama

Cyptotrama asprata is a striking species, usually yellow and scurfy or woolly, growing on wood. It was originally described from Sri Lanka but it is known from many tropical and subtropical regions. In 1980 Scott Redhead reviewed the genus in North America and synonymised many similar-looking species with *C. asprata*. Since 1980 a number of new species have been described which are phylogenetically confirmed to belong to *Cyptotrama* and morphologically clearly different. However, phylogenetic data indicates *C. asprata* is a species complex. One of the synonymised species *C. chrysopepla* has been re-instated, based on phylogenetic and morphological data. Similarly the sequence data for New Zealand indicate we have two species in the complex. *C. asprata* sensu stricto in New Zealand always has a bright yellow/orange uniformly convex pileus. The second species, *C. 'waipoua'* has colours that vary from white to lemon to dark brown. The cap is less woolly than *C. asprata* and is always dimpled, like a golf ball. Microscopically there isn't much difference although the spores of *C. 'Waipoua'* are larger on average than *C. asprata* (11 x 6, Q=1.7)

1	Cap bright yellow/orange, without dimples	<i>C. asprata</i>
1'	Cap cream to lemon to dark brown, always with dimples	<i>C. 'waipoua'</i>

	
<p>Cyptotrama asprata</p>	<p>Cyptotrama 'Waipoua'. PDD 105621 = JAC13369</p>
	
<p>Cyptotrama 'Waipoua'. PDD 105721 = JAC13470</p>	<p>Cyptotrama 'Waipoua'. PDD 72864</p>

Gloiocephala and Anastrophella

Gloiocephala are marasmioid species which are easily distinguished by the pileipellis structure and the generally tibiiform-shaped cheilocystidia, typical of several genera in the Physalacriaceae. The species usually have relatively long spores. *Anastrophella macrospora* is likely to fall within *Gloiocephala* when fresh material is sequenced. *Marasmius meridionalis*, with undulating folds rather than true gills, and with rotilis cells is also (surprisingly) a *Gloiocephala* according to sequence data, and close to *G. nothofagi*. I'm not aware of any *Gloiocephala* with rotilis cells. Similarly *G. JAC12054* is cyphelloid in form and again related to *G. nothofagi*. *Gloiocephala phormiorum*, *Anastrophella macrospora*, *Marasmius pusillimus*, *G. tibiicystis* seem to share a number of common features (see discussion under *Cryptomarasmius*). Material identified as *G. phormiorum* has

sequences placing it within the Physalacriaceae but it is remote from other *Gloiocephala* sequences but close to a sequence of *Marasmius perpusillus*. It has an erumpent growth form similar to *Physalacria stilboidea*. *G. xanthocephala* seems to be relatively common on decaying leaves. One sequence obtained for this species also places it away from *Gloiocephala* and closer to *Paraxerula* & *Strobilurus*. However all these relationships are based on 2 loci and require additional sampling and support. The key here is derived from Horak & Desjardin (1997)

1	Without a stipe	2
1	With a stipe	3
2	With gill-like folds, reddening with age	<i>G. rubescens</i>
2'	With a few normal gills, white	<i>G. JAC12054</i>
3	Fertile hymenium on upper surface of cap. Frb nutant.	<i>Anastrophella macrospora</i>
3	Fertile hymenium on lower surface and frb not nutant	4
4	Spores > 11um long and > 6.5um broad. Gills fold-like or absent.	5
4	Spores < 11um long and < 5.5 um broad. Gills normal or absent	6
5	Cap to 25mm diam. Stem short, eccentric or absent, frb reddening.	<i>G. rubescens</i>
5'	Cap to 7mm and stipe to 7mm. (see also <i>Cryptomarasmius</i> discussion)	<i>G. phormiorum</i> (Gen. nov.?)
6	Gills absent and hymenium smooth	<i>G. tibiicystis</i>
6'	With normal gills	7
7	Cheilocystidia tibiform	<i>G. nothofagi</i>
7'	Cheilocystidia fusoid to lageniform	8
8	With pilocystidia. On wood	<i>G. gracilis</i>
8'	Without pilocystidia, on dead leaves	<i>G. xanthocephala</i> (Gen. nov.?)



Gloiocephala rubescens



Gloiocephala JAC12054

	
<p>Gloiocephala phormiorum. PDD 87023 = JAC 9921. Scale = 2mm</p>	<p>Gloiocephala nothofagi. PDD 96594 = JAC 12476</p>
	
<p>Gloiocephala gracilis PDD 86930 = JAC9820. Scale 2mm</p>	<p>Gloiocephala xanthocephala. PDD 87329 = JAC10240. Scale 2mm</p>

Hymenopellis

Hymenopellis, *Mucidula* and *Oudemansiella* were all treated under *Oudemansiella* until relatively recently. Petersen and Hughes revised the group on a global basis in 2010, introducing these and some other genera. There has been a tendency in recent papers to continue using *Oudemansiella* sensu lato, however the morphology and phylogenetic support is strong for recognising the segregate genera.

The two New Zealand species are easily separated microscopically by the spore shape. Both species can vary from olivaceous to brown in colour but one is 4-spored and the other 2-spored. It seems likely that *H. mundroola* (2-spored) has been introduced because it seems to be associated with modified habitats. The phylogenetic data for *H. mundroola* are problematic. ITS sequences labelled *H. superbiens*, *H. gigaspora* and *H. mundroola* are essentially the same but the first two are 4-spored species. I think the sequence data is telling us that 2 & 4 spored versions of the same species exist. As a consequence spore size also varies. If this equivalence is confirmed then the correct name for the NZ introduced species should be *H. gigaspora*.

1	Spores ellipsoid , $Q > 1.4$ 2-spored	<i>H. mundroola</i>
1'	Spores subglobose, , $Q < 1.3$, 4-spored	<i>H. colensoi</i>



Hymenopellis colensoi. PDD 96441 = JAC12341



Hymenopellis colensoi. PDD 105571 = JAC 13318



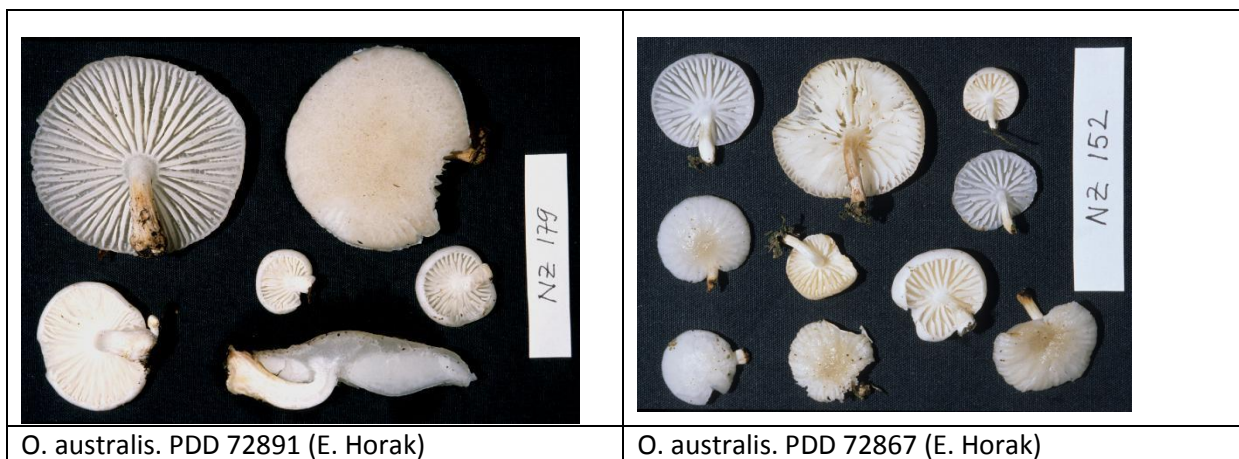
Hymneopellis mundroola. PDD 96221 = 11832



Hymneopellis mundroola PDD 97157 = JAC 13063

Oudemansiella australis





Following the split of *Oudemansiella* by Petersen & Hughes the only remaining New Zealand species in the genus was *O. australis* which they placed in synonymy under *Oudemansiella apalosarca*. This species was originally described from Sri Lanka. I believe these two species are different. *O. australis* was described from New Zealand by Greta Stevenson and it is a relatively common species, long known under that name. The name has been subsequently used for collections outside New Zealand from Australia and Papua New Guinea. Until recently the only sequence data available came from Au and PNG material. Sequence data for recent NZ collections of this species clearly indicate the Australian/PNG species is not the same as the New Zealand species although they are nearest relatives. I therefore propose to continue using Stevenson's name for an independent taxon and I believe its use for Au and PNG material is incorrect. The sequence data indicate *O. australis* is also present in the Cook Islands. Whether the Australian species is the same as the Sri Lanka version, and therefore correctly called *O. apalosarca*, probably requires more genetic sampling. I have not investigated the potential morphological differences between *O. apalosarca* and *O. australis*.



Physalacria

Physalacria is a very distinctive genus. *P. stilboidea* is extremely common on dead leaves of *Pseudopanax*, especially *P. crassifolius* and *P. ferox*. The fruitbody is emergent from a bulb of tissue buried in the leaves. *P. pseudotropica* is much larger and less common. Sequence data indicate the recently described *P. sinensis* from China is a later synonym.

1	Spores < 7um long. On wood	<i>P. pseudotropica</i>
1	Spores > 8um long. On leaves and twigs	2
2	Spores < 12 um, frb a lobed pouch, on twigs	<i>P. JAC10363</i>
2	Spores > 14um long, frb an inflated pouch	3
3	Cystidia capitate. On <i>Cryptomeria</i> leaves	<i>P. cyptomeriae</i>
3'	Cystidia not capitate, other substrates	4
4	Spores 13-15um. Usually on <i>Pseudopanax</i> or <i>Griselinia</i>	<i>P. stilboidea</i>
4'	Spores 18-21. On <i>Phormium</i>	<i>P. JAC10051</i>

 <p>A cluster of small, white, bulbous mushrooms with thin, translucent stems, growing on a dark, textured substrate. An inset image in the bottom right corner shows a magnified view of the stem and base of one of the mushrooms.</p>	 <p>A single, larger white mushroom with a bulbous head and a long, thin stem, growing on a dark, textured substrate. A black scale bar is visible in the bottom right corner.</p>
<p><i>Physalacria pseudotropica</i>. PDD 96406 = JAC11317</p>	<p><i>Physalacria</i> JAC10363. PDD 87451, scale=2mm</p>
 <p>A group of small, white, bulbous mushrooms with thin stems, growing on a dark, textured substrate.</p>	 <p>A single, large white mushroom with a bulbous head and a long, thin stem, growing on a light-colored, textured substrate. A black scale bar is visible in the bottom left corner.</p>
<p><i>Physalacria stilboidea</i>. PDD 80849 = JAC 9421</p>	<p><i>Physalacria</i> JAC10051. PDD 87149. Scale = 0.5mm</p>

References

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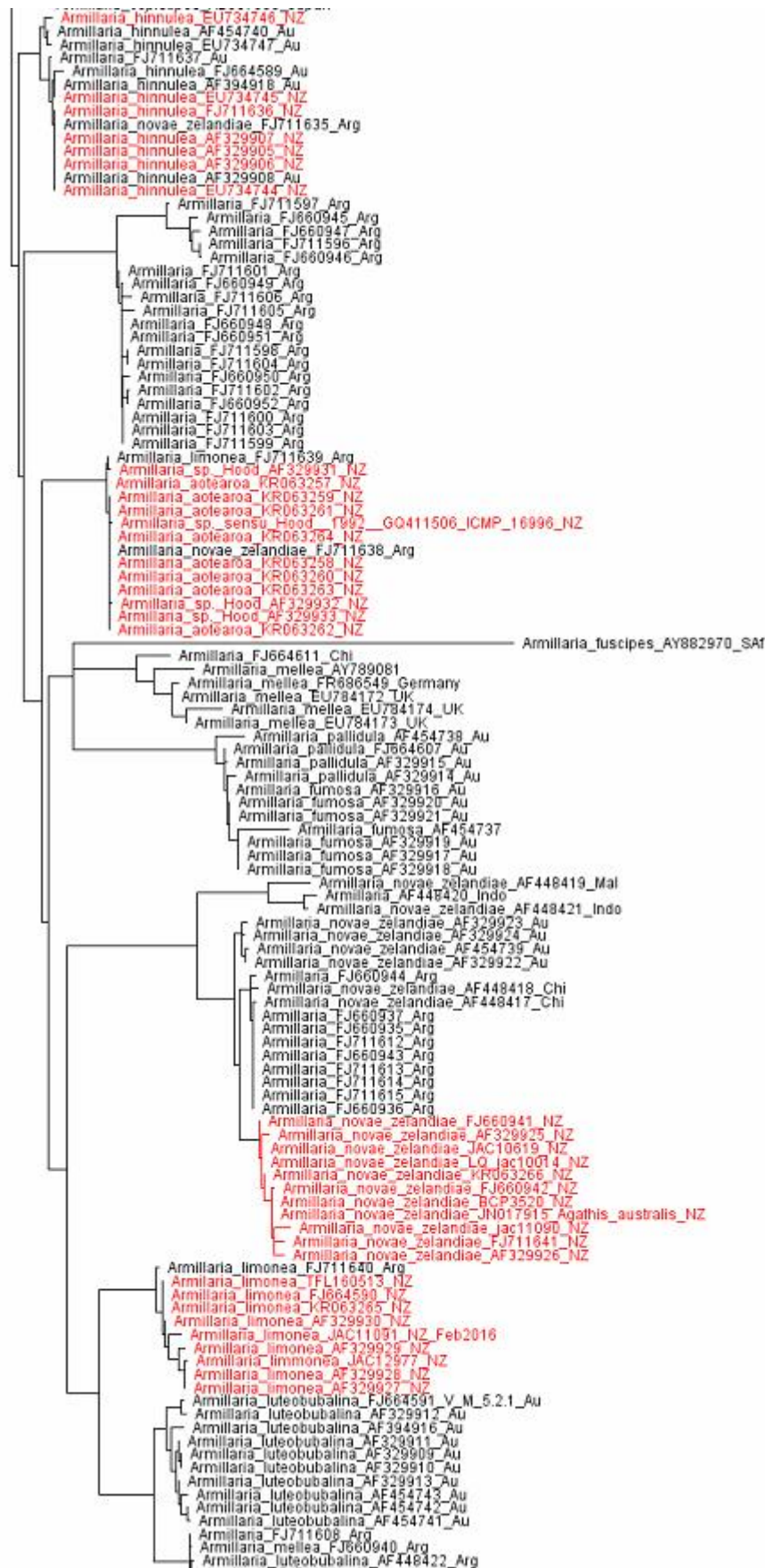
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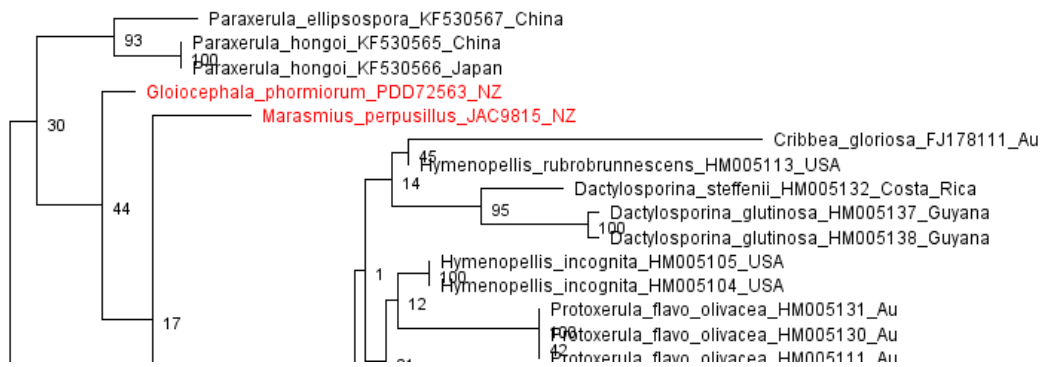
Petersen, R.H. & Hughes, K.W. (2010) The *Xerula/Oudemansiella* Complex (Agaricales). *Nova Hedwigia Beiheft* 137: 1–625.

Redhead, S. A., and Ginns, J. 1980. *Cyptotrama asprata* (Agaricales) from North America and notes on the five other species of *Cyptotrama* sect. *Xerulina*. *Can. J. Bot.* 58: 731-740 86–94.
doi:10.3852/11-309

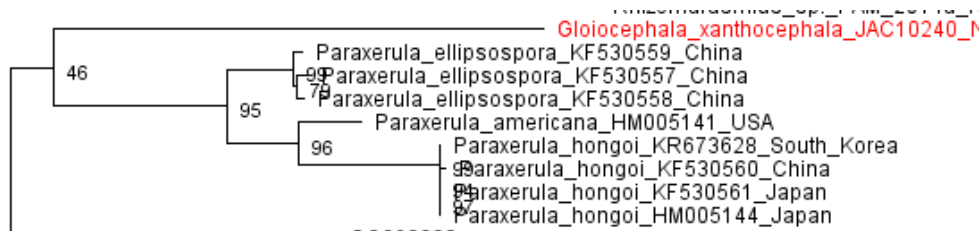
ITS RaxML - Armillaria



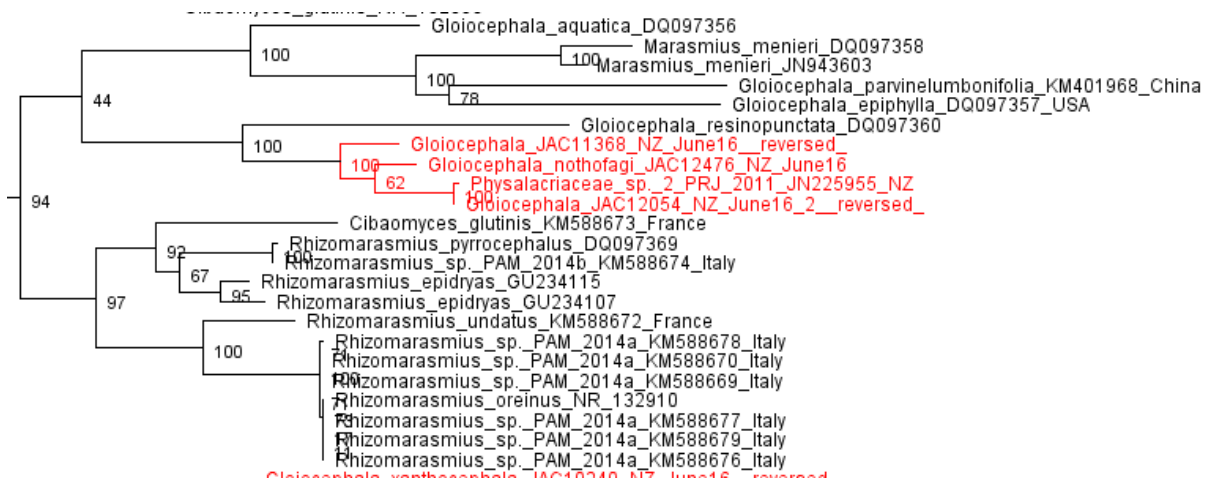
LSU RAxML – unsupported but different position of *G. phormiorum* and *M. perpusillus*



ITS RAxML – different position of *G. xanthocephala*

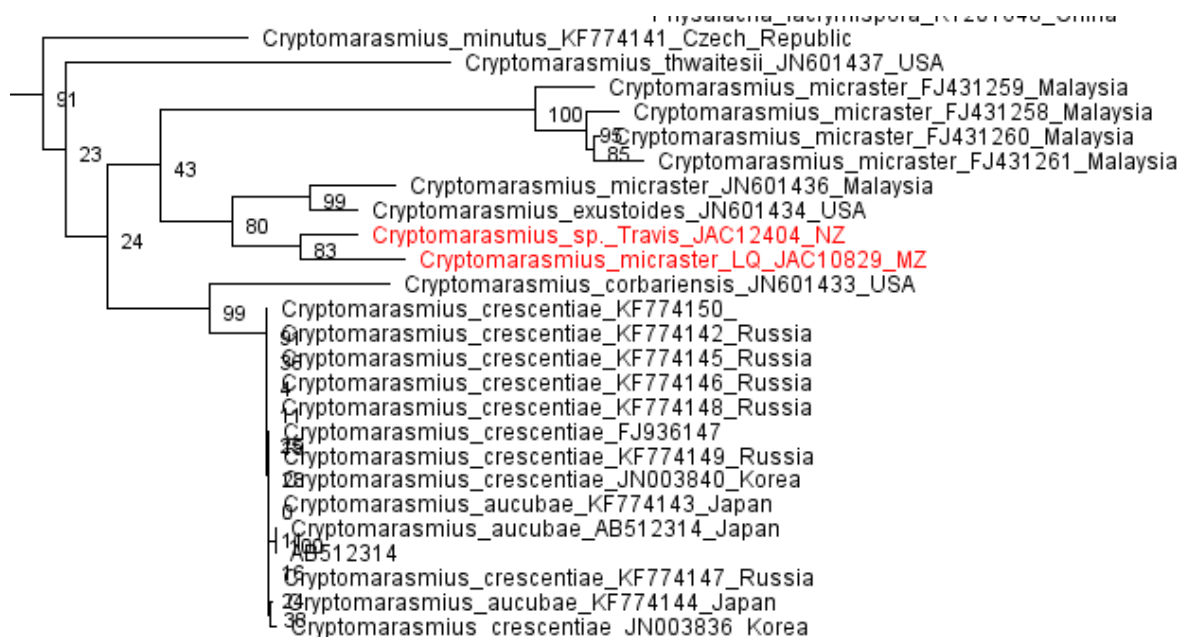


ITS RAxML – *Gloiocephala sensu stricto*

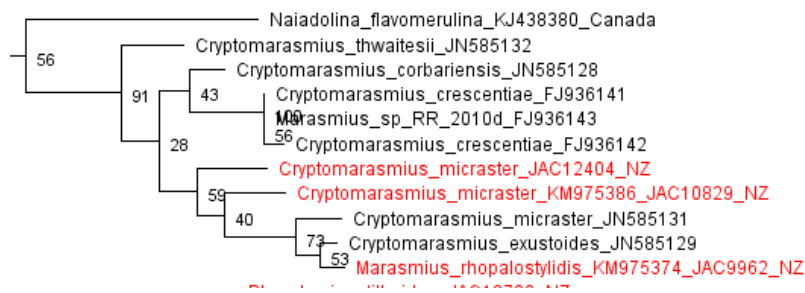


G. JAC11368 = *Marasmius meridionalis*

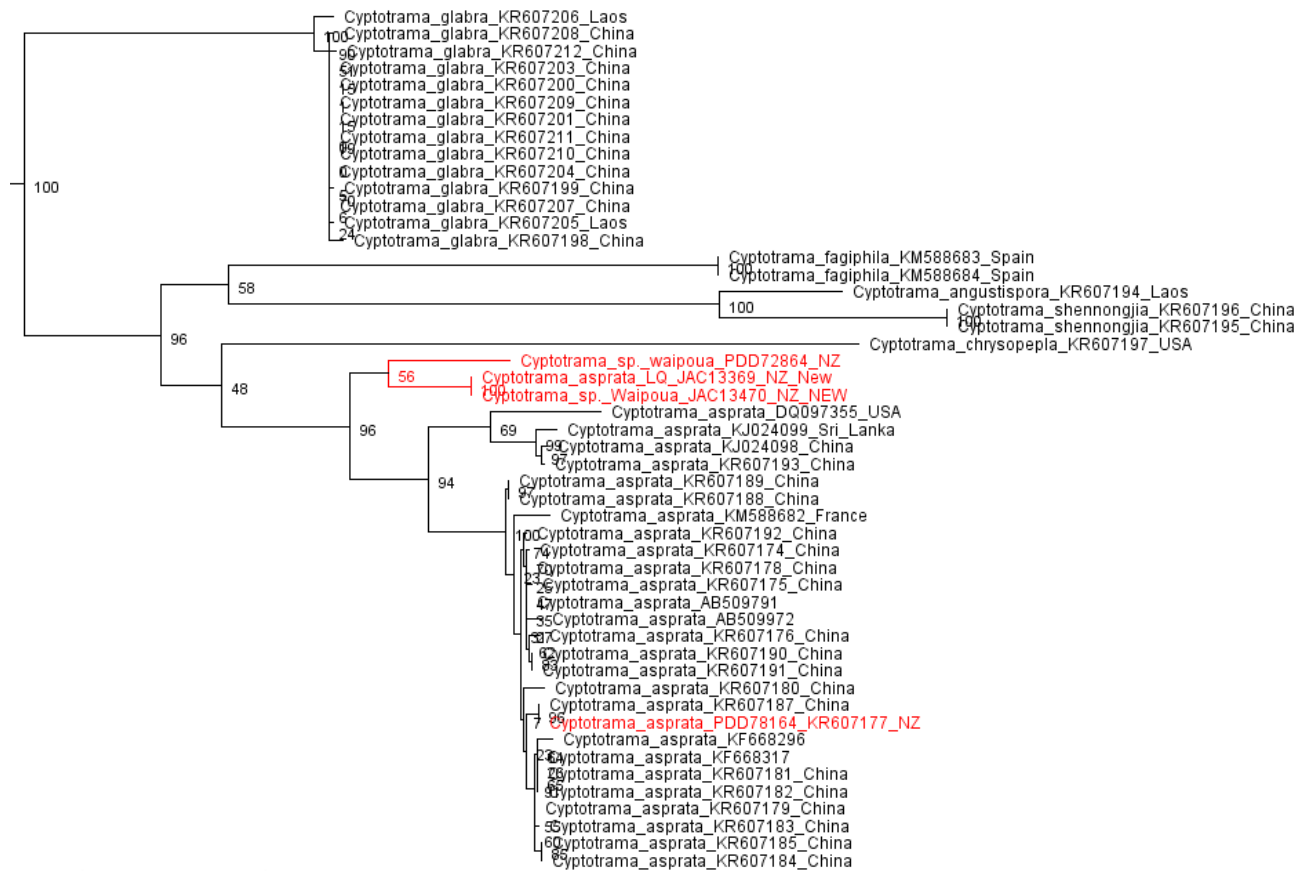
ITS RAxML – *Cryptomarasmius sensu stricto*



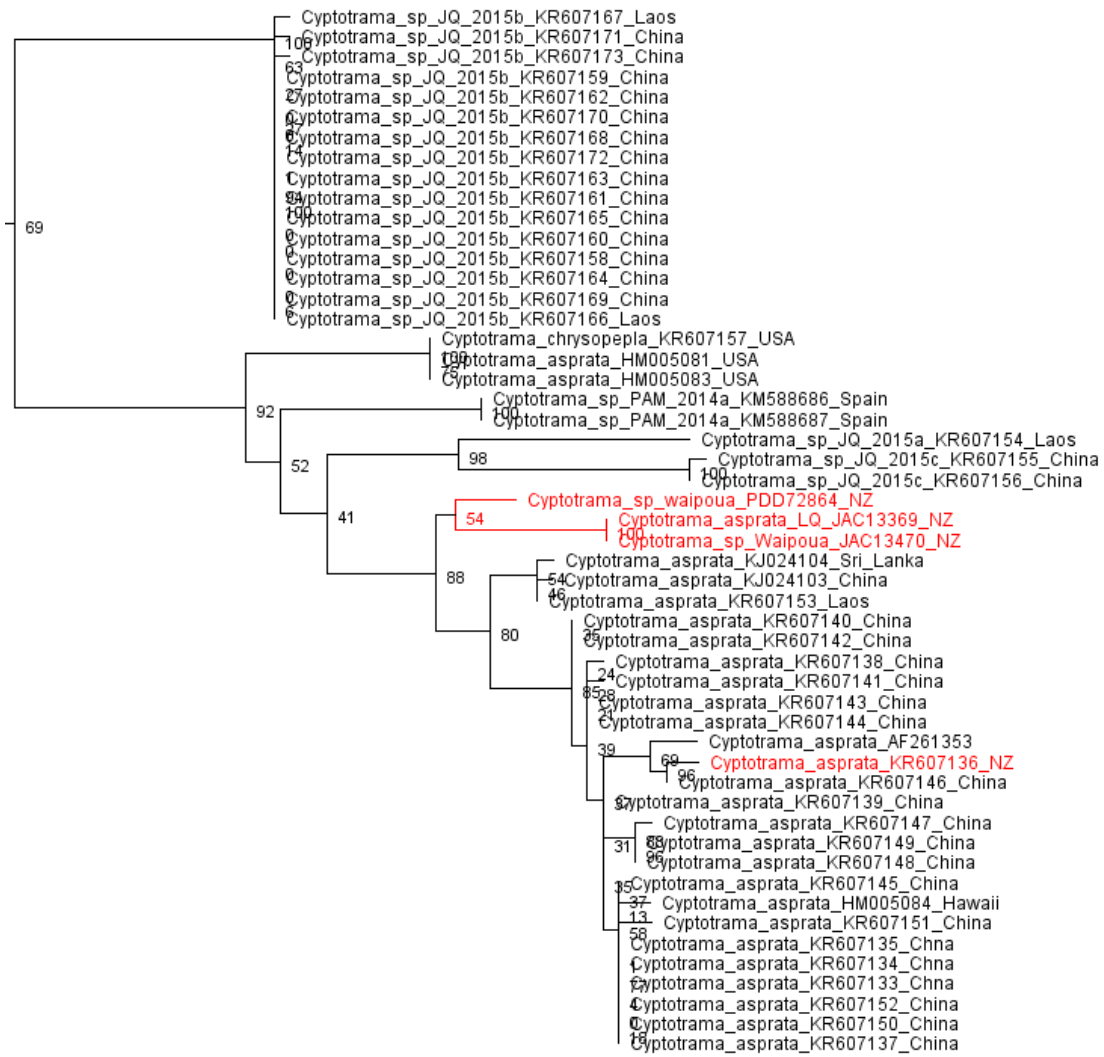
LSU RAXML – *Cryptomarasmius sensu stricto*



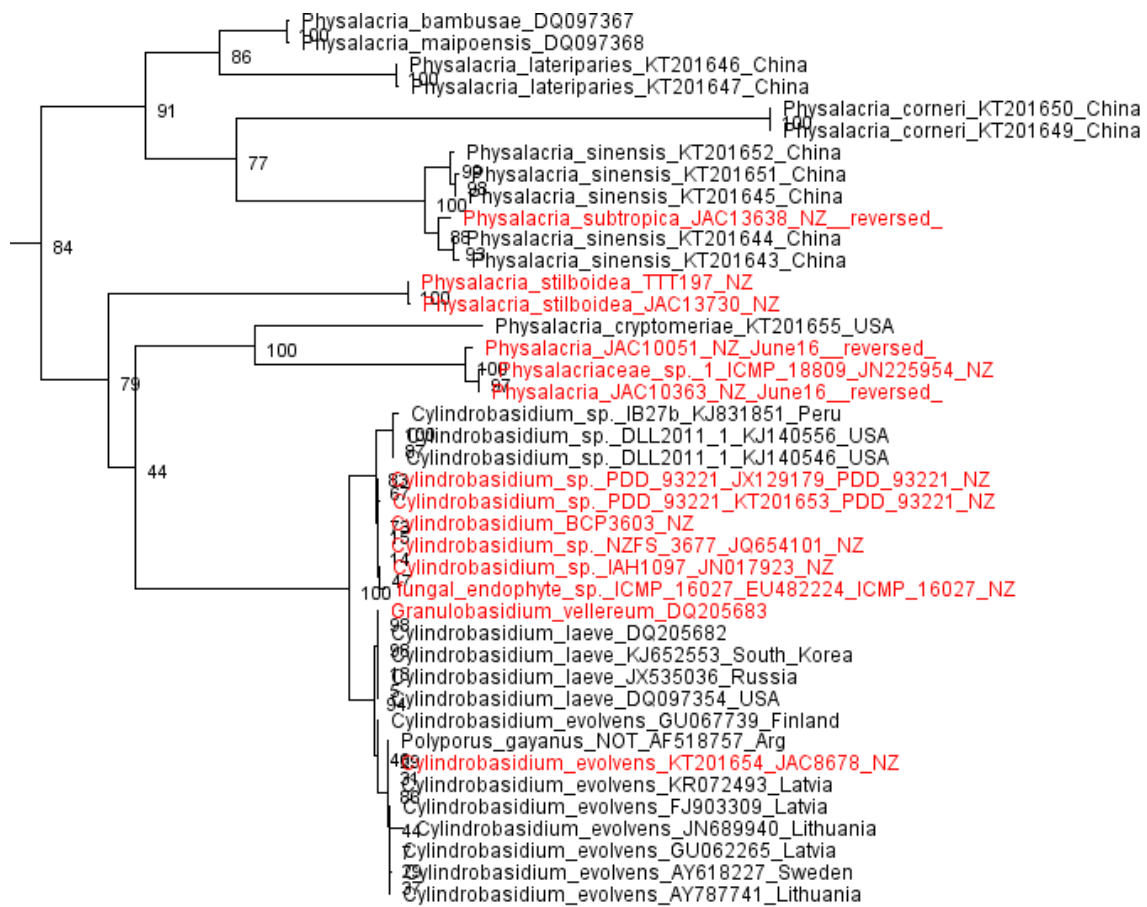
ITS RAxML – *Cyptotrama*



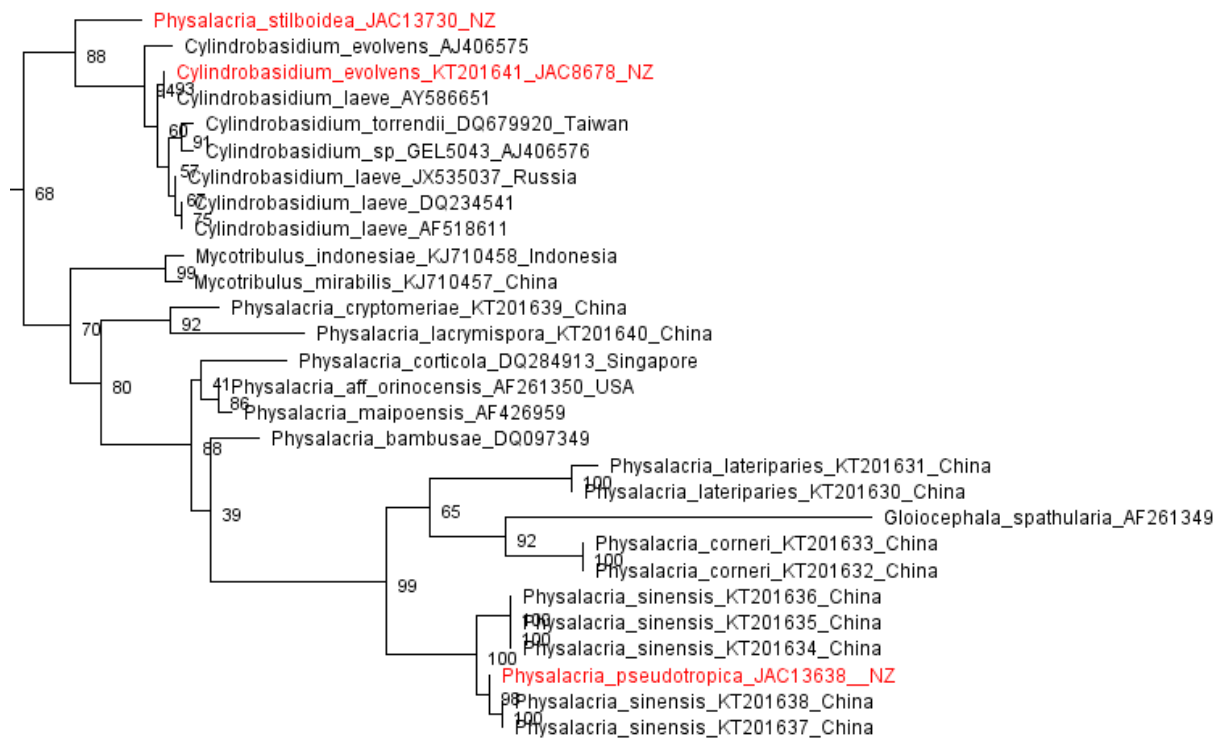
LSU RAxML - *Cyptotrampa*



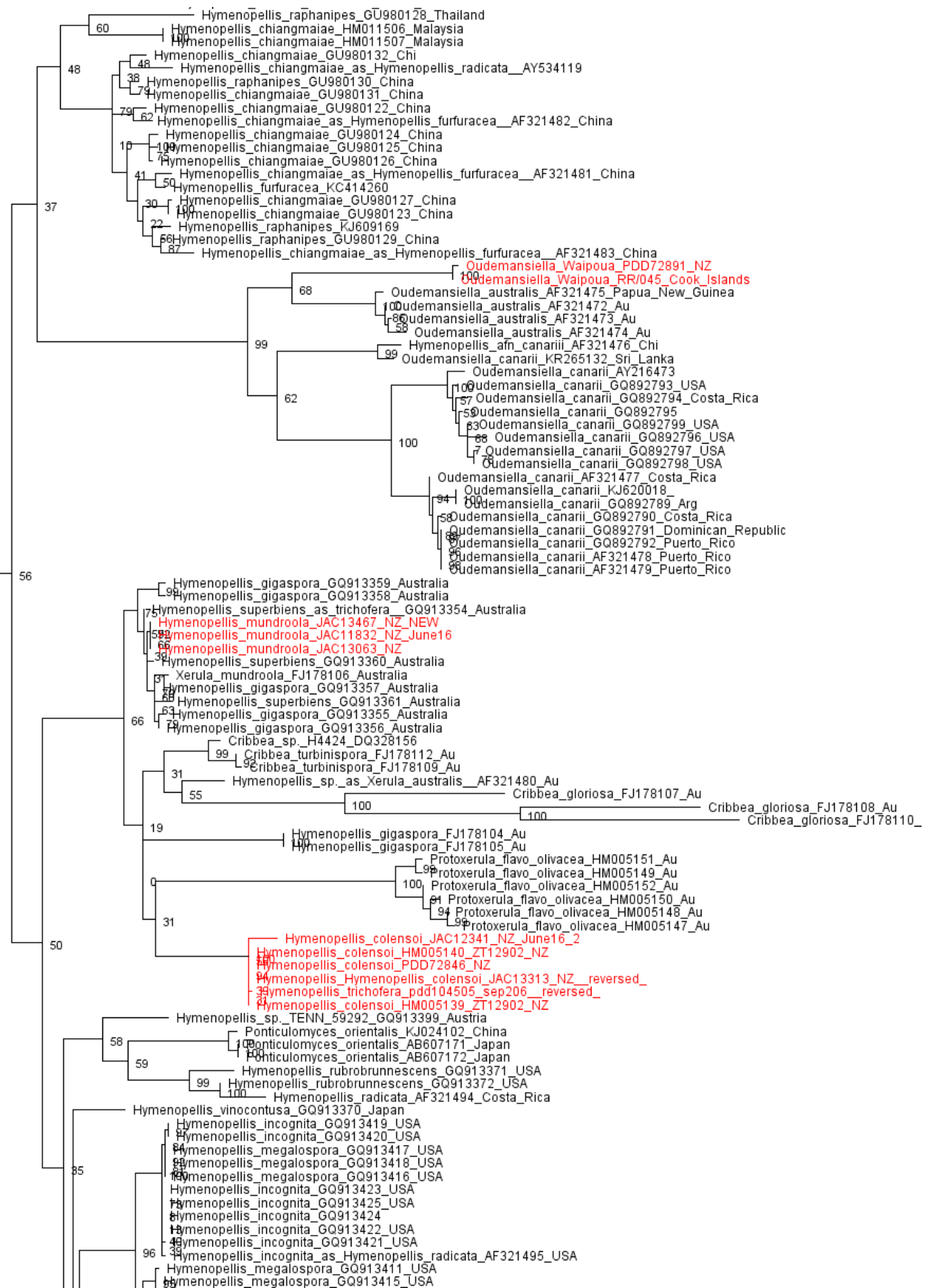
ITS RAxML – *Cylindrobasidium*/*Physalacria*



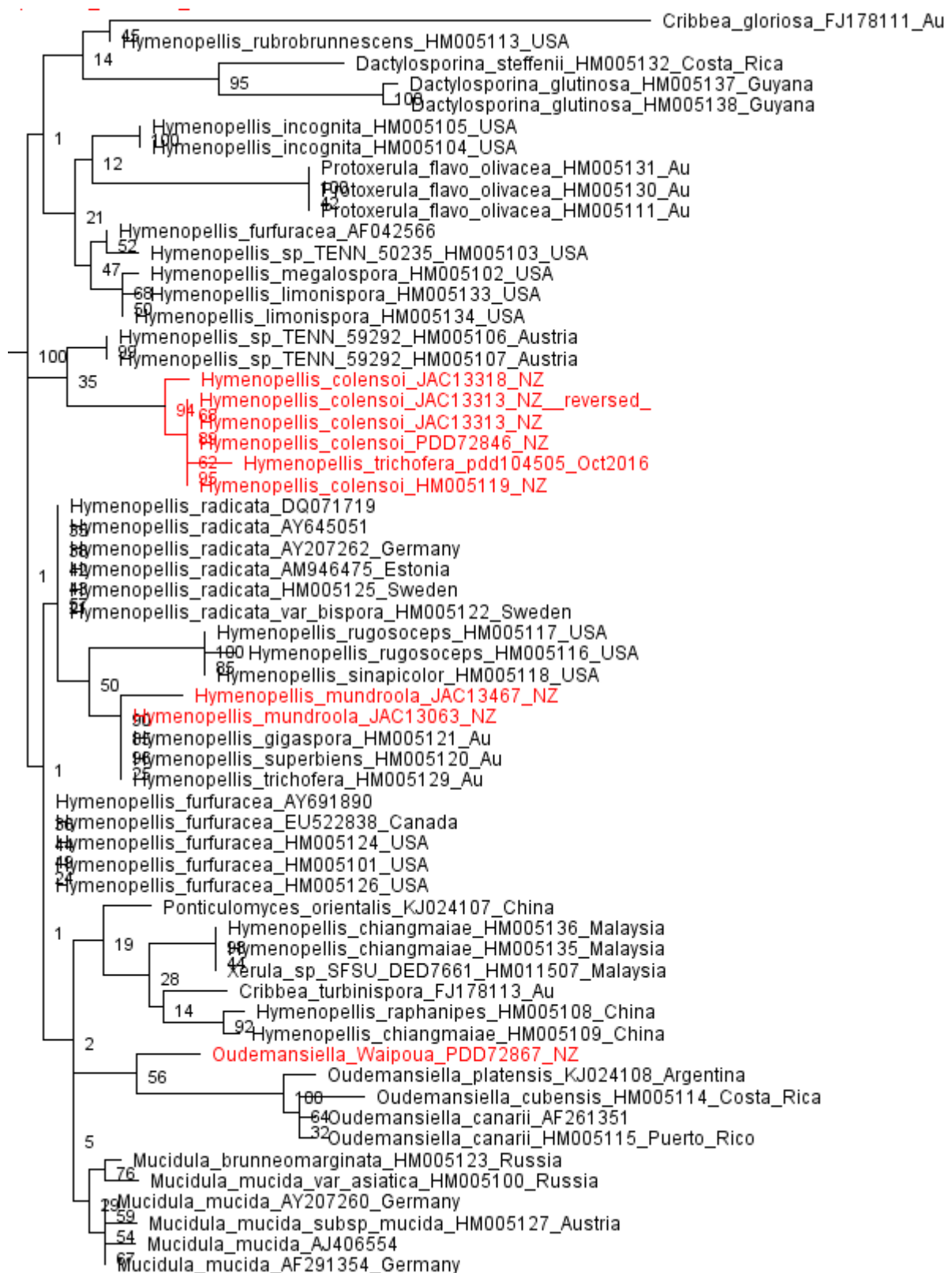
LSU RAxML - *Cylindrobasidium*/*Physalacria*



ITS RAxML Hymenopellis/Oudemansiella



LSU Hymenopellis/Oudemansiella



References