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 Physalacriacaeae. These usually have pilocystdia and non-dextrinoid tissue, unlike true Marasmiaceae. A number of genera are recognisable microscopically because they possess characteristic 'tibbiform' 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.

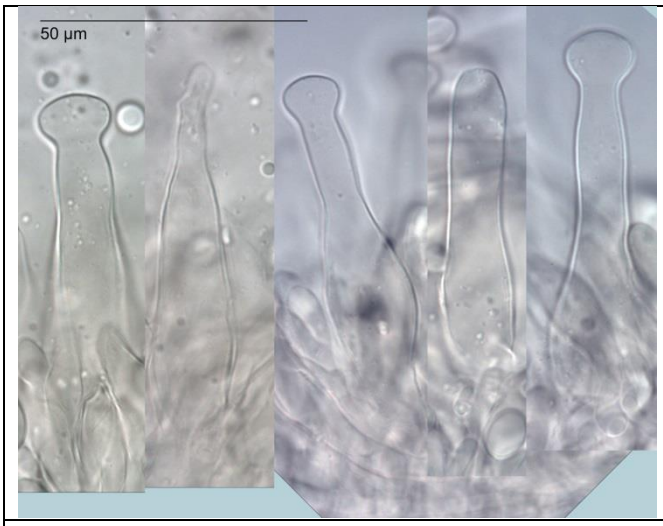


Fig. 1. Tibbifom cheilocystidia of Hymenopellis mundroola

Key to the NZ genera of Physalacriaceae

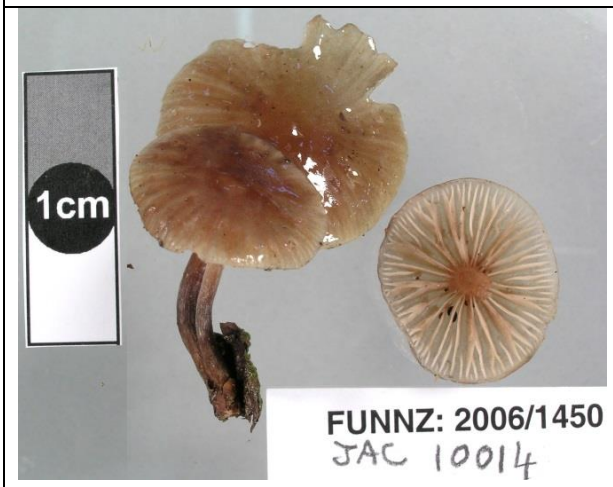
1	Frb agaricoid, medium sized (> 4cm)	2
1	Frb small (< 1cm) , marasmioid, reduced or resupinate	6
2	Frb on soil and rooting (sometimes attached to fragments of buried wood)	Hymenopellis
2	On wood	3
3	Stem with a ring	Armillaria
3'	Stem without a ring	4
4	Spores large, > 14um diam.	Oudemansiella
4	Spores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

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. Untypical forms of some species look exactly like other species. See the images below, which are all of material confirmed by sequencing. *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*. It 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 (then looking like *A. hinnulea*) but generally has signs of grooves on the cap and viscid in wet weather (but not always, see PDD 95747). *A. novaezelandiae* is generally smaller in stature than the other species and the relatively spindly stem darken to black with age towards the base (but again, not always). *A. hinnulea* seems to be restricted to the north west of South Island and isn’t a species I have seen yet. The recently described *A. aotearoa* is reported from Taupo, Canterbury (and now Buller). One distinguishing character is a hygrophanous band around the cap perimeter. However, if it isn’t present it can look very similar to atypical forms of *A. novaezelandiae* (e.g. PDD95747). Currently it would be very difficult to guarantee the correct identification of all our species based on gross morphology, especially when dealing with atypical forms. 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 (but not always!).	Armillaria novaezelandiae
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).	Armillaria limonea
2’	Without yellow colours anywhere, usually pinkish brown	3
3	Cap with hygrophanous zone towards perimeter when fresh (not always reliable!). Spores 6-8.5 x 4-6	Armillaria aotearoa
3’	Cap without hygrophanous zone towards perimeter when fresh. Spores 7.5-9.5 x 5-7	Armillaria hinnulea

	
Armillaria novaezelandiae (typical form). PDD 95405 = JAC10949	Armillaria novaezelandiae (untypical). PDD 87529 = JAC10619
	
Armillaria novaezelandiae (untypical) PDD 87113 = JAC10014	Armillaria novaezelandiae (untypical) PDD 95747 = JAC11457
	
Armillaria limonea (typical form). PDD 95542 = JAC 11091	Armillaria limonea (untypical). PDD 97076 = JAC 12977

	
Armillaria aeoteoroa (typical). PDD 91742	Armillaria aeoteoroa (untypical) PDD 96215 = JAC11819
	
Armillaria hnnulea (Scion)	Armillaria hnnulea (Scion)

Cryptomarasmius and related

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 Physalacriacaeae 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/epipylloidea 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 epiphylloidea might also be considered as members of *Cryptomarasmius*. In NZ this includes *Marasmius merdionalis* 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. The position of *M. pusillissimus* remains unknown but is likely to be related. 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 *Marasmiu*s 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.

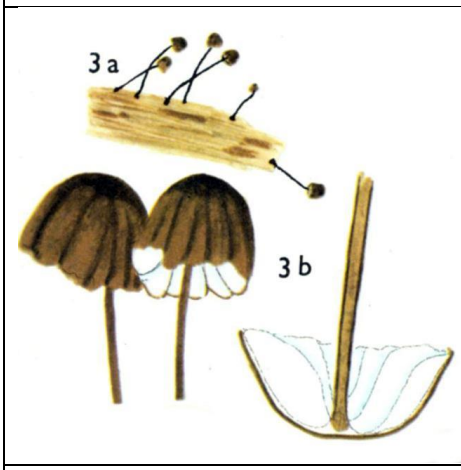
1	Stipe absent. Gills 1 (or few). Frb cream	Marasmius unilamellatus (Cryptomarsmius?)
1	Stipe present	2
2	Stipe not wiry, white/cream. Frb without gills	3
2	Stipe wiry, black/dark brown, at least towards base. Frb gills or not	5
3	Pileus without cystidia. Hymenium with tibiiform cystidia. (See also Gloiocephala phormiorum with a few fold-like gills).	Marasmius perpusillus (gen. nov?)
3’	Pileus with cystidia	4
4	Pilocystidia not rotalis, just projecting leptocystidia. Hymenial cystidia not tibiiform. (see also Gloiocephala tibiicystis with capitate pilocystidia)	Marasmius pusillissimus
4	Pileus with rotalis cells and projecting leptocystidia . Hymenial cystidia tibiiform	Marasmius meridionalis (Gloiocephala?)
5	Pileus with rotalis cells and leptocystidia	6
5	Pileus with only rotalis cells	7
6	On leaves of Pseudopanax. Spores > 13um long. Stipe black	Marasmius rhombisporus (Cryptomarasmius?)
6’	On leaves of Rhopalostylis. Spores < 12um long. Stipe black.	Cryptomarasmius rhopalostylidis
7	Gills absent or not well-formed gills	Cryptomarasmius sphaerodermus
7’	With well-formed gills	8
8	Spore Q < 2 . Stipe black	Cryptomarasmius fishii
8’	Spore Q >2.2	9
9	Pileus with projecting smooth cells with resin fragments, in addition to similarly shaped rotalis cells. Stipe black	Cryptomarasmius exustoides
9	Pileus of just rotalis cells. Stipe black	Cryptomarasmius micraster

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

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

Marasmius meridionalis PDD 95832 = JAC11368

Cryptomarasmius rhopalostylidis. PDD 87065 = JAC9962. Scale 2mm



Cryptomarasmius fishii

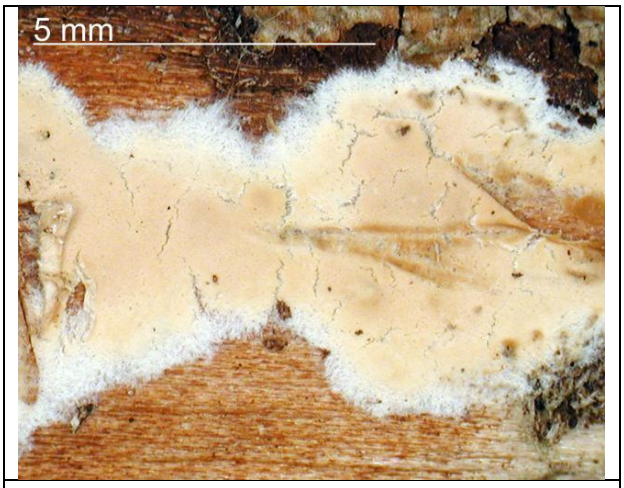
Cryptomarasmius micraster. PDD 87330 = JAC10241. Scale 2mm. ('Travis' is a synonym)

Cylindrobasidium

Cylindrobasidium generally forms a pale cracked crust on dead wood. As such it is similar to a number of 'corticioid' 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	C. coprosmae
1’	Spores 8-10 x 4-5 um	C. laeve



Cylindrobasidium leave. PDD 79912 = JAC8678

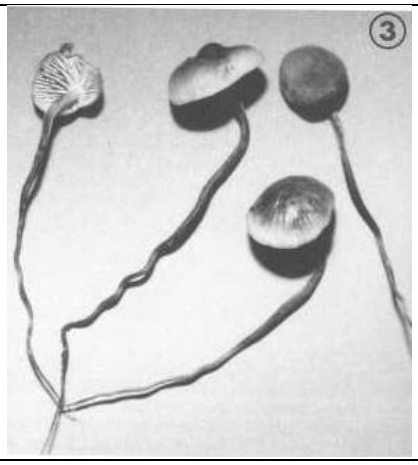
Flammulina

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	F. stratosa

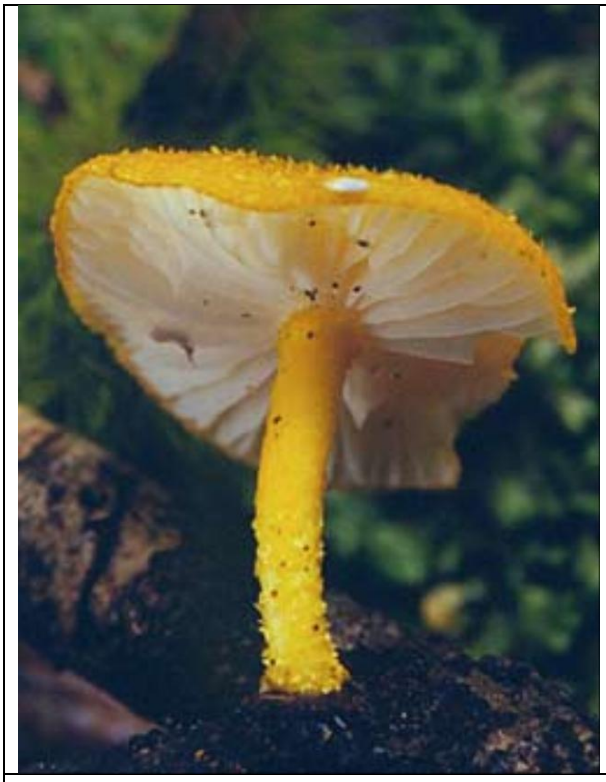
1’	Stipe thicker, > 4mm, not radicating. Spore Q > 2	F. velutipes

	
Flammulina velutipes. PDD 96903 = JAC12799	Flammulina stratosa

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 *Cytoptrama* 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	C. asprata
1’	Cap cream to lemon to dark brown, always with dimples	C. ‘waipoua’

	
Cyptotrama asprata	Cyptotrama ‘Waipoua’. PDD 105621 = JAC13369
	
Cyptotrama ‘Waipoua’. PDD 105721 = JAC13470	Cyptotrama ‘Waipoua’. PDD 72864

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 rotalis cells is also (surprisingly) a *Gloiocephala* according to sequence data, and close to *G. nothofagi*. I’m not aware of any *Gloiocephala* with rotalis cells. Similarly *G. JAC12054* is cyphelloid in form and again related to *G. nothofagi*. *Gloiocephala phormiorum, Anastrophella macrospora, Marsmius pusillimus, G. tibiicystis* seem to share a number of common features (see discussion under *Cryptomarasmius*). Material identified as *G. phormiorum* has

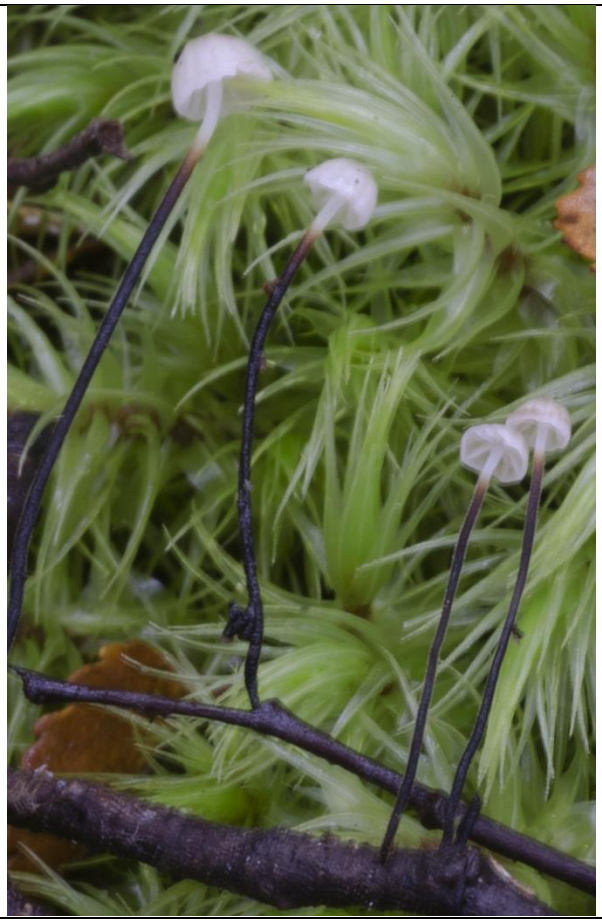
sequences placing it within the Physalacriaceae but it is remote from other *Gloiocephala* sequences but close to a sequence of *Marasmius perpusillus*. It has an erumpent growth form similar to *Physalacria stilboidea*. *G. xanthocephala* seems to be relatively common on decaying leaves. One sequence 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	G. rubescens
2’	With a few normal gills, white	G. JAC12054
3	Fertile hymenium on upper surface of cap. Frb nutant.	Anastrophella macrospora
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.	G. rubescens
5’	Cap to 7mm and stipe to 7mm. (see also Cryptomarasmius discussion)	G. phormiorum (Gen. nov.?)
6	Gills absent and hymenium smooth	G. tibiicystis
6’	With normal gills	7
7	Cheilocystidia tibbiform	G. nothofagi
7’	Cheilocystidia fusoid to lageniform	8
8	With pilocystidia. On wood	G. gracilis
8’	Without pilocystidia, on dead leaves	G. xanthocephala (Gen. nov.?)

Gloiocephala rubescens

Gloiocephala JAC12054

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



Gloiocephala nothofagi. PDD 96594 = JAC 12476

Gloiocephala gracilis PDD 86930 = JAC9820. Scale 2mm

Gloiocephala xanthocephala. PDD 87329 = JAC10240. Scale 2mm

Hymenopellis

Hymenopellis, Mucidula and *Oudemansiella* were all treated under *Odemansiella* 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	H. mundroola
1’	Spores subglobose, , Q < 1.3, 4-spored	H. colensoi

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*.

	
O. australis. PDD 72891 (E. Horak)	O. australis. PDD 72867 (E. Horak)

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

	
Physalacria pseudotropica. PDD 96406 = JAC11317	Physalacria JAC10363. PDD 87451, scale=2mm
	
Physalacria stilboidea. PDD 80849 = JAC 9421	Physalacria JAC10051. PDD 87149. Scale = 0.5mm

References

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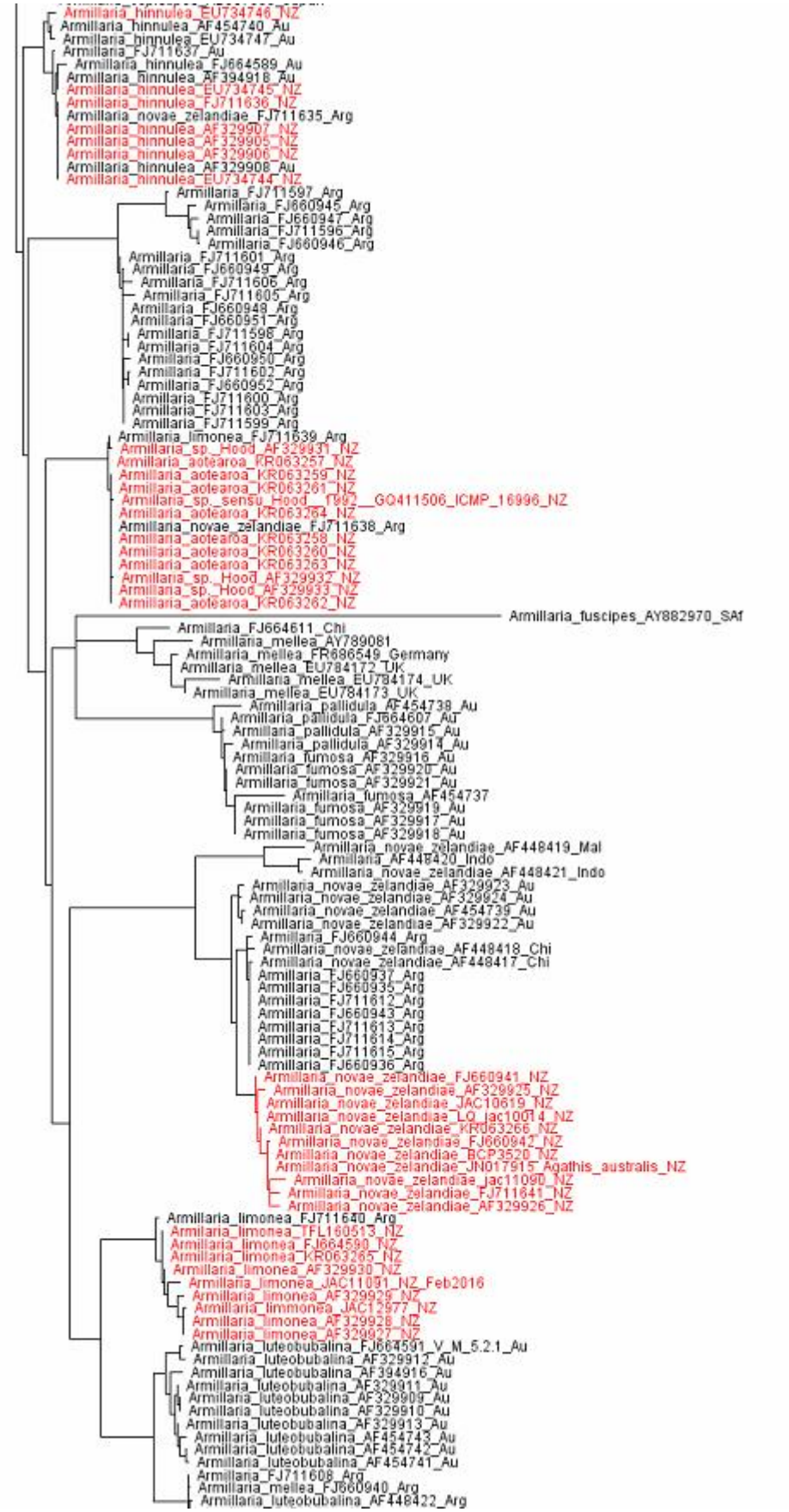
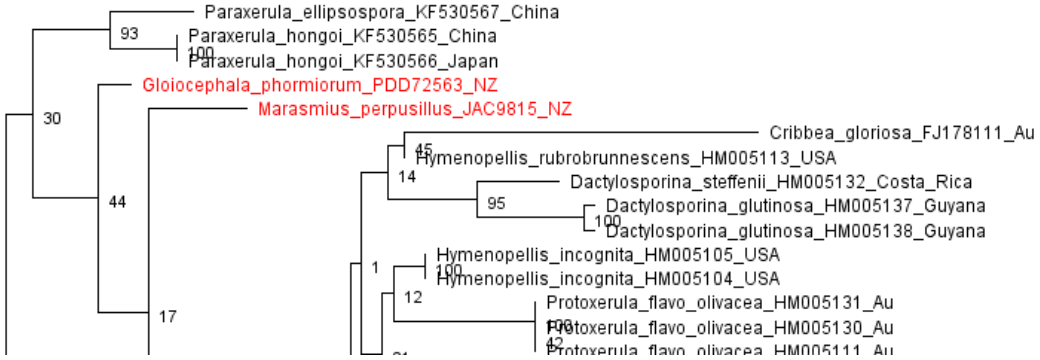
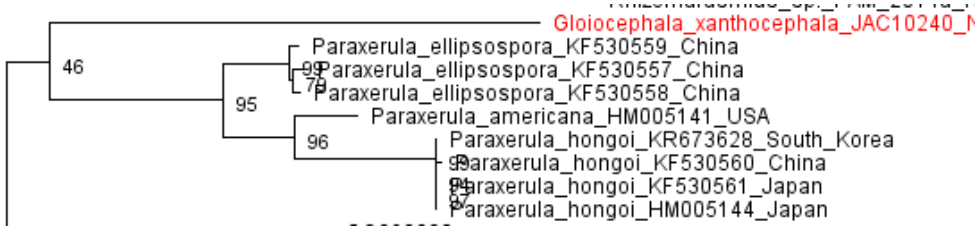
ITS RAxML - Armillaria



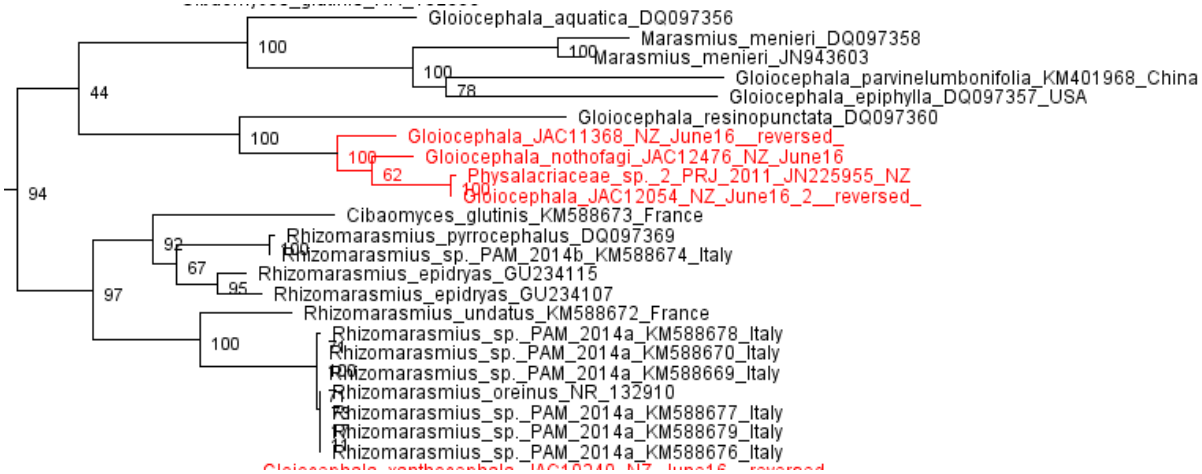
LSU RAxML – unsupported but different position of G. phormiorum and M. perpusillus



ITS RAxML – different position of G. xanthocephala

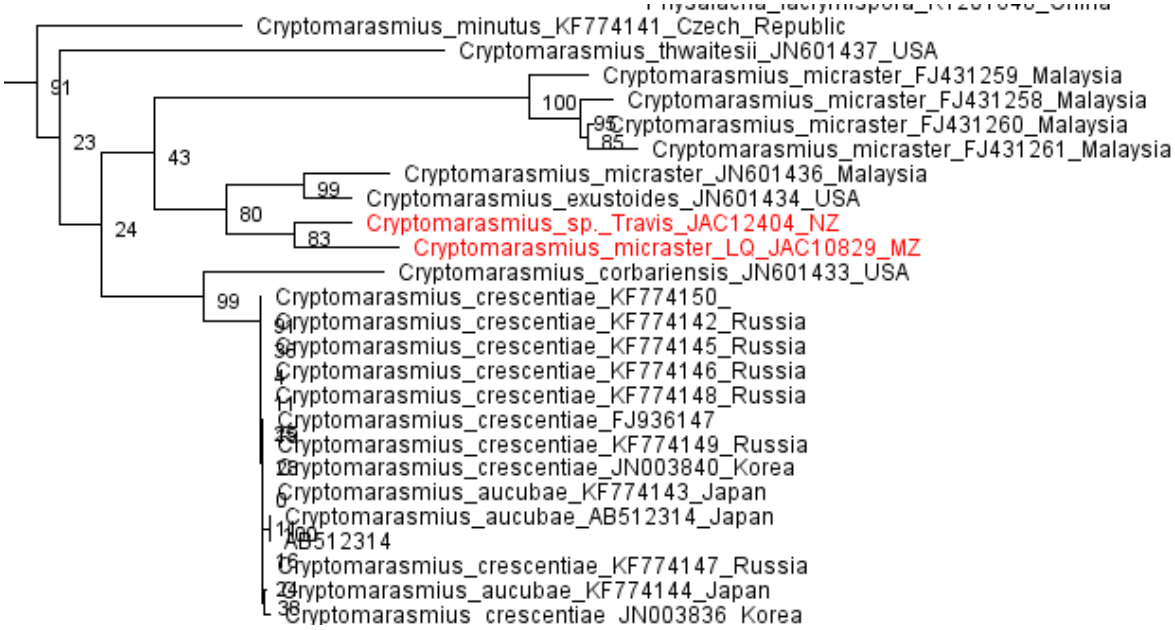


ITS RAxML – Gloiocephala sensu stricto

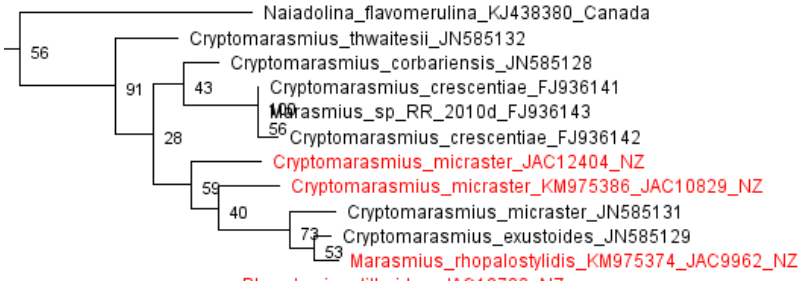


G. JAC11368 = Marsmius merdionalis

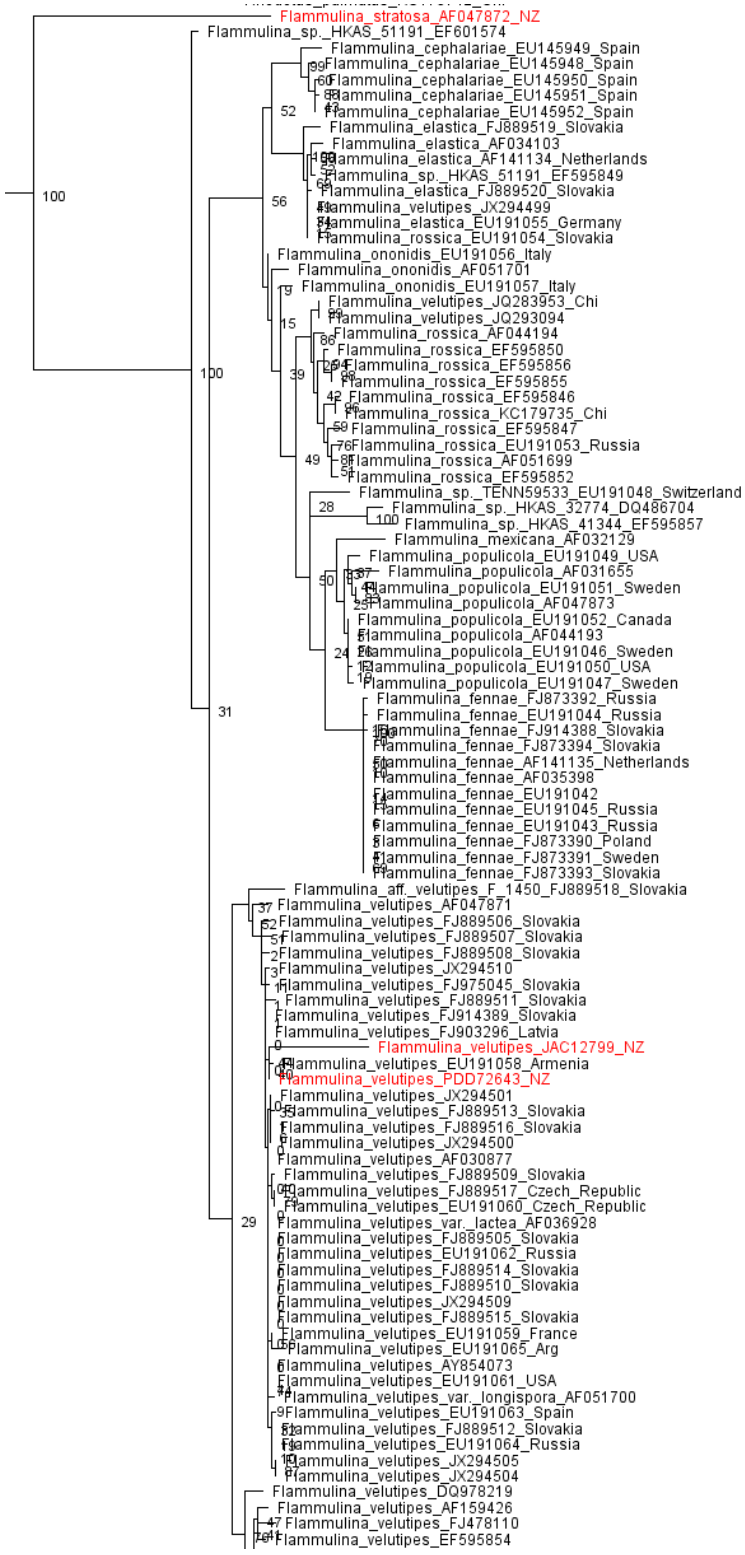
ITS RAxML – Cryptomarasmius sensu stricto



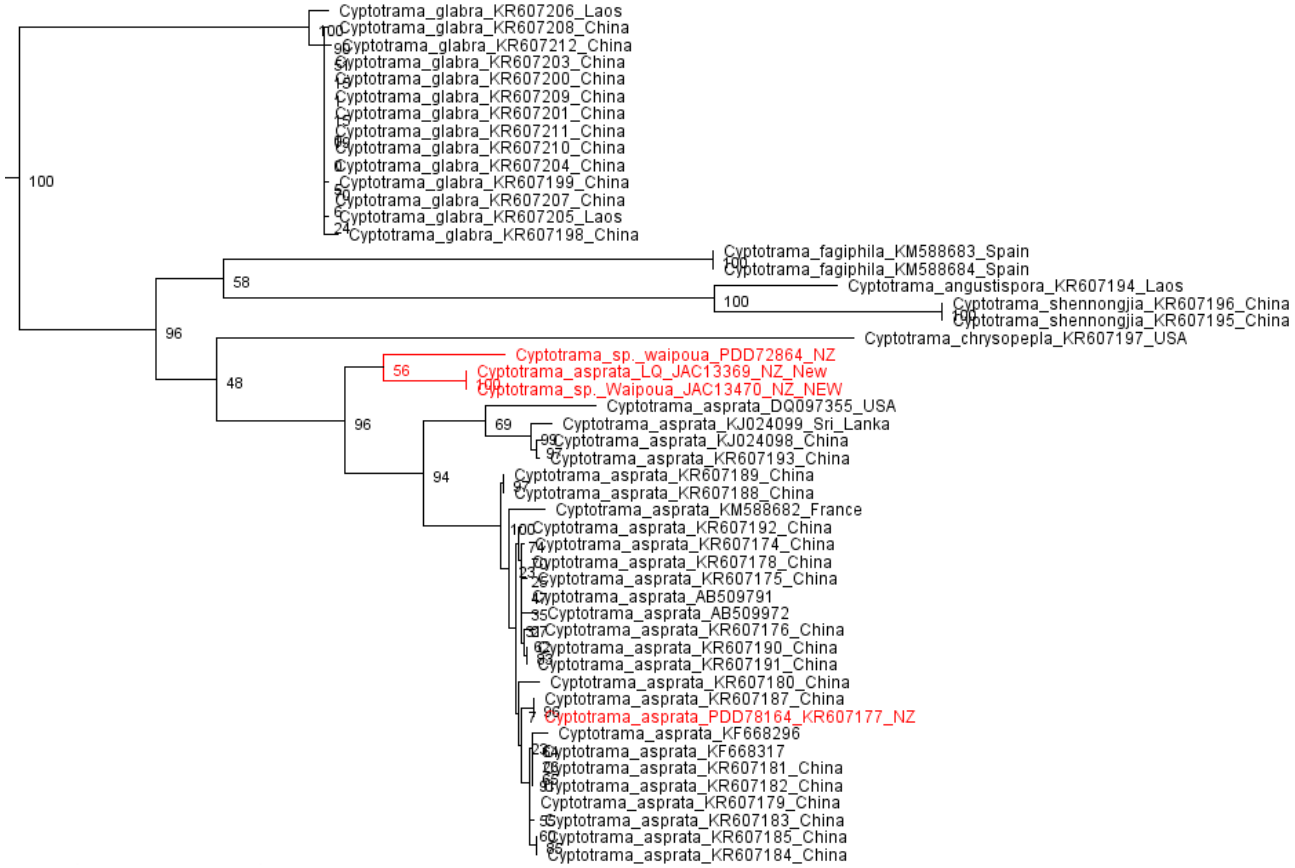
LSU RAxML – Cryptomarasmius sensu stricto



ITS RAxML Flammulina



ITS RAxML – Cyptotrama



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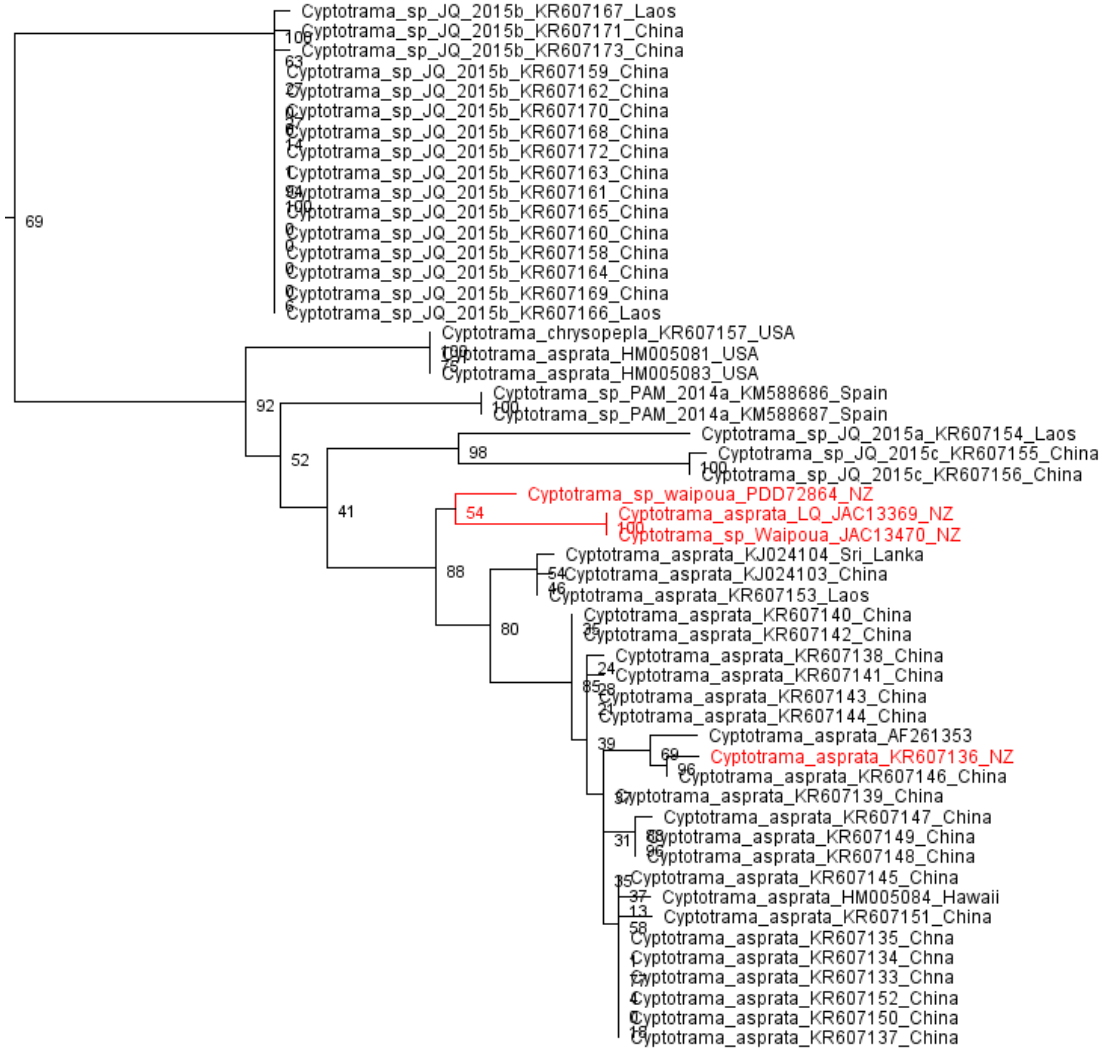
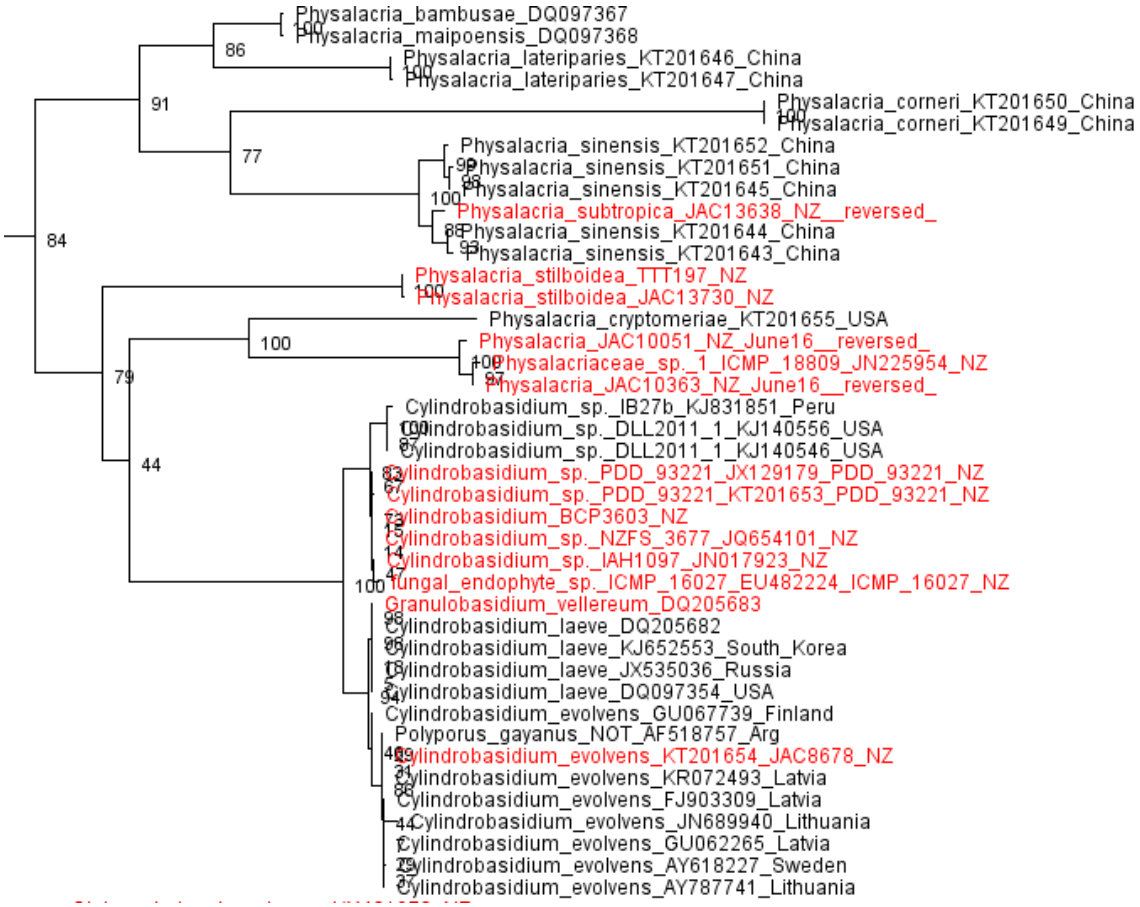
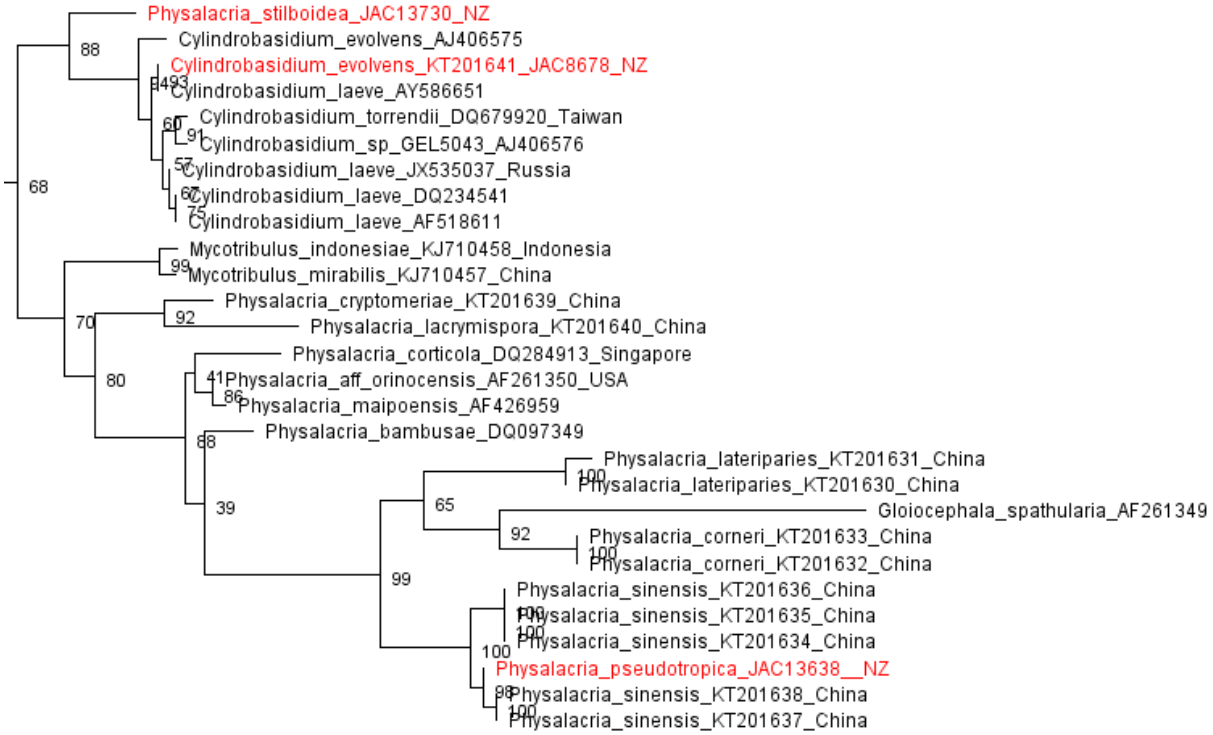


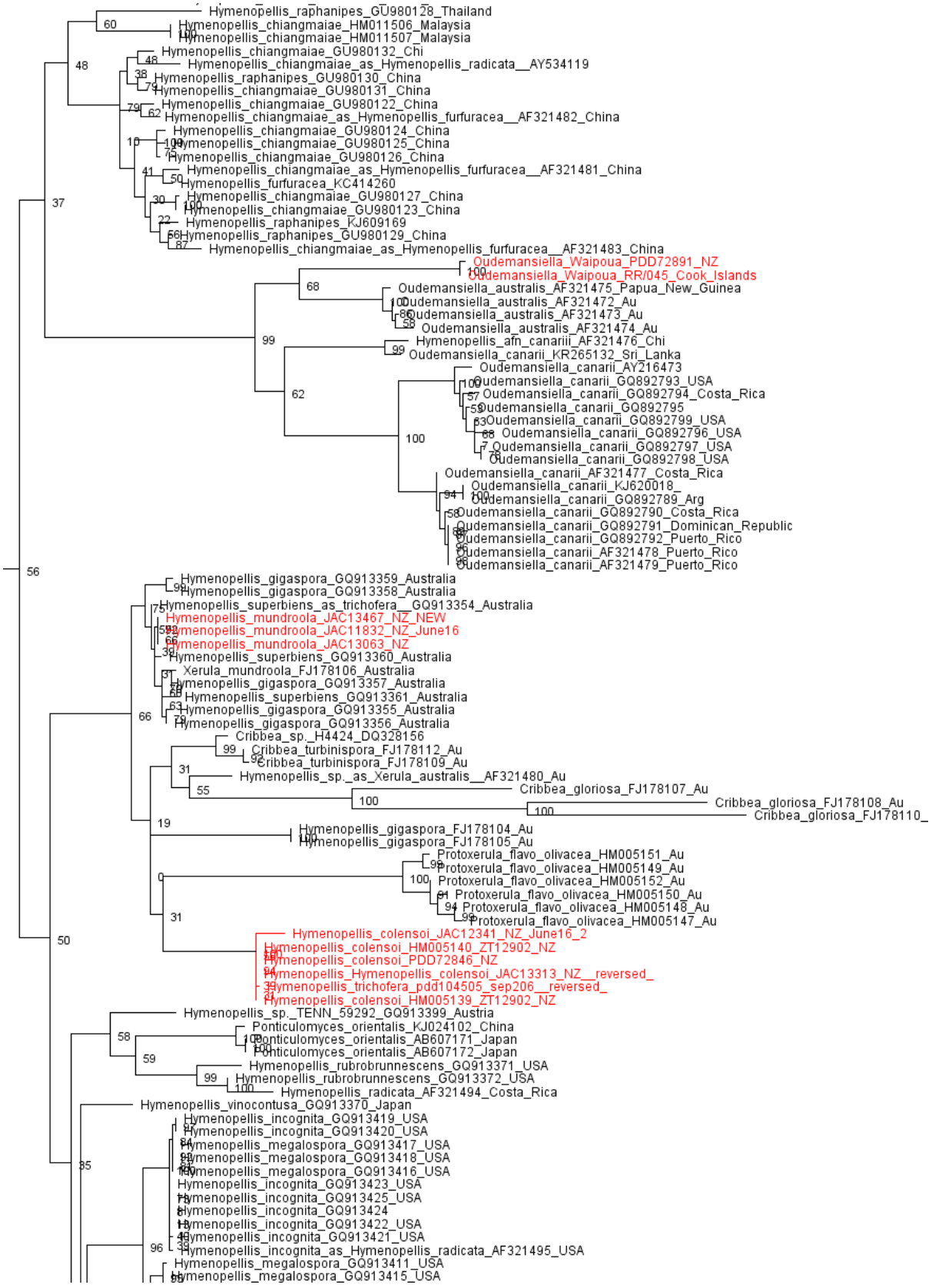
ITS RAxML – Cylindrobasidium/Physalacria



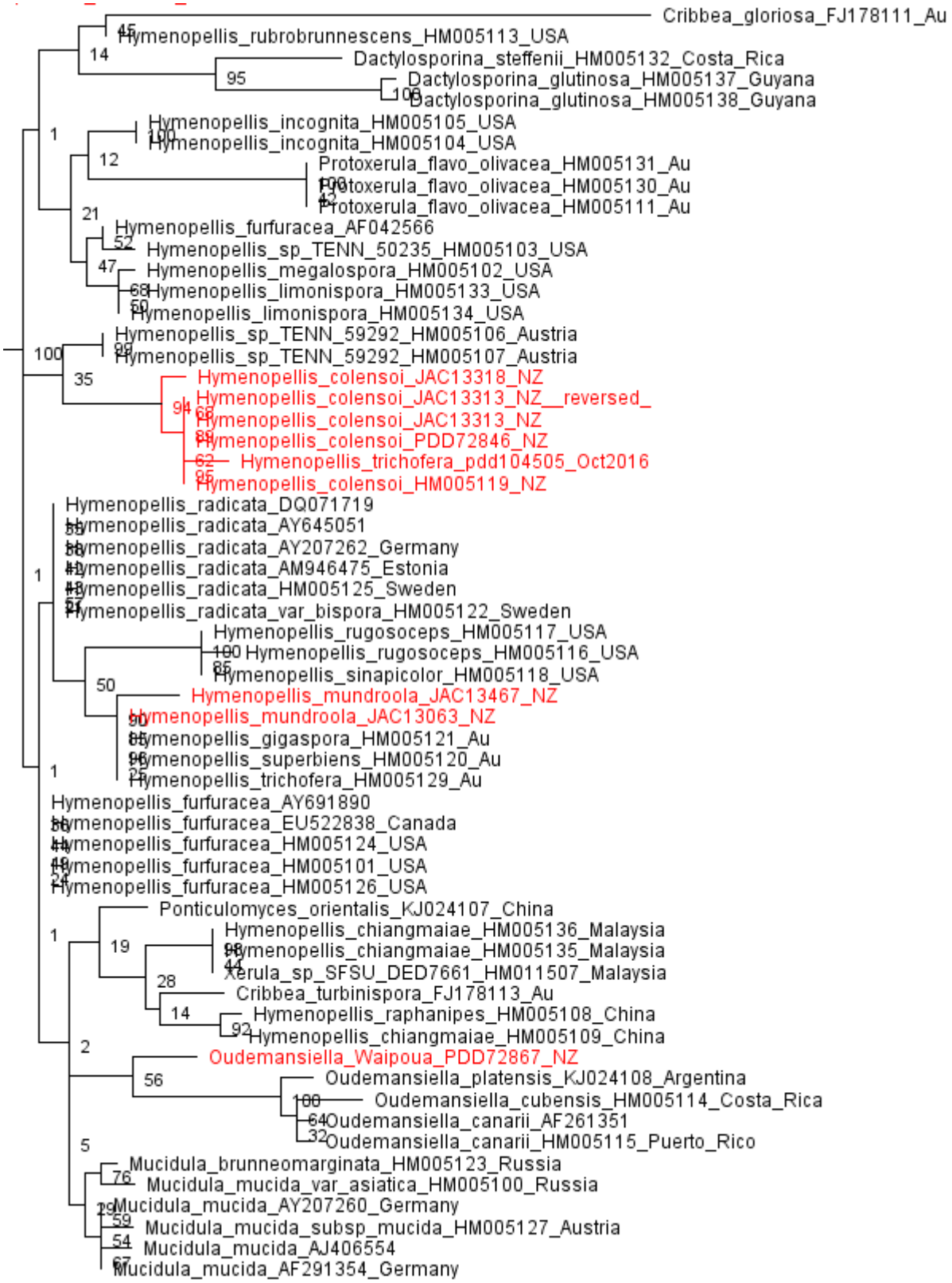
LSU RAxML - Cylindrobasidium/Physalacria



ITS RAxML Hymenopellis/Oudemansiella



LSU Hymenopellis/Oudemansiella



References