New Zealand species of *Clavulina*

Mycological Notes 45

Jerry Cooper, October 2025

Introduction

Clavulina species are ectomycorrhizal, and sequence data shows they form a well-supported clade within the Cantharellales. There remains some debate about the recognition of a broad Hydnaceae family incorporating Clavulinaceae and Cantharellaceae. I choose to recognise these families separately.

A phylogenetic analysis of New Zealand collections suggests that our use of *Clavulina* names requires re-evaluation. As usual with my notes, this is very much a work in progress.

The current phylogenetic tree for the NZ species may found here …

https://www.funnz.org.nz/sites/default/files/2024AugMultiClavulina.pdf

In New Zealand the genus was last revised by Ron Petersen in 1988[1], and he recognised 16 taxa. The subsequent use of Petersen's 1988 keys/concepts, and the slides/paintings in that work, has led to several names being commonly adopted for NZ specimens, such as *C. brunneocinerea*, *C. geoglossoides* and *C. samuelsii*. Sequencing of PDD collections under these names indicates many more than three species, and the names not consistently applied to any single species. In general, the key characters have proven to be unreliable. The sequence data show that colours can vary significantly during maturation and between collections, especially for the white/cream/grey/purple series (most of them). The degree of branching is also a variable factor, although those forming simple, single clubs seem consistent. There are relatively few species I believe can be identified by macro-features alone. Petersen's key makes use of micro-features, especially cystidia morphology, which is useful, but it is important to note that cystidia can often form in patches and otherwise sparse or absent. You need to hunt for them using a stereomicroscope. Certainly, in some species cystidia are common and emergent, and then they give the fruitbody a macroscopic velutinous to warty/ rough appearance. The length of basidia is not a character I have consistently noted, but I doubt it is usefully diagnostic. Spore size is quite variable. Therefore, the historical differentiation of species has been based on characters that are variable and unreliable. Unfortunately, good stable characters have yet to be found, except for the mycorrhizal host preference.

Petersen adopted several names of species described overseas and I doubt any are present in New Zealand, except perhaps Australian-named species associated with myrtaceae. We now know that ectomycorrhizal species like *Clavulina* are biogeographically rather restricted, and most New Zealand species are endemic and host restricted. Thus, the beech associated species are usually different to the tea-tree associated species. Petersen did not explicitly mention potential mycorrhizal hosts but we can use his specimen data to gain some insights (often inferred from the type locality).Several newly described species in 1988 were based on single specimens, and it is always a cause for concern that the full range of morphological variability has not been captured in descriptions based on a single specimen. In general, the 1988 keys and descriptions cannot easily be reconciled with

[1] Petersen, R.H. (1988) The clavarioid fungi of New Zealand. DSIR Science Information Publishing, Wellington, New Zealand.

modern phylogenetically circumscribed species. Identification of our *Clavulina* species is not straightforward.

Currently we have sequence data for two type collections, so there can be no doubt about a modern interpretation of *Clavulina subrugosa* var. *tenuis*, and *C. brunneocinerea*. In the following notes I have used Petersen's names *C. septocystidiata* and *C. samuelsii*, but without much confidence. My use of the name *C. zealandica* is well supported by morphology and host association. Petersen did not consider introduced species which we have included here, and they probably incorporate at least one concept from Petersen's work (*Clavulina cavipes* sensu Petersen = *Clavulina rugosa*).

In the phylogenetic analysis the New Zealand taxa form a single lineage. This clade contains collections from New Caledonia, Australia and a single species from China (*C. minor*). The remaining northern hemisphere species are in separate clades. Consequently, it is not surprising our species seem to share many common features that are distinct from northern hemisphere species (e.g. cystidia). New Zealand has many similar species that are part of a regional and relatively recent radiation. That is a common pattern for many taxa, and not just fungi. Within that radiation I can find no useful correlations between species hosts and phylogeny or fruitbody characters and phylogeny.

At this stage, and to avoid confusion, I have disregarded several of Petersen's names that aren't easily applied to modern collections. I have provided tag names to most of these phylogenetic species I couldn't reconcile with Petersen's species.

A Trial Key

I don't have much faith in this key but it is perhaps a step in the right direction.

1	Frbs white, with introduced tree	2
1	Frbs white, grey, purplish, with native beech or tea-tree	3
2	Frbs rugulose. Mainly with pinaceae but also oaks	C. rugosa
2	Frbs not rugulose, with cristate tips. With broadleaved exotic trees	C. coralloides
3	With beech	4
3	With tea-tree	11
4	Frbs simple, or sparingly branched at the apex, solitary, or gregarious	5
4	Frbs regularly branched	7
5	Frbs gregarious, stipe bases mustard colour on drying	C. sp. 'Totara'
5	Frbs solitary, sacttered	6
6	Spores < 10um. With obvious cystidia	C. sp. 'Routeburn'
6	Frbs often shortly forked at the apex , spores > 10um. With cystidia in discrete scattered bundles.	C. sp. 'Blackball'
7	Frbs ultimately pale cream to pinkish or occasionally light grey	C. zealandica
7	Frbs ultimately always dark grey/purple	8
8	Frbs purplish, and base of stems, and often tips, with orange colours	C. brunneocinerea
8	Base of stems if differently coloured then cream	9
9	Cystidia > 100um	C. septocystidiata
9	Cystidia < 100um	10
10	Cystidia mult-septate	C. sp. 'Rees valley'
10	Cystidia with single basal septum	C. sp. 'Lottery Bush'
11	Frbs pinkish, inflated	C. vinaceocervina var. avellanea
11	Frbs cream or grey/purple	12
12	Frbs cream-ish	15

12	Frbs grey/purple	13
13	Surface smooth. No cystidia	C. sp. ‘Kowhai’
13	Surface hispid to warty. Cystidia present	14
14	Surface hispid to rugose. Clubs uniform in colour.	C. sp. ‘Mt Lees’
14	Surface warty/rough. Clubs usually with paler tips	C. samuelsii
15	Frbs with apex densely cristate	C. sp. ‘Dry Bush’
15	Frbs with apex not densely cristate	C. subrugosa var. tenuis

Introduced species

Clavulina coralloides

Associated only with introduced mycorrhizal angiosperms in NZ. Always branched and with finely cristate tips.

JAC12912 Quercus	
	

Clavulina rugosa

It seems likely the Petersen use of the name *C. cavipes* is the same. This species occurs with introduced mycorrhizal gymnosperms and angiosperms in NZ.

JAC9061 with *Quercus*	JAC13429 With *Pseudotsuga*
	
JAC10545 With *Pinus*	

Australasian Clade

The Beech associated species

Petersen's species I have not been able to reconcile with modern collections, or are perhaps synonyms of some described below are: *C. alutaceosiccescens*, *C. floridana* sensu Petersen, *C. geoglossoides* sensu Petersen pp, *C. humilis*, *C. leveillei* sensu Petersen, *C. purpurea*, *C. septocystidiata*, *C. subrugosa* sensu Petersen

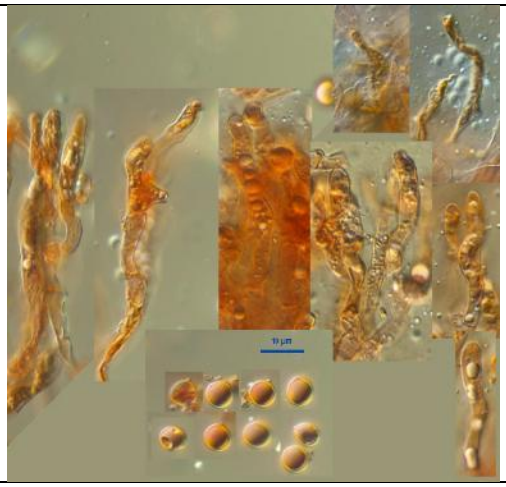
Clavulina septocystidiata #1

Often in large troops, under beech, 40-100 mm high, in fasciculate clusters, 30-100 mm across, stipe 18-40 mm long, 4-8 mm thick, orangish, branches smoky, tips tan to ochre, taste indistinct.

Cystidia present but not emergent, trama clamped, branching, with brown content becoming concentrated as hyphae collapse. Spores 6 um subglobose.

Petersen's photo of this is white but the dried type specimen is uniformly pigmented. The type specimen also has shorter cystidia than these collections. Consequently, there is doubt about correct identification. Note the overall similarity with *C. brunneocinerea* and see *C. septocystidiata* #2

JAC16469/NS4202/PDD 113613	JAC17762/PDD 114872
	

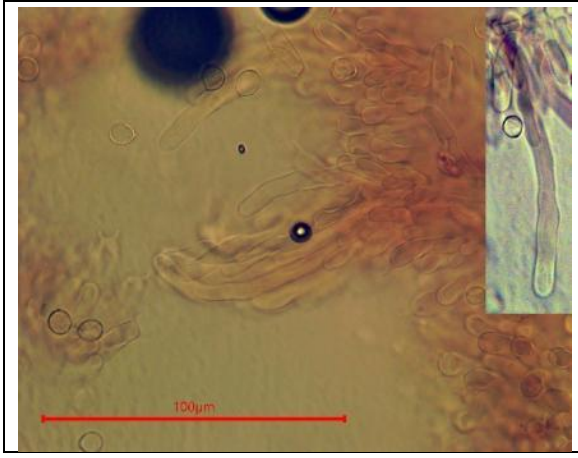
	

Clavulina sp. 'Lottery Bush (PDD 114369)'

With a single combined stem and white basal mycelium, rough surface to branches, branches maturing wine coloured, naked stipe-base brown before the white sock.

Trama clamped, cystidia in fascicles, no septa, to 100um, spores 10 x 9um.

There is one candidate for *C. purpurea* although that may be a synonym of *C. brunneocinerea*

JAC17259/PDD 114369		JAC17587/PDD 114698
		
		

Clavulina brunneocinerea

Scattered in litter and soil under beech, 20-60 mm high, crown 10-40 mm across, branches grey, stipe initially purple becoming grey to orange with age, base whitish, no odour, taste mild or sweetish. Dries uniformly slate grey. Hymenium peeling in fresh material, to reveal white sub-hymenium. Cystidia visible as fascicles and macroscopically displaying a warty surface to the branches.

Trama hyphae clamped, with dark intra-cellular pigments, cystidia occasionally 1-septate and clamped, occasionally with oleiferous apex, spores globose 7.5-10um, with dark pigments, basidia 70um long.

The colours of this species are variable but quite often the branch apices are cristate. It seems likely that *C. purpurea* represents a colour form of the same species although Petersen's single specimen was very large. The identity of *C. brunneocinerea* is confirmed by sequence similarity with the type.

jac10007	Jac14884

Jac11803

Jac13924

Jac13919

Jac14903

Jac14913

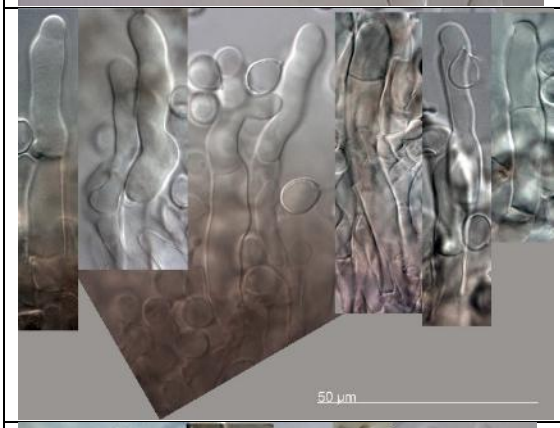
Clavulina sp. 'Rees Valley (PDD 106273)'

Frbs branched, 30-60mm high, branches 3-7mm thick, stipe ivory, branches purple-grey, no odour, taste mild. Branches warty under dissecting scope.

Trama clamped, basidia to 40-70um, with brown patchy content, cystidia in fascicles, to 70um, sometimes emergent, sometimes not, with gloeoplerous tips, septate, or not, and clamped. Spores 10.6 x 6.7um, basidia to 45um.

Jac14105

Jac14910

Clavulina septocystidiata #2

Frbs to 75mm high x 35mm across, branches pinkish cinnamon to grey, rugulose, stipe cream to pale orange, slightly rooting, and forming a single root (to 20mm) which seems characteristic. No odour, taste mild to slightly acrid.

Cystidia occasional, gloeoplerous, to 120um x 10um, multi-septate, basidia to 80um, spores 10.6 x 9um.

Jac15985	Jac14901

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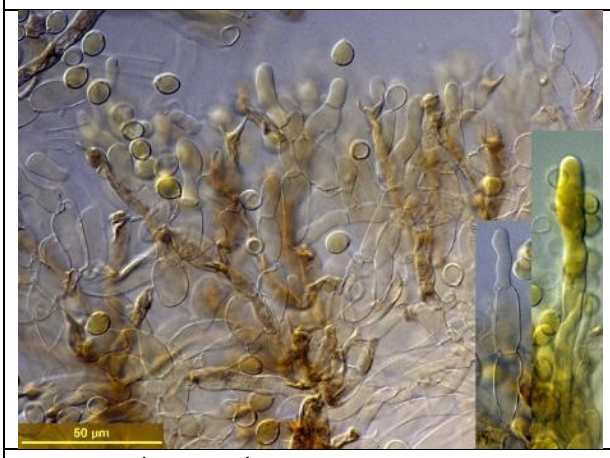
<tr><td> 
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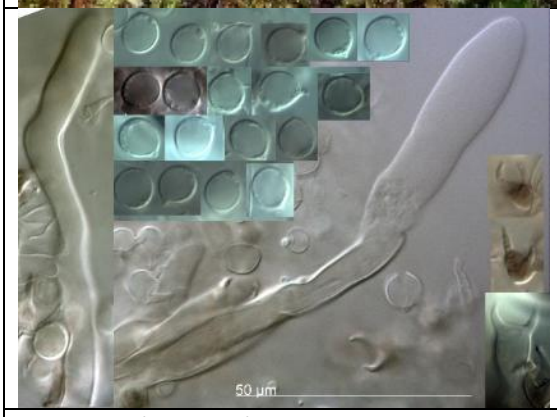
Clavulina sp. 'Routeburn (PDD 106275)'

Frbs solitary, simple clubs, 30-100 mm high, 2-5 mm thick, tapering towards tip, white to pale grey. Stipe white to pale yellow.

With obvious emergent cystidia, septate or not, clamped. Spores, including apiculus to 9.1 x 7.7um. Trama clamped, basidia without pigment.

This is one of several species I believe Petersen interpreted as *C. geoglossoides* and the most common of the versions. *C. geoglossoides* was originally described from Australia in association with myrtaceous hosts and probably not present in New Zealand, although it may be the same as *C. sp. 'Kowhai'*. *C. sp. 'Routeburn'* is more closely related to the Australian *C. tasmanica* which Petersen indicated is more sooty brown in colour and without cystidia. Pale, simple forms may represent *C. alutaceosiccescens*. See also *C. hispidulosa*.

Jac14107	Jac14885
	
	
JAC17838/NS5900/PDD 114948	
	

Clavulina sp. 'Blackball (PDD 107092)'

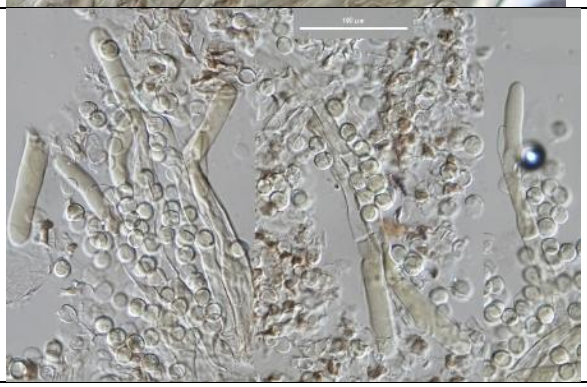
Frbs simple clubs, 30-150mm high, 1-7mm thick, tips sometimes forked near apex, minutely velvety, initially cream, becoming two-tone with grey upper and pale lower stem. No odour, taste mild/sweetish.

With emergent cystidia in scattered bundles, trama clamped, spores 8-12 x 8-10um.

This is another species historically misidentified as *C. geoglossoides*. It may also be the same as Petersen's concept of *C. floridanus* with clamp connections. Petersen's concept of that does not have cystidia. The true *C. floridanus* is one of the very few species originally described without clamp connections but Petersen's concept for the species in New Zealand does have them. Another candidate for Petersen's concept of *C. floridana* is *C. sp. 'Totara'*.

Jac14876	JAC17833/NS5895/PDD 114943
	
	
Jac16167	JAC14909/NS2731/PDD 107125
	

Pdd112081	Pdd 111984
	
JAC14912/NS2601/PDD 107128	JAC16450/NS4183/PDD 113594
	
JAC17664/NS5732/PDD 114775	JAC17747/NS5816/PDD 114857
	

Clavulina sp. 'Totara (PDD 107095)'

Frbs 30 – 100 mm high, 1-5mm thick, initially white becoming two-tone with grey upper and white to yellowish base. Base colours darkening mustard yellow on drying. No odours, taste mild.

No cystidia, trama clamped, spores to 12x10um subglobose.

Potentially this may represent *C. alutaceosiccescens*.

Pdd 89881 beech	Jac14878
	
Jac14879	Jac9049

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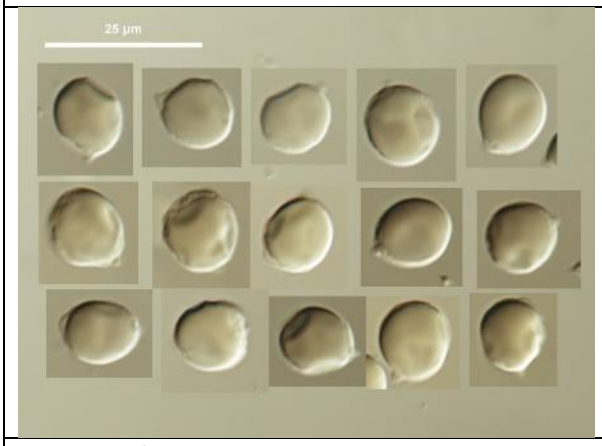
<tr><td> 
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<tr><td>JAC16781/PDD 113911</td><td></td></tr>
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Clavulina zealandica

Frbs scattered, fasciculate, branched, often with finely branched apices, white, cream, tan, pinkish grey to lilac grey. 50-90mm high, to 50 across. Odour nil or sweetish, taste mild.

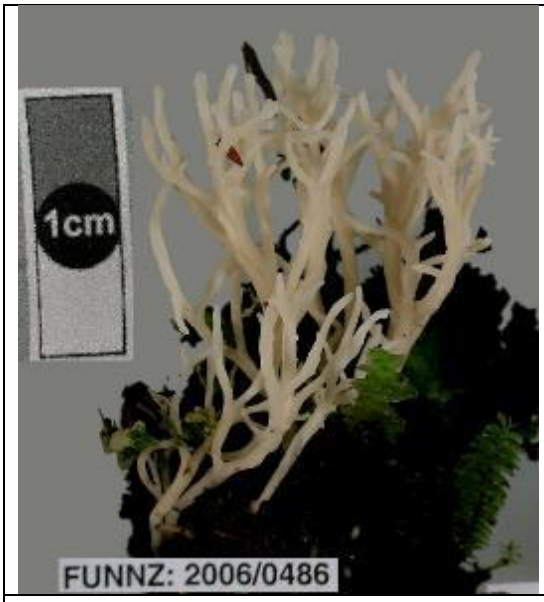
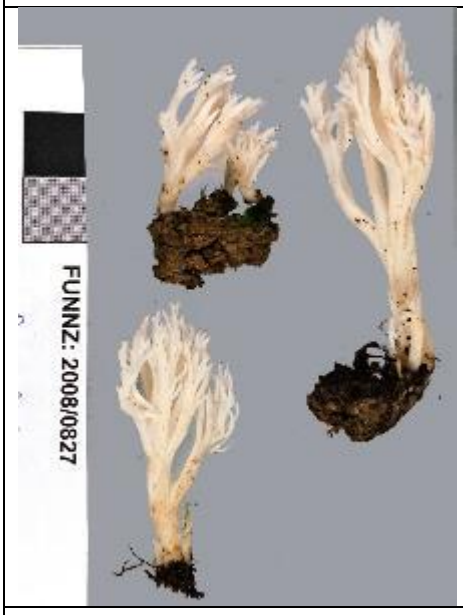
Cystidia uncommon, emergent & septate, spores subglobose 8.5-12 x 7.5-10um, trama clamped

A very common species, but also very variable in appearance.

Petersen described *C. zealandica* without cystidia, and in the specimens presented here they are usually not seen, but occasionally present and then quite obvious. The spore size is variable.

Perhaps Petersen's *C. alutaceosiccescens* is a synonym for the creamy-yellow version. Specimens have been misidentified historically as *C. subacuta*, C*. urnigerobasidiata*, and *C. samuelsii*.

Pdd 89833	Jac14873
	
Jac14905	Jac12911
	
Jac16288	Jac14908
	
Jac10133	Jac10752

	
Jac13750	Jac13392
	
Jac10745	JAC17750/NS5819/PDD 114860
	
Jac16545	Jac14904

	
Jac10455	Jac14106
	
Jac14882	JAC8993/PDD 80259
	
JAC14877/NS2556/PDD 107093	JAC14906/NS2639/PDD 107122
	
JAC14907/NS2564/PDD 107123	JAC15963/NS3690/PDD 113110

	
JAC17580/PDD 114691	
	

The tea-tree associated species

Petersen's species I have not been able to fully reconcile with modern collections, or are perhaps synonyms of some described below, are: *C. copiocystidiata*, *C. subrugosa*, C*. urnigerobasidiata*, *C. hispidulosa* sensu Petersen, *C. cavipes* sensu Petersen, *C. geoglossoides* sensu Petersen, C*. leveilei* sensu Petersen, C*. leveillei* var. *atrica*, *C. septocystidiata*.

Clavulina vinaceocervina* var*. avellanea

Frbs fasciculate, to 50mm x 10mm across, branches 2-3mm, usually pinkish tan but also grey in one collection. Clubs apically branching, surface finely velutinate, bruising brown and tips frequently dark. Taste mild, odour none.

Trama unclamped, cystidia sparse, spores subglobose 9um.

The type collection was described from beech forest but I suspect tea-tree was also present. The absence of clamp connections and the pinkish hues are distinctive, except that PDD 114964 is anomalous.

JAC14088 tea-tree?	JAC13255 tea-tree

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<tr><td>JAC17836/NS5898/PDD 114946</td><td></td></tr>
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Clavulina sp. 'Dry Bush (PDD 96957)'

Frbs fasciculate, 10-30mm with branches 1-3mm thick, tan to grey with variable colouration, branch tips becoming cristate.

This is the tea-tree version of *C. brunneocinerea* and equally variable in form and colour. Branches have a tendency to be cristate. More collections are required, and critical comparison with *C. hispidulosa* and *C. alutecaosiccesens*. There are no micro-details for this species currently. Specimens have been misplaced.

JAC12853	JAC17843
	
OTA62602	
	

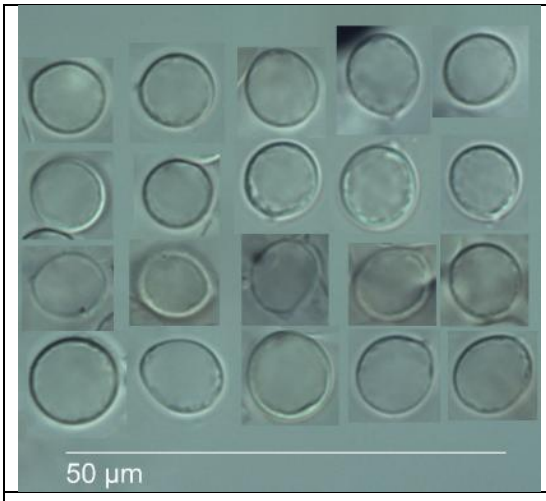
Clavulina sp. 'Mt Lees (PDD 107151)'

Frbs to 50mm high, grey to greyish lavender/purple, fasciculate, surface velutinous to hispid.

Trama clamped, cystidia not observed, spores 9-9.5x8um, basidia with brown pigments.

The purple colouration in some specimens is suggestive of *C. purpurea* but that is a beech-associated species.

JAC14151	JAC14891
	



JAC14936

JAC18035

JAC18153

Clavulina samuelsi

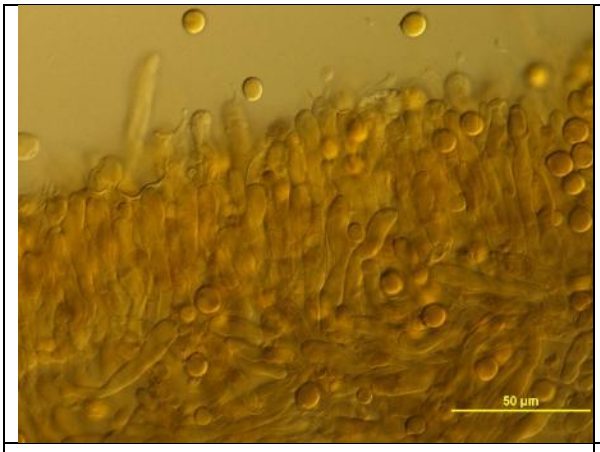
Frbs to 60mm tall and 60mm across, branches 1-4mm thick, simple to gregarious, sparingly branched, sometime cristate at the apex, white when young becoming lavender grey, tips often paler tan, surface warty/hispid with age, no odour, taste mild.

Trama clamped, cystidia present in dispersed fascicles, spores 9 x 8um, basidia with brown pigments.

Petersen treated *C. samulesii* as a species with simple clubs often clustered into groups. He noted a distinct difference in colour between the stipe and the hymenium, but that is a common and variable feature of several species.

This taxon seems the most likely candidate for *C. samulesii* but I am not confident. The holotype is most definitely a tea-tree associated species. Potential alternatives/synonyms for this taxon are *C. floridana* sensu Petersen, *C. urnigerobasidia* and *C. hipidulosa*. There is a deposited sequence under this name from Tasmania but I believe that is a misidentification and may represent *C. tasmanica* with a similar deposited sequence.

JAC14626	JAC14911
	
JAC14875	JAC14881
	

	
JAC14900	JAC15835
	
JAC15897/PDD 113044	
	

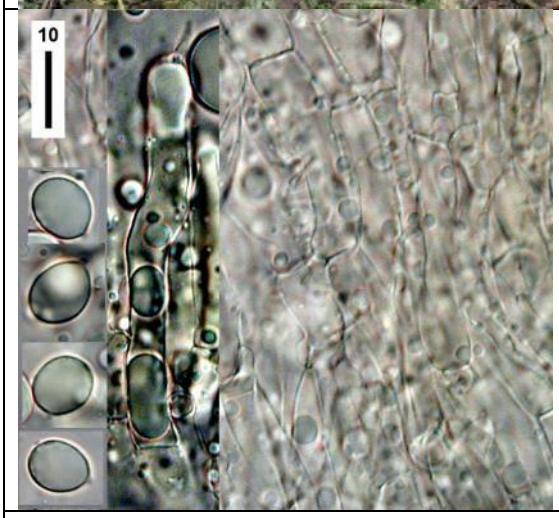
Clavulina subrugosa var. tenuis

Frbs 20-60mm x 30-40mm across, branched 2-7mm thick, fasciculate, occasionally solitary, simple to sparingly branched towards the apex, white to cream, tips often pointed and then turning brown.

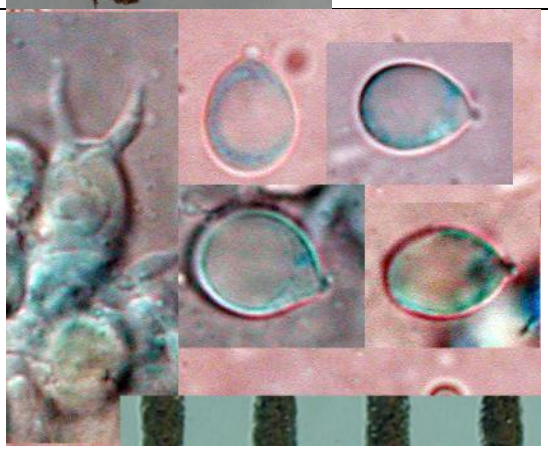
Trama clamped, spores 7-12 x 7-10um, no cystidia., no odour, taste earthy.

We have a sequence of the type collection for this species so there is no doubt about identity. Petersen described this as occurring with beech but at the type locality (Abel Tasman National Park, Coast Track) it could have been tea-tree or beech and I suspect it was tea-tree. Other locations such as Auckland are with tea-tree, without doubt.

Jac10173	JAC10647/PDD 95299



JAC13254



JAC13380

JAC13412 tea-tree

JAC12870

JAC14883

JAC18770

JAC17160/PDD 114270

JAC17796/NS5865/PDD 114906

JAC18291

JAC13411

Clavulina sp. 'Kowhai Bush (PDD 114723)'.

Frbs. 0-90mm x 20mm, simple to apically branched, pale to dark grey-lavender, with white to cream stipe base, bruising darker,

Trama clamped, cystidia absent, spores 9x 7.5um.

The ITS sequences of all the specimens are the same within a few base-pairs, however the morphology is extremely variable. The simple clubs, and micro-morphology of JAC14268 seem close to Petersen's concept of *C. geoglossoides* in New Zealand with tea-tree, but this species has no cystidia, not even in scattered fascicles. Petersen's concept of *C. geoglossoides* includes multiple species with the most common beech-associated versions including C*. sp. 'Routeburn'* and *C. sp. 'Blackball'.*

JAC14226	JAC14628

JAC16526

JAC17612

Acknowledgements

As usual this synopsis would not have been possible without the specimens collected by Noah Siegel, Grey Smith, Peter de Lange and others. Sanger sequencing by Duckchul Park.

Petersen's type locations, hosts & collections

Names in red remain to be recollected or resolved. Some are potential synonyms.

Beech associated taxa

Clavulina alutaceosiccescens: Murchison 6 mile creek, with beech Examined material appears immature. TENN 42219 = RHP 55023 (not present in PDD). PDD 46634 (currently listed as the holotype) = RHP 46634. no duplicates in TENN. (= C. zealandica?, Blackball?).

> Petersen described this as a white to cream with simple clubs and with cystidia. Unfortunately, colour is not diagnostic. It is potentially the simple of *C. sp. 'Routeburn'* or *C. sp. 'Totara'*.

Clavulina zealandica: SI St Arnauds. Beech. Type TENN 43429 = PDD 46652 = LRH43429

Clavulina septocystidiata: NI UNP; Beech. Type TENN 43381 = LRH43381 = PDD 46640

Clavulina purpurea: Murchison. Beech or tea-tree? Type TENN 44119 = RHP 55160 = PDD 46659.

> Petersen indicated a diagnostic feature are the macroscopically visible tufts of emergent cystidia, but unfortunately that is not a good diagnostic character. This is probably the purple form of *C. brunneocinerea*.

Clavulina humilis: Colenso. Beech or tea-tree? Maungaroa.

> Described on rotting wood, but as a mycorrhizal species that is unlikely to be diagnostic.

Clavulina brunneocinerea: NI Waikari-iti track, Urewera. Beech. Holotype TENN 42267 = PDD 46660 = RHP 601.

Tea-Tree associated taxa

Clavulina copiocystidiata: NI. Tea-tree

> This species is described as having aseptate cystidia but the figure has a number of conspicuously clamped septa. Type [GS] 43666 = PDD 46662, and presumably = TENN 42267 = RHP 601 (listed as Holotype in TENN). The date and locality are correct. *C. hispidulosa* sensu Petersen and *C. samuelsii* are potential synonyms.

Clavulina samuelsii: NI Tea-tree. Type [GS] TENN 43662 = LRH43662 = PDD 46628

Clavulina subrugosa var. tenuis, *Auckland*. Tea tree. Type TENN 43395 - LRH43395 = PDD 46661

Clavulina urnigerobasidiata: Auckland. Tea tree. Type TENN 43611 = LRH43611 = PDD 46643

> Petersen considered this to be a species with unusual micro-features such as brown pigmentation and atypical basidial ontogeny. However, multiple species display brown plasmatic content in the basidia, and ontogeny is rather difficult to work out in most specimens. This is probably a synonym of *C. samuelsii* or my *C. sp. 'Mt Lees'*.

Clavulina vinaceocervina var. *avellanea*: Abel Tasman. Tea-tree. Type TENN 43610 = RHP 43610 = PDD 46631

Extra-limital names used with uncertain application

Clavulina subrugosa a Cleland, Australian name probably misapplied in NZ. All specimens are the variable *C. subrugosa var. tenuis*.

Clavulina hispidulosa: Corner name (Type India). A diagnostic feature is the fasciculate, clamped, septate cystidia, but unfortunately many NZ species have this.

Clavulina cavipes: a corner name (Type Malaysia). Petersen's application of the name probably refers to forms of *C. rugosa*.

Clavulina floridana: singer name (Type USA). Petersen's use (for a single collection) could refer to multiple NZ taxa.

Clavulina geoglossoides: A Corner species described from Victoria, Australia, and no doubt with a myrtaceous host. Petersen applied the name in New Zealand to primarily to a beech associated species which is here called *C. sp.'Routeburn* and *C. sp. 'Routeburn'*. He did also make collections under teat tree and they are represented by *C. sp. 'Kowhai'*.

Clavulina leveillei: A Saccardo name. Petersen's use of the name encompasses several species.

Clavulina leveillei var. *atricha*: A Corner (Type Malaysia). Petersen's use is difficult to assign.

Petersen's Key

1.	Cystidia present in hymenium, either clustered or scattered, aseptate or septate	2
1.	Cystidia absent	14
2.	Clamps present on tramal hyphae and basidia	3
2.	Clamps absent; fruit bodies some shade of pinkish cinnamon or avellaneous, simple to branched, slender; spores subglobose	C. vinaceocervina var. avellanea
3.	Fruit bodies simple to very sparsely branched	4
3.	Fruit bodies regularly and usually arbuscularly branched	6
4.	Fruit bodies drying to tan or alutaceous shades	5
4.	Fruit bodies drying to grey, mouse-grey or drab colours; fruit bodies simple, ivory below, mouse-grey above; cystidia refringent, aseptate (above hymenial layer); spores 8.3-10 x 7.2-9.4 (Lw = 9.2 um)	C. geoglossoides
5.	Fruit bodies white to cream all over; cystidia aseptate, emergent; spore Lm = 8.9 um	C. alutaceosiccescens
5.	Fruit bodies white when young, slowly becoming avellaneous to mouse-grey by maturity; cystidia septate, clamped, emergent; spore Lw = 8.4 um	C. samuelsii
6	Fruit bodies minute, trichome-like, white to pale grey; cystidia septate, clamped; on rotten wood or woody duff	C. humilis
6.	Fruit bodies larger; colour various	7
7.	Mature branches purple, grey, drab, or fuscous-grey	8
7.	Mature branches cinnamon-buff to pale pinkish cinnamon	13
8.	Stipe pigmented tan, cinnamon-tan or purple-black; fruit bodies copiously branched; cystidia emergent	9
8.	Stipe ivory to yellowish; fruit bodies sparsely to copiously branched; cystidia emergent or not	10
9.	Stipe tan to cinnamon-tan; branches grey to cinereous grey; spore Lm = 8.5 um	C. brunneocinerea
9.	9. Stipe purple-black with white bloom; branches purple when young, purple-drab by maturity; spore Lm = 9.0 um	C. purpurea
10.	Basidia 40-50 um long	11
10.	Basidia 75-85 um long	12
11.	Cystidia aseptate [JAC ?!] clavate; spore Lm = 8.0 um	C. copiosocystidiata
11.	Cystidia septate, clamped; spore Lm = 9.1 um	C. hispidulosa
12.	Cystidia 80-125 um long, emergent	C. leveillei var. leveillei
12.	Cystidia 50-70 um long, not emergent	C. leveillei var. atricha
13.	Cystidia septate, clamped, with apical cell emergent and refringent; spore Lm = 9.36 um	C. septocystidiata
13.	Cystidia aseptate, hardly emergent; spore Lm = 8.6 um	C. urnigerobasidiata
14.	Spore Lm less than 9 um; fruit bodies gracile, usually simple, white to dull greenish yellow	15
14.	Spore Lm more than 9 um	16
15.	Stipe and hymenium off-white in youth; stipe slowly turning sordid greenish yellow in age; hymenium turning pallid avellaneous by maturity	C. subrugosa var. subrugosa

15.	Stipe and hymenium off-white in youth, turning to pallid cream in age	C. subrugosa var. tenuis
16.	Fruit bodies simple, drying with stipe ochraceous orange and hymenium olivaceous grey	C. floridana
16.	Fruit bodies irregularly branched, drying dull ochraceous or grey with white stipe	17
17.	Fruit bodies drying grey with white stipe, irregularly branched; fresh colour dull light pinkish cinnamon	C. cristata var. zealandica
17.	Fruit bodies drying dull ochraceous, irregularly branched; fresh colour white, ivory to pale avellaneous	Clavulina cf. cavipes

Character matrix for Petersen's concepts

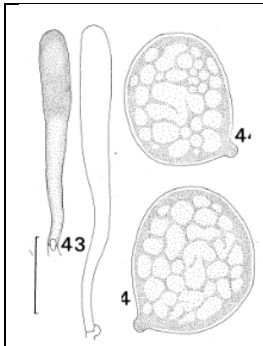
	Trees	# colls	size	form	colour	trama width	basidia	spores	Q	cystidia	Cystida frequency	grouped	septation	clamps	emergent
alutaceosiccescens	b	7	28 x 2	simple/branch	cream	-7	65-75x8	8.9x7.5	1.2	70-100x8-9	common?	n	0-1	Y	0
brunneocinerea	b	16	90x40	arbuscular	Brown/tan, stipe white	-12	65-75-7-8	8.5x7.5	1.2	110-150x10-12	occasional	y	0	Y	40
cavipes	t	6	50x24	branched	Pink/vinaceous buff, stipe orange	-12	50-60x7-9	9.2x8	1.2	none	none	-	-	Y	-
copiocystidiata	t	2	35x10	branched	Grey/brownish, pale stipe	-9	42-47x7	8x7	1.2	50-85x10-12	common	n	0	Y	40
zealandica	b	7	80x30	branched	Pink/vinaceous/grey	-10	50-60x7-8	9.4x8	1.2	none	none	-	-	Y	-
floridana	?	1	15x4	simple	Cream, grey, vinaceous	-8	70-80x8	9.8x8	1.2	none	none	-	-	Y	-
geoglossoides	t	18	70x7	simple/branched	Ivory to tan?	4-20	65-79x8-10	9x8	1.1	100-200x8.5-10	common?	n	y	y	70
hispidulosa	t	3	48x18	branched/arbuscular	pinkish brown to grey	-15	40-45x8-9	9x8	1.2	100-160x10-12	common	n	2-5	Y	0
humilis	b	1	10x1	Simple/branched	White to grey	4-6.5	35-45x7-9	8.8x8	1.1	220x8	inconspicuous	n	1-3	y	y
leveillei	?	8	40x15	Subpalmate/branched	grey	3-14	75-83x7.6-9.5	8.7x7	1.2	80-125x8.3-11	Common, hard to see	n	0	Y	-
Var atricha	b/t	5	60x30	branched	grey	-8	40-60x7-8	8.5x7	1.2	40-60x8-10	common	n	0	Y	-
purpurea	b	1	170x45	branched	Purple grey to purple black	-9	60-80x7-9	9x7.3	1.3	80-160x9-10	Common?	y	0-1	y	100
samuelsii	t	3	35x4	Simple/branched	Ivory to violaceous, ochre in stipe	2.5-6	60-70x7.5-9.5	8.4x7	1.2	150 x 9-12	common	n	1-4	y	50
septocystidiata	b	6	70x20	Branched/arbuscular	Pinkish cream to tan	-12	60-80x8-9.5	9.1x7.3	1.3	-(250)90x10-12	common	y	many	y	100
subrugosa	t	3	83x8	Simple/branched	Yellowish brown	4-12	50-65x7-8.5	7.3x6	1.2	none	none	-	0	Y	-
Var tenuis	t	5	55x5	Simple/branched	Yellowish brown	3-8	38-60x-8.5	8x6.5	1.2	none	none	-	0	Y	-
urnigerobasidiata	t	1	45x20	branched	Brown/violaceous	2.5-7	36-41x7.5-8.3	8.6x8	1.1	30-40x6.8-9	inconspicuous	n	0	Y	0
vinaceocervina	t	4	65x20	Branched/arbuscular	Yellowish brown to vinaceous	2.5-7	65-75x7-9	9.9x9.9	1.1	85-160x10-12	common	n	0	N	0

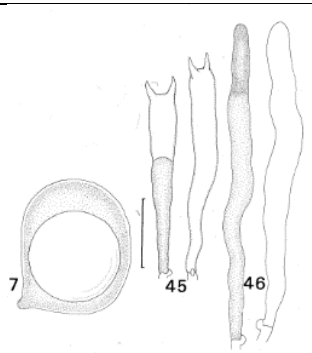
Key characters of NZ tagged species.

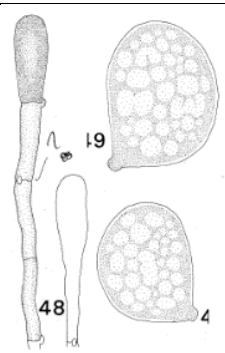
	Host	spores	Q	cystidia	form	Notes
'Lottery Bush'	B	10 x 9		Y, 50um, basal septum	branched	rugulose
'Rees Valley'	B	10 x 7		Y septate	branched	rugulose
'Routeburn'	B	9.1x7.7		Y	simple	
'Blackball'	B	11.5x10		Y/N. 1-2 septate	simple	Sometimes rugulose
'Totara'	B	6-7/9.6x7		N	Simple	
'Dry Bush'	T				Arbuscular/cristate	
'Mt Lees'	T	8.9x8.1/9.5		N	Sparingly branched	With vinaceous cols
'Kowhai Bush'	T	9 x 7.5		N	Branched or fasciculate	

Petersen's Photos/figures

Clavulina alutaceosiccescens - beech	Clavulina brunneocinerea - beech	Clavulina copiocystidiata -tea tree
		



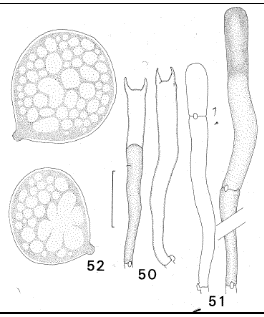




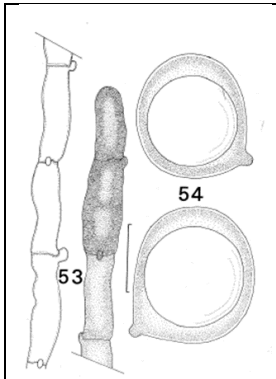
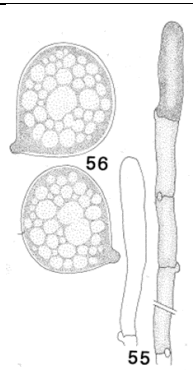
Clavulina cristata var. zealandica - beech

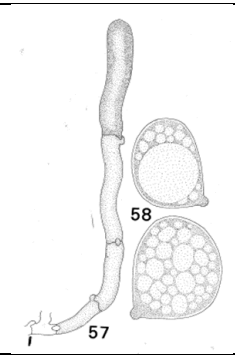
Clavulina floridana sensu Petersen - beech

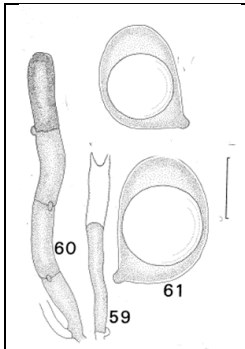
Clavulina geoglossoides sensu Petersen - beech

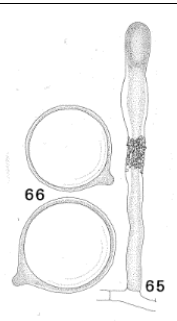
		

Clavulina hispidulosa sensu Petersen – tea tree	Clavulina humilis - beech	Clavulina leveillei sensu Petersen
		

		
Clavulina leveillei var atricha sensu Petersen	Clavulina purpurea – beech	Clavulina samuelsii – tea tree
		

		
Clavulina septocystidiata - beech	Clavulina subrugosa var tenuis – tea tree	Clavulina vinaceocervina var avellanea – tea tree
		





Clavulina urnigerobasidiata – tea tree