New Zealand species of Tremellodendropsis

Mycological Notes 44

Jerry Cooper, January 2025

History of the genus and New Zealand species

Tremellodendropsis species are common in New Zealand. They are relatively easy to recognise amongst the club fungi, not least because the fruitbodies are exceptionally tough. At the outset I should say that identifying any New Zealand *Tremellodendropsis* species requires careful microscopy.

The first serious work on this group of fungi can be found in the ground-breaking global monograph of club fungi by Corner in 1950. He introduced the genus *Aphelaria*, based on the species *A. dendroides* from Java. For New Zealand he accepted the presence of *A. dendroides* and *A. pusio*. The latter species described from New Zealand by Berkley in 1855 (as *Clavaria pusio*). In 1953 Corner published an update where in the genus he recognised subgenus *Aphelaria* and subgenus *Tremellodendropsis* based on *A. tubersosa*, described from the UK. These subgenera were separated on an important distinction. In subgenus *Aphelaria* the hyphae are unclamped and the basidia normal, whereas in subgenus *Tremellodendropsis* the hyphae are clamped and the basidia show a peculiar septation that looks cruciate from the top, with longitudinal septa extending from the 4 sterigma into the basidium but not completely longitudinally septate when viewed from the side, i.e. the longitudinal septum terminates inside the basidial tissue. *A. pusio* belonged in this *Tremellodendropsis* subgenus. In this new subgenus he also recognised *A. flagelliformis* (also described by Berkeley from NZ in 1855), and *A. tasmanica* (described from Tasmania). So, at this time we had four *Aphelaria* species – *A. dendroides*, *A. flagelliformis*, *A. pusio*, and *A. tasmanica*.

In 1954 Alleyne Crawford, working at the Cawthron Institute, published a paper specifically on the New Zealand species. In that paper she raised *Tremellodendropis* to the level of genus, and presumably still recognised *Aphelaria* but did not treat it. Within her newly recognised genus she had two subgenera, *Tremellodendropsis* with partially longitudinally septate, and subgenus *Transeptia*, based on *T. transpusio*, where the longitudinal septate are completed by intersection with the basidial wall or a basal transverse septum within the basidium. She recognised subgenus *Tremellodendropsis* containing *T. pusio*, *T. flagelliformis*, with two separated varieties var. *ovalispora* and var. *tasmanica* (not present in NZ), and subgenus *Transeptia* with *T. transpusio* (type New Zealand), also with two separated varieties, var. *minor*, and var. *inflata*. So, at this time we had the four species *A. dendroides*, *T. flagelliformis* (+ vars.), *T. pusio* and *T. transpusio* (+vars.).

Corner's monograph received criticism for being a work that was written without a revision of relevant material, especially types, and he did not see any New Zealand material of *A. dendroides*. That is understandable because Corner's work on the monograph was mostly done while he was a Japanese prisoner of war in Singapore. Unlike most prisoners he had some degree of freedom because he was tasked with looking after the Singapore Botanic Gardens during the war, and much would have been lost without his presence. However, he was subsequently regarded with suspicion by many western taxonomists who viewed him as a collaborator. In my view much of the criticism he received for the *Clavaria* book, and other work, was clouded by this inappropriate view of Corner's role in Singapore during the war. Derek Reid, then head of the Mycology section at Kew (and who later supported my early mycological interests) was especially negative towards Corner. Crawford, it seems, was guilty by association. In 1956 Reid published his revision of the group. He rejected the partial/complete basidial septation as a distinguishing character for *Tremellodendropsis* and so

rejected Crawford's analysis. Instead, he still accepted *T. tuberosa* (the type species) but placed Crawford's species in his new genus *Pseudotremellodendron*, based on *P. pusio*. For New Zealand he had just *P. pusio*, with *T. flagelliformis* (+ var. *ovalispora*), and *T. transpusio* (+ var. *minor* and var. *inflata*) as synonyms. So, in Reid's view we had just *A. dendroides* and *Pseudotremellodendron pusio*.

Corner, writing in 1970, rejected Reid's *Pseudotremellodendron*, pointing out that Reid's distinction did not hold for the type of *T. tuberosa* which he had, by then, examined. He distinguished the process of transverse septation occurring before spore formation in subgenus *Transeptia*, and after in subgenus *Tremellodendropsis*.

In 1985 Ron Petersen reviewed all the various types and in 1987 he specifically tackled the New Zealand species. He reasonably reverted to using *Tremellodendropsis*. He accepted the distinction between complete and partial septation and raised Crawford's *T. transpusio* var. *inflata* to species. At this time we had *T. flagelliformis*, *T. inflata*, *T. pusio* and two undescribed but insufficiently known species. Petersen's concept of *T. flagelliformis* included both *T. tasmanica* and *T. flagelliformis* var. *ovalispora*. His concept of *T. inflata* includes *T. transpusio* var. *minor*, and his concept of *T. pusio* included *T. transpusio* var. *transpusio* var. *transpusio* var. *transpusio* var. *transpusio* var. *minor*, and his concept of *T. pusio* included *T. transpusio* var. *transpusio*. Petersen highlighted one more important character associated with some species. For *T. pusio* and his undescribed T. sp II he notes that the spores germinate by repetition, i.e. the spores produce a short germ-tube from which a secondary and smaller spore develops.. This phenomenon is common in many tremellaceous groups. This character was noted by Crawford for her *T. transpusio* and her drawing of *T. flagelliformis* var. *tasmanica* shows something similar. It was also mentioned for a study of the type specimen of *T. pusio* by Reid. Petersen also placed an emphasis on measurements of the spore eccentricity. He also distinguished *T. inflata* as having bulbous basidia.

By this time the New Zealand status of *Aphelaria dendroides* seem to have been forgotten about. The use of the name in New Zealand has persisted to the present day, but the available collections indicate we don't have this species and all records refer to our *Tremellodendropsis* species or are misidentification of *Trechispora* (*Scytinopogon*). Indeed, I'm not sure anybody knows what *A*. *dendroides* (with unclamped hyphae and non-septate basidia) means in a current sense. There are no sequences. It should be noted that most NZ species of *Tremellodendropsis* show only some clamped hyphal tissue, and sometimes difficult to observer basidial septa. Confusion of our *Tremellodendropsis* species with the description of *Aphelaria* is possible, even with microscopy.

So, with this rather convoluted history of names and concepts, what do modern sequenced collections of *Tremellodendropsis* tell us? And how do the characters of complete/incomplete longitudinal septation, spore repetition and eccentricity stack up?

I first sequenced one of our species back in 2013. At the time there were just a couple of sequences of *Tremellodendropsis* in GenBank. The earliest is AF291375 from Costa Rica and from that Weiss & Oberwinkler (2001) and others tentatively assumed the genus belonged in the Auriculariales. We now know that specimen was misidentified. The second sequence (GQ981528) was of the type species, *T. tuberosa* from the UK, and it was clear my sequence was related. The puzzle was that these sequences were not remotely related to anything else. It was later in 2016 that the position of *Tremellodendropsis* (or rather lack of position) was confirmed as a an early-diverging isolated group, now placed in its own order – the Tremellodendropsidales. *Tremellodendropsis* is an old genus of fungi. Deposited 'root tip' sequence data suggests it might be mycorrhizal, but if so then it isn't the usual ectomycorrhizal association with beech or tea-tree because species are widespread in

podocarp forests. Since the first sequenced NZ collection I have collected, and sequenced, many more, and we have a lot of different species.

First let's summarise Petersen's view, his synonymy, and critical characters of the types (including my recent measurements taken from Crawford's NZ types):

Petersen's 1987 Revision

Taxon	Spore rep.	Spore size & Q	Basidia septation	Macro features
T. inflata Syn. T. transpusio, var. minor	no	Inflata: 11.8 x 7.2, Q=1.66 var. minor: 8.7 x 4.4, Q= 1.97[jac]	Complete/aberrant	3cm, tips flattened, pinkish buff 2cm, pinkish brown to flesh coloured
T. pusio Syn T. transpusio	yes	Pusio: 13.2 x 7.1, Q=1.82 Transpusio: 13.2 x 6.1, Q=2.417[jac]	complete	2.5cm, tips terrete, off white to ivory
T. sp. II	yes	15.9 x 7.3, Q=2.14	complete	7 cm, tips flattened, pendulous, ivory to pale yellow
T. flagelliformis Syn. var. ovalispora	no	flagelliformis: 10.5 x 6.3, Q= 1.56 var. ovalispora: 9.0 x 8.0, Q=1.26 [JAC]	incomplete	6cm, tips terete, pinkish fawn
T. sp. l	no	8.9 x 7.2 um, Q=1.23	incomplete	6cm, tips flattened, cream

Petersen's main characters for NZ species

Petersen's key

 Basidia incompletely cruciately septate; spores subglobose to broadly ellipsoid to ellipsoid (Em < 1.6) Basidia completely cruciately septate; spores ellipsoid (Em = >1.6) Spores 10-12 X 7.2-8.6 um (Lm - 10.6um, Q 1.35); fruitbodies pallid pinkish tan odor negligible Spores 8.3-9.4 X 6.8-7.6 um (Lm - 8.9 um, Q 1.23); fruitbodies pale dull yellow (cream color); odor mild to moderate, spicy Spores 11.5-15.1 X 6.5-7.9 (Lm - 12.89 um); fruitbodies color probably creamy; odor unknown; Australia Spores not germinating by repetition; basidia subbulbous, often aberrantly septate. Spores 9-11.2 X 5.4-6.8um, (Q 1.67, Lm = 9.7) Spores germinating by repetition; basida subbulbous or not Basidia subcylindrical to clavate, never bulbous; fruitbodies upright, slender . Spores 9.4-12.2 X 5-6 (L 10.26, Q 1.87um) Basidia subbulbous when young; fruitbodies positively geotropic, on soil overhangs with algae. Spores 13.7-17.6 X 6.8-7.9 (L 15.9, Q 2.14) 			
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The Type Localities

Aphelaria dendroides	Java
T. flagelliformis	Bay of Islands
T. flagelliformis var. ovalispora	Tararua Ranges
T. pusio	Dannevirke?
T. transpusio	Wellington

T. tranpusio var. minor	Wellington
T. inflata	Nelson
Petersen Sp. I	Puketi Forest
Petersen Sp. II	Mt Taranaki

Petersen's Descriptions

T. flagelliformis

Fruitbodies up to 6 cm high, up to 2.5 cm broad, arbuscular, erect, branches in 2-4 ranks. Stipe arising from spreading white, tough, basal patch or a tight ball of mycelium Involving significant substrate, usually discrete, up to 30 X 4 mm, off-white to "pinkish buff," felty but not strigose. Branches erect, tough, somewhat divergent, flattened below, less so upward, "cinnamon buff," "vinaceous buff," "light ochraceous buff," "pinkish buff," avellaneous;" axils acute; apices prolonged, terete, off white ("pale pinkish cinnamon"); all parts occasionally rubri-vlnescent upon bruising ("dull Indian purple," "anthracene purple"). Taste negligible to musty; odor negligible. FCL = negative to grey

Hyphae of branch trama 2-4 pm diam, thin- to slightly thick-walled (wall up to 0.3 um thick), strictly parallel, tightly packed, hyaline, clamped. Hymenium thickening; basidia 90-130 X 10-12 um, with a long equal base, broadly clavate upward, aseptate to Incompletely cruciately septate, the septa extending to 20 um and ending indiscreetly; contents multiguttulate to granular when immature, coalescing into several large, refringent guttulae by maturity; sterigmata (2)-4, stout, curved, up to 15 um long. Spores 10-12.2 X 7.2-8.6 um (E = 22-1.48; E"1 - 1.35; Lm = 10.62 um), broadly ellipsoid, smooth, hyaline; contents granular to foamy when immature, uni- to biguttulate when mature, the guttules conspicuously refringent; wall up to 1 um thick; hilar appendix small, papillate; germination by repetition absent.

T. inflata

Frultbodies up to 3 cm high, up to 1.5 cm broad, branched, erect, arising from an off-white basal mat involving a small ball of substrate; consistency tough, fibrous. Stipe up to 20 X 3 mm, off-white to pallid pinkish tan ("pinkish cinnamon," "pinkish buff"), felty, occasionally strigose at very base. Branches concolorous, flattened, erect, parallel to somewhat divergent; axils acute; apices prolonged, <1 mm thick, "pinkish buff" to "pale pinkish cinnamon," more or less terete. No color changes on bruising or picking. Taste negligible; odor negligible to faintly musty. FCL = negative.

Hyphae of branch trama 1.8-2.5 um diam, thin- to slightly thick-walled (wall up to 0.3 um thick), hyaline, strictly parallel, tightly packed; septa with or without clamp connections. Hymenium thickening; basidia 40-60 X 9-11 um, arising as a digitate hyphal tip from a clamp, elongating significantly, then rather abruptly inflating distally, becoming transversely septate about 18-25 um from the apex, then producing longitudinal septa between the sterigmata which join the transverse septum; mature basidia retaining the subbulbous shape; sterigmata (2)-4, stout, divergent, occasionally arising laterally on the basidium. Spores 9-11.2 X 5.4-6.8 um (E = 1.47-1..93; JE^M - 1.67; L^M - 9.7 (um), ellipsoid to narrowly ovate, flattened adaxially, hyaline; contents uniguttulate when mature; hilar appendix broad, papillate, truncate; germination by repetition absent.

T. pusio

Fruitbodies up to 2.5 X 1.5 cm, subsimple to branched dichotomously, extremely slender (no part more that 1 mm thick), arising from a small off-white mycelial patch involving very little substrate.

Stipe up to 11 X 1 mm, smooth. Branches extremely slender, erect, divergent; axils acute; apices prolonged up to 5 mm, acerose. All parts "pale pinkish buff," with stipe and lower branches bruising dull avellaneous. Taste, odor and FCL reaction unrecorded.

Hyphae of branch trama 1.5-2.5 um diam, hyaline, thin to slightly thick-walled (wall up to 0.2 um thick), strictly parallel, tightly packed, clamped commonly (not Invariably). Hymenium thickening; basldia 35-50 X 9-11 um, clavate, arising as a broadly cylindrical hyphal tip, gradually inflating apically, producing a transverse septum 13-20 um from the apex, and longitudinal septa between the sterigmata joining the transverse septum and often stretching it upward with apical expansion; contents multiguttulate at maturity; sterigmata 4, stout, somewhat divergent. Spores 9.4-12.2 (15.1) X 5-6 (7.6) um (E = 1.80-2.00; E = 1.87; Lm 10.26 um, excluding outsize spore), ellipsoid, flattened adaxially; contents uni- to biguttulate at maturity; hilar appendix blunt, broad; germination by repetition abundant, with the sterigma often double.

T. sp. l

Fruitbodies up to 6 X 2 cm, arising from substantial off-white mycelial patches not Involving significant substrate when picked, branched in 2-4 ranks, tough. Stipe up to 33 X 3 mm, off-white, felted, undulate-equal. Branches "cream color" to "warm buff," flattened somewhat downward, more or less terete upward, tough, erect and somewhat divergent; axils acute; apices prolonged, acute, "cream buff." Odor spicy, penetrating, like *Clavicorona* spp.; taste negligible.

Hyphae of branch trama 2-4 um diam, thin- to slightly thick-walled {wall up to 0.3 urn thick), hyaline, tightly packed, strictly parallel, long-celled; septa sometimes clamped, basidia 80-100 X 10-12 um, clamped, with long, equal basal portion and abruptly inflated clavate apex, incompletely cruciately septate, the septa extending 6-10 um in basidial lumen and ending indecisively; contents foamy to multlguttulate; sterigmata 2-4, stout, curved. Spores 8.3- 9.4 X 6.8-7.6 um (E - 1.15-1.37; E1* = 1.23; $L^{\text{TM}} = 8.9$ um), subglobose to broadly ellipsoid, hyaline; contents uniguttulate when mature; wall up to 0.2 um thick; hilar appendix papillate, broad; germination by repetition absent.

T. sp. ll

Fruitbodies positively geotropic, up to 7 X 2.5 mm, simple or once-furcate or irregularly lobed, tough in consistency, ivory colored to very pale clear yellow, tapering toward base, flattened toward apex and often narrowly palmate, arising from Inconspicuous mass of mycelium and Involving significant soil when picked; apex often "avellaneous;" on volcanic soil covered with algae.

Tramal hyphae 3-4 um diam, thin- to thick-walled {wall up to 0.3 um thick), hyaline, conspicuously clamped, loosely packed, generally parallel. Subhymenium rudimentary. Hymenium thickening, with effete basidia crumpled but persistent; basidia 65-75 X 17-21 um, inflated apically but with equal basal portion, completely cruciately septate, clamped; contents multiguttulate to foamy upward, with proximal portion becoming homogeneous; sterigmata 4, up to 11 um long, stout, straight, divergent. Spores 13.7-17.6 X 6.8-7.9 um (E - 1.86-2.29; Em - 2.14; L10 " 15.9 u m), boletoid to undulate cylindrical, hyaline, smooth, thin-walled; contents opalescent; hilar appendix inconspicuous, papillate; germination by repetition occasional.

Re-examination of Crawford's Type collections

T. flagelliformis var. ovispora PDD 44749 (=T. flagelliformis sensu Petersen)



It is difficult to decide if the basidia are completely septate or not. Some of the older collapsed ones do look completely septate. No sign of spore repetition. Spores Length: μ =10.1 μ m, σ =0.54; Width: μ =8.1 μ m, σ =0.48; Q: μ =1.26, σ =0.08; V: μ =348.0 μ m³, σ =52.34: n=20.

T. transpusio PDD 44743 (=T. pusio sensu Petersen)



Very little material is left and all fragmented. Basidia mostly completely longitudinally septate. Spore repetition abundant. Spore size variable, Length: μ =13.2 μ m, σ =0.83; Width: μ =6.1 μ m, σ =0.37; Q: μ =2.17, σ =0.19; V: μ =258.7 μ m^3, σ =35.72: n=23. Petersen synonymised *T. flagelliformis* var. *ovispora* with var. *flagelliformis* because he found the variability in spore sizes too large to justify the separation. His 1985 spore measurements from the type are 8-10 x 5-7 um. His 1987 treatment of the NZ species considers a range of collections, but there is no real guarantee he was looking at the same taxon. The morphology of sequence-identical collections suggests there are reliable differences in spore size and that var. *ovalispora* could correspond to one of the more recently recognised phylogenetic taxa.

PDD 44754 Tremellodendropsis tranpusio var. minor (=T. inflata sensu Petersen)

This holotype collection is a single unsealed slide on which the only visible structures are spores. There is reference to a spirit collection, mentioned by Petersen in 1985, and the current whereabouts of that collection are unknown. This slide collection is non-functional as a holotype. The spores are: length μ =8.7 μ m, σ =0.53; Width: μ =4.4 μ m, σ =0.30; Q: μ =1.97, σ =0.18; V: μ =89.7 μ m^3, σ =13.63: n=25, and are non-repeating. Note that Petersen did not include this under synonymy with *T. pusio* and synonymised with *T. inflata*. It does not seem to have repeating spores but the size/shape of spores is quite different to *T. pusio*.

Petersen in his revision says "*My measurement of spores of the type specimen of var. minor are almost the same as those of the type of var inflata.*" Statistically my re-measurements from the type collections do not support that statement. I believe var. *minor* should be recognised as an independent taxon.



PDD 44746 T. tranpusio var. inflata (=T. inflata sensu Petersen)



The remaining material is sparse. Not many mature basidia or spores were found. Spore size is variable and I think this collection is immature. Basidia are completely septate, subbulbous and no spore repetition was seen. Spores: Length: μ =11.4 μ m, σ =1.29; Width: μ =7.5 μ m, σ =0.62; Q: μ =1.53, σ =0.19; V: μ =338.3 μ m³3, σ =79.47: n=12

Analysis of recent collections

Macro-morphological methods

All species are really tough and the normal practice of examining a squash of tissue does not work. You will break cover slips. My approach has been to examine the fruitbodies under a stereo microscope looking for branches with obvious spore production, present as a white powdery appearance. Often these fertile portions are subapical. I break off a small part of the branch, perhaps 4mm in length, and let it soak in a drop of 5% KOH on a slide for 10 minutes. I then use a needle to hold one end of the strip, and scrape the surface using an ophthalmic scalpel (a favourite dissecting tool for me). The surface layer of the hymenium will slough off the underlying tough cortex. The resulting fragments are then stained in NH4OH+Congo Red. The mount is then viewed at x1000 using Differential Interference Contrast. If you do not have access to DIC then you will need to find a suitable high refractive index mounting fluid (NH4OH is not adequate). The combination of Congo-Red stain and DIC is usually enough to clearly show the critical septation of the basidia. Petersen used Phloxine in his studies, but I get better images with Congo red.

Molecular methods

I generally use a very simple DNA extraction with the Sigma Extract-N-Amp kit, where a small piece of tissue is placed in an extraction buffer and left for 10 minutes, followed by heating at 95c for 3 minutes, addition of 'neutralising' buffer (BSA), and then 1ul of the extract used in a direct PCR. This expensive kit is composed of cheap reagents for which the recipe can be found online. I have used the standard primers of ITS1F/ITS4 and LROR/LR5 and both generally work for *Tremellodendropsis*. Sequencing was carried out by my colleague Duckchul Park using Sanger Big Dye technology.

Phylogenetic analysis.

Sequences were aligned with the MAAFT E-INSI-I algorithm, and ML analysis using IQ-Tree with its internal model finder, and a 1,000 ultra-fast bootstraps.

Results

At the time of writing the sequence data indicate that we have 12 or 13 distinct species of *Tremellodendropis*, and I'm confident yet more will be found, especially in the far north. In reviewing the morphology of these species, I have re-introduced some of the names previously placed in synonymy by Petersen. I may or may not be correct, but it seems sensible at this stage to use existing names where possible. None of the names I have used have a morphology that exactly matches previous descriptions, except for *T. flagelliformis*.

First here is the current phylogeny of sequenced material together with my interpretation of taxon identities.



Clade	Colls	Rep.	Size/Q	Septation	Morphology	Candidates
C1	JAC17917	no	16.4 x 6.1, Q =	complete	2.5cm, tips	None
			2.68		terete, white	
C2	JAC14940	yes	12.5 x 5.9, Q =	complete	2cm, tips terete,	Like pusio
			2.14		white	but white
C2	JAC12887	no	10.7 x 5.1, Q =	complete?	1cm, tips terete,	none
			2.1		yellowish tan	
C2	JAC14938	no	9.5 x 5.6, Q =	complete	3cm, tips terete,	none
			1.7		fawn pinkish	

C2	JAC14942, JAC16272	no	10.8 x 6.0, Q = 1.8	complete	1.7cm, tips flattened, pinkish fawn	Inflata?
C3	17858,18021	no	7.9 x 4.9 ,Q = 1.62	Complete /incomplete -anomalous	3.4 cm, tips terete?, cream to ivory	transpusio var. minor?
C4	JAC18286	no	10.3 x 7.7, Q = 1.34	complete	1cm, blunt, ivory	none
C5	jac14941, jac9939, jac17260	no	10.2 x 7.3, Q = 1.4	Incomplete	3cm, tips flattened, white, cream to ivory, greyish	none (sp. 'Lottery Bush')
C5	16840, pdd119776	no	9.5 x 7.6, Q = 1.26	incomplete	6cm, tips flattened, Cream to yellowish	Sp. I? (sp. 'Ulva')
C5	17939	no	12.0 x 7.2, Q = 1.68	Incomplete	5cm, tips terete, cream to ivory	none
C5	jac13843, jac17896	no	10.6 x 8, Q = 1.34	incomplete	4cm, tips palmate, cream to flesh	flageliformis var. ovalispora
C5,	jac14646, pdd 116871	?	?	?	3cm. tips palmate, cream to flesh	
C5	Lots of collections	No	9.7 x 6.5, Q = 1.5	Incomplete	3cm, tips flattened, cream to gray becoming flesh coloured.	flagelliformis

The occurrence of secondary spore formation is a distinct feature of *T. pusio* (seemingly regardless of variations in reported fruitbody colouration). The formation of a complete versus incomplete longitudinal septa is semi-supported by phylogenetics. The position of Clades 3 is poorly supported and the presence of basidial septa equivocal. I am not convinced by the distinction of any transverse septum occurring before or after spore formation. It is a difficult character to observe, and I don't think it provides any useful level of taxonomic distinction, at least in the specimens I have looked at. The same is true of bulbous versus elongate basidia or the presence/absence of clamps.

It is certainly worth emphasising that these features distinguishing groups within *Tremellodendropsis* appear to be restricted, and partial basidial septation is so far only present in New Zealand species.

1	Frbs with pinkish/flesh-coloured tones at maturity	2
1	Frbs white to ivory, tan to pale yellow	5
2	Basidia complete septation, to 3cm, spores to 10um,	3
	Q=1.5 (if spores > 10um and repeating see T. pusio)	
2	Basidia Incomplete septation	4
3	tips flattened	T. inflata
3	tips terrete	JAC14938
4	Q < 1.4, tips palmate	T. flagelliformis var. ovalispora
		& JAC14646
4	Q> 1.5, tips flattened but not palmate	T. flagelliformis

A trial key for the currently recognised NZ phylogenetic taxa

5	Basidia complete septation	6
5	Basidia incomplete septation (but see also var. minor)	10
6	Spores > 14um, Q > 2.5, pure white, spores not	JAC17917 (if spores repeating
	repeating	see T. sp. II)
6	Spores < 14um, Q < 2.5	7
7	Spores to 13um, Q > 2, tips acerose, spores repeating	T. pusio
7	Spores < 12um, spores not repeating	8
8	Yellowish tan, to 1cm, Q > 2, without geniculate	T. JAC12887
	'paraphyses'	
8	White, cream to ivory, with geniculate 'paraphyses'	9
9	Spores < 9um, Q > 1.5, tips acerose, to 3cm	T. transpusio var. minor
9	Spores > 9um, Q < 1.5, tips blunt, to 1cm	T. JAC18286
10	Q <1.3, < 10um, tips flattened, frbs to 6cm, cream to	T. sp. 'Ulva' (potentially
	pale yellow	Petersen sp. I)
10	Q >1.3, > 10um, cream to ivory or greyish	11
11	Q > 1.5, > 11um, tips acerose, cream to ivory	T. JAC17939
11	Q < 1.5, < 11um, tips flattened, white, cream greyish to	T. sp. 'Lottery Bush'
	ivory	

Note that the presence of flesh-coloured tones is variable, so work both sides of the first couplet. In addition, for those species that show a partial basidial septation I have sometimes found just a few basidia that have total septation. It is clear that these are post-spore production. I have not looked at this further, but the critical character of partial septation should be seen as applying to most basidia, but perhaps not a small minority.

Brief notes on sequenced collections

Clade 1

T. sp. JAC17917

Col. N. Siegel, Opepe Scenic Reserve, Taupo, NI, 21st May, 1923, NS5979/ PDD 115027

14-25 mm high, single stalk 6-10 mm long, to spreading crown 9-19 mm across, flesh tough(ish), no odor, taste mild. potentially tuberous.

spores very elongate at maturity but starting globose/ovoid, basidia septation complete, no repetition of spores seen. Spores Length: μ =16.4 μ m, σ =1.38; Width: μ =6.1 μ m, σ =0.40; Q: μ =2.68, σ =0.31; V: μ =325.5 μ m^3, σ =45.68: n=29. The spore dimensions are like Petersen's sp. II but here the there is no repletion by germination



Clade 2

T. pusio

Noting that my collections are white and T. Pusio was described by Petersen as pale pinkish buff.

JAC14940

Col. G. Smith, Mt Lees Reserve, Sanson, NI, 1st Aug. 2018, PDD 107155

Growing on a mossy bank beside a track in a partially modified habitat. Up to 20 mm in height.

Basidia completely longitudinally septate, spores germinating by repetition. Spores Length: μ =12.5 μ m, σ =0.66; Width: μ =5.9 μ m, σ =0.40; Q: μ =2.14, σ =0.15; V: μ =227.8 μ m^3, σ =34.60: n=20



T. sp. JAC12887

Col. J.A. Cooper, Te Wera Reserve, Taranaki, NI, 17th May 2013, PDD 96991

Hyphae clamped. Basidia cruciately septate and with complete transverse septum. Spores, length=9.7–12.1 μ m (μ =10.8, σ =0.92), width=4.6–5.9 μ m (μ =5.4, σ =0.37), Q=1.8–2.2 μ m (μ =2.00, σ =0.16), n=8.





T. sp. JAC14938

Col. G. Smith, Bruce Scenic Reserve, Hunterville, NI, 2nd Aug. 2018, PDD 107153

Growing on the ground in broadleaf-podocarp forest. Up to 30 mm high.

Basidia with complete septation, spore repetition not seen (although a few smaller spores present). Length: μ =9.5 μ m, σ =0.60; Width: μ =5.6 μ m, σ =0.43; Q: μ =1.70, σ =0.13; V: μ =156.5 μ m^3, σ =29.20: n=20



T. inflata JAC14942 Col. G. Smith, 15th July 2018, Manawatu Gorge, Balance, NI, PDD 107157

Growing horizontally out of a bank beside a track in broadleaf-podocarp forest. About 20 mm in length. Most of the branch tips sharply pointed.

Basidia longitudinally completely septate, bulbous when immature, 4-spored. Hyphae clamped. Spores 13x7, variable, no repetition seen.



T. sp. JAC16272

Col. N. Siegel, 8th May, 2019, Rimutaka Forest Park, Orongorongo track, NI, PDD 113417

Scattered from soil and moss, in mixed broadleaf-podocarp-beech forest. 15-17 mm high, 6-8 mm across at crown, tough texture, no odor.

Basidia completely septate. Spores Length: μ =10.8 μ m, σ =0.62; Width: μ =6.0 μ m, σ =0.47; Q: μ =1.81, σ =0.16; V: μ =207.1 μ m^3, σ =35.78: n=20





Clade 3

T. transpusio var. minor

JAC17858

Col. N. Siegel, 15th May, 2023, Pelorus Bridge Scenic Reserve, forest near campground, SI, PDD 114968

20-34 mm high, 7-17 mm at crown, tough, no odor, taste not sampled. Habitat: Scattered in duff under tree ferns, Dacrycarpus dacrydioides and mixed broadleaf trees

This has abundant thin cylindrical 'paraphyses'. Completely longitudinally septate. No spore germination seen. Spores Length: μ =7.9 μ m, σ =0.52; Width: μ =4.9 μ m, σ =0.20; Q: μ =1.62, σ =0.12; V: μ =99.3 μ m³, σ =10.87: n=20





JAC18021

Col. G. Ridley, 28th May 2023, Wellington, Otari Wiltons Bush, NI, PDD 115132

Growing on twig in leaflitter, under broadleaf-podocarp forest. The growth direct from wood is unusual, and not like 17858. The presence of any septa in the basidia is only obvious in older collapsed basidia. Clamps are only present on the thick-walled cortical hyphae. Spores Length: μ =8.8 μ m, σ =0.73; Width: μ =5.5 μ m, σ =0.33; Q: μ =1.61, σ =0.15; V: μ =137.9 μ m^3, σ =21.69: n=20



Clade 4

T. sp. JAC18286

Col. J.A. Cooper, 3rd Aug. 2024, Kerikere River Track, NI

Fruitbodies relatively small

No spore repetition, basidial septation complete, spores Length: μ =10.3 μ m, σ =0.66; Width: μ =7.7 μ m, σ =0.40; Q: μ =1.34, σ =0.08; V: μ =319.2 μ m^3, σ =45.71: n=20. With geniculate paraphyses



Clade 5

T. sp. 'Lottery Bush'

JAC14941

Col. G. Smith, 30th Jul. 2018, Mt Lees Reserve, Sanson, NI, PDD 107156

Growing on a bank beside a track through scrubby vegetation including tea-tree. Up to 25 mm high.

No spores or basidia found.



JAC9939

Col. J.A. Cooper, 30th Apr. 2006, Montgomery Park Reserve, Banks Peninsula, SI, PDD 87043

With a slightly tuberous root.

Basidia incompletely cruciate (but with occasional immature basidia that do look complete). Length: μ =10.6 μ m, σ =0.76; Width: μ =7.7 μ m, σ =0.37; Q: μ =1.37, σ =0.11; V: μ =330.9 μ m^3, σ =40.61: n=20





JAC17260

Col. J.A. Cooper, 11th Apr. 2022, Lottery Bush, Hurunui, SI, associated with *Dacrydium cupressinum*, PDD 114370

Cream with laterally flattened tips.

Clamps inconspicuous and perhaps not always present. Basidia partially longitudinally septate. Spores not germinating but becoming elongate at maturity. Length: μ =10.2 μ m, σ =0.74; Width: μ =7.3 μ m, σ =0.50; Q: μ =1.41, σ =0.14; V: μ =287.4 μ m³, σ =49.64: n=20



T. sp. 'Ulva (PDD 113970)'

Potentially = Petersen sp. I

JAC16840

Col. J.A. Cooper, 12th Apr. 2021, Ulva Island, SI, PDD 113970

To 6cm tall.

Incompletely longitudinally. Spores not repeating. Clamps looped, obvious. spores Length: μ =9.5 μ m, σ =0.43; Width: μ =7.6 μ m, σ =0.40; Q: μ =1.26, σ =0.07; V: μ =286.6 μ m^3, σ =39.80: n=20. Colour perhaps not right for ovalispora.



PDD 119776

Col. S. da Silva, 12th Apr. 2021, Ulava Island, SI.



T. sp. JAC17939

Col. N. Siegel, 23rd May, 2023, Sanctuary Mountain, Maungatautari. NI, PDD 115049

29-49 mm high, 15-31 mm across, tough rubbery fibrous, odor and taste unpleasant. Habitat: Scattered from moss and soil under tree ferns, in mixed broadleaf-podocarp forest

Clamps looped, spores not repeating, basidia partially septate. Spores Length: μ =12.0 μ m, σ =0.78; Width: μ =7.2 μ m, σ =0.53; Q: μ =1.68, σ =0.11; V: μ =326.8 μ m^3, σ =58.69: n=20



T. flagelliformis var. ovalispora

JAC13834

Col. J.A. Cooper, 17th May 2015, Keith George Memorial Park, Upper Hutt, NI, PDD 106039

Col. J.A. Cooper

With a basal hyphal ball



JAC17896

Col. Ni. Siegel, 17th May, 2023, Manawatu Gorge, Tawa Loop Track, NI, PDD 115006

26-37 mm high, 5-20 mm across at crown, though, rubbery-fibrous, slightly rancid odor, taste mild. With a basal bulb

No spore repetition, basidia incompletely septate, Spores Length: μ =10.6 μ m, σ =0.58; Width: μ =8.0 μ m, σ =0.38; Q: μ =1.34, σ =0.08; V: μ =353.4 μ m^3, σ =43.46: n=15





T. sp. JAC14646

Col. G. Smith, 30th May 2017, Ashhurst, NI, PDD 106525

Growing on the ground at the base of a large tree in broadleaf-podocarp forest. Pale apricot-pink colour, up to 30 mm in height. Tips of branches appear to be flattened.

Unfortunately, the species represented by JAC14646 and PDD 116871 remains uncharacterised. I made 3 attempts to find spores or basidia on JAC14646 and gave up. The fruitbodies are immature. I have not loaned PDD 116871. I'll wait until a photographed/sequenced collection turns up.



T. flagelliformis

JAC17907

Col. N. Siegel, 17th May, 2023, Pohangina, Totara Reserve, NI, PDD 115017

41-59 mm high, 15-40 mm across, flattened upright branches, tough, odor unpleasant, taste indistinct. Habitat: Scattered in duff and soil in mixed broadleaf-podocarp forest, under tree ferns



JAC15524

Col. G. Smith, 4th Aug. 2018, Ashhurst Domain, Ashhurst, NI, PDD 112674

Growing on the ground and on a standing tree-fern trunk in a native forest remnant (Up to 55 mm in height.



JAC17261

Col. J.A. Cooper, 11th Apr. 2022, Lottery Bush, Hurunui, under *Dacrydium cupressinum*, SI, PDD 114371

with pale mauve colours and spiky tips. Growing amongst the cream/flattened tip colony. Perhaps associated with root ball which 17260 was not. The same or not? [JAC:16/01/2025] basidia partially longitudinally but note that septum reaches wall. No spore repetition. spores Length: μ =9.7 μ m, σ =0.62; Width: μ =6.5 μ m, σ =0.37; Q: μ =1.50, σ =0.14; V: μ =214.8 μ m^3, σ =25.60: n=20



PDD 105309

Col. B.S. Weir, 24th Jul. 2017, Waitakare Ranges, Auckland City Walk, NI, PDD 105309



JAC16556

C. C.F. Schwarz, 13th May 2019, Ngahopua Track, Lake Okataina, Bay of Plenty, NI, PDD 113699



JAC14625

Col. P. de Lange, 25th Jun. 2017, Auckland, Waitemata Harbour, Kendall Bay, NI, PDD 106504

in mixed Metrosideros/Kunzea forest bordering coast swamp forest. Fruiting bodies colonial, pale apricot orange to orange-white, with stout stipe, then much divided, apices of divisions acute.

4-spored, spores 10 x 6, Q= 1.7, basidia partially vertically septate



JAC15882

Col. N. Siegel, 12th Apr. 2019, Franz Josef, SI, PDD 113029

Soil under broadleaf and podocarp trees. 27-52 mm high, crown 21-40 mm across, tough stingy texture, with softer rubbery coating.



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