

Notes on *Russula* in New Zealand

March 2014, Jerry Cooper & Pat Leonard

INTRODUCTION

Here is some basic data for New Zealand species of *Russula*, together with a preliminary key.

Pat Leonard and I have been working on a revision of New Zealand species of *Russula*, *Lactifluus* and *Lactarius* for a number of years. That work is close to completion and a manuscript describing the new species is in preparation. We are conscious the work has taken much longer than expected. We started out preparing a Lucid multi-access key to the group based on the outstanding early work on the group in New Zealand by Ross McNabb. In the process of preparing the character matrix for that group we realised a fundamental revision was necessary because of the number of undescribed taxa, and the variability in the characters we were using, which only came to light after extensive sequencing of collections. The good news is that sequencing indicates very clear boundaries between species. In addition not many new species have turned up in recent years, so we feel confident we have most species. The bad news is that obvious morphological features, such as colour and taste, are usually not sufficiently stable to allow unambiguous identification of those species. Micromorphological features are much more informative, but much harder to obtain. If you want to identify New Zealand species of *Russula* with any confidence, then detailed microscope work is necessary, and even then it takes some experience to recognise diagnostic characters.

The molecular phylogeny of New Zealand species of *Russula* and *Lactarius* fits neatly into the now well established higher-level sub generic classification. I (JAC) have used that classification to drive the key. Some species remain to be sequenced and their placement is tentative. One clear fact emerging from the phylogenetic work is that many New Zealand species form a recently diverged clade within *Russula* subgenus *Russula*. I have called that clade the 'Zealandia group'. Distinguishing between some species in this group is especially difficult because of their close relationship. I (JAC) take sole responsibility for the key, and these notes, and I apologise for their unfriendliness. I'm sure my colleague Pat will produce a much friendlier version in time, and we will eventually revisit the Lucid key which initiated this work.

In total for *Russula* we have about 52 taxa, with 12 currently undescribed. The group is also rich in hypogeous forms. Teresa Lebel is leading the work to describe these taxa.

In the key the letters SV stand for sulphovanillin, and it refers to the purple staining of elements when some structures are mounted in a mixture of vanillin and concentrated sulphuric acid (a mixture available to few I know). FeSO₄ refers to the reaction when the stipe tissue is rubbed with a crystal of Iron sulphate (raw material for growing crystals available in any gardening shop). Q refers to the eccentricity of the spores, i.e. the length divided by the width.

The sectional key is taken almost entirely from Bon's work.

REFERENCES

McNabb, R.F.R. Russulaceae of New Zealand 2. *Russula* Pers. ex S. F. Gray, 2003, *New Zealand Journal of Botany*, 11:4, 673-730

Bon, M. Cle monographique des russules d'Europe. 1988. *Documents mycologiques* 18:n70-71, 1-120

SPECIES WITHIN SUBGENERA OF RUSSULA IN NEW ZEALAND

COMPACTAE

R. littorea, R. multicystidiata, R. solitaria?, R. cremeoochracea, R. papakaiensis, R. pirispora ined., R. australis, R. allochroa, Gymnomyces cristatus, Gymnomyces sp.

PLORANTES

R. inquinata, R. rimulosa, R. pseudoareolata, R. griseobrunnea, R. horopito ined.

INGRATULA

R. vinaceocuticulata, R. riwakaiensis ined., R. acrolamellata, R. acrolamellata var var. nothofagi, R. amoenolens, R. novae-zelandiae, R. austrofoetida ined.

HETEROPHYLLIDIA

R. aucklandica?, R. pudorina?, R. grisea, R. albolutescens, R. griseoviridis, griseostipitata

RUSSULA

R. wilsonii ined., R. laccata, R. roseopileata, R. umerensis, R. hinewaiensis ined., R. kermisina, R. vivida?, R. purpureotincta, R. nitida

ZEALANDIA GROUP

R. atroviridis?, R. tricholomopsis, R. macnabbii ined., R. caananesis ined., R. roseostipitata, R. tawai, R. subvinosa?, R. miniata, R. macrocystidiata, R. griseoviolacea complex, R. pilocystidiata, Gymnomyces fuscus, Gymnomyces sp., G. leucocarpus, R. tapawera

KEYS TO NZ RUSSULA – AFTER BON & McNABB

Key to sections

1	Pileus context hard and compact, either moist or blackening with or without preliminary reddening. Nonforked lamellae, with abundant free plates and lamellulae. Profile often infundibuliform (lactarioid) or with margin strongly inrolled. Colours dull, white, cream, yellow, brown	2
1'	Pileus context near compact or sometimes soft. Lamellae forked or anastomosed at least near insertion. Species either unchanging or ± yellowing or browning, turning russet, rarely reddening or greying and in this case with rather vivid or varied colours	3
2	Pileus colours brown, context reddening (slowly) or blackening, FeSO ₄ reaction usually green/grey. Pileus ± convex or depressed finally. Epicuticular hyphal end cells with brown vacuolar pigment (necropigment?), pileocystidia absent or difficult to see but sometimes with capitate terminations, constricted, sometimes branched or diverticulate to moniliform; cystidia and basidia ± slim or slender. Spores slightly decorated and with a non amyloid supra-appendicular plage	Compactae
2'	Pileus colours yellow, cream or pale brown, context white, unchanging or near browning, often moist, FeSO ₄ pink or nil. Lamellae with clear droplets and profile almost always infundibuliform (lactarioid). Cuticle with hyphal end cells not distinctive and pileocystidia common, not distinctive, rarely absent. Cystidia and basidia ± stout; spores with ornamentation more in relief and supra appendicular plage ± amyloid.	Plorantes
3	Margin strongly tuberculate striate, strongly incurved at least when young; stipe cavernous. Colors yellow, ochraceous, grayish brown or brown with violet tomentum. Taste often acrid or nauseating; odors strong in general. Pigment sometimes membranous or ± incrustated but then not acid resistant (or very slightly). Pseudopileocystidia SV+ or unimportant. Spores with supra-appendicular plage absent or not amyloid	Ingratula
3'	Otherwise	Heterophyllidia and russula sensu lato inc zealandia

Plus *Russula pleurogena*, a poorly known small brown pleurotoid species unlike anything else – except in Africa!

In following keys the Beech/Tea-tree associations are generally strict but don't rely on them.

PLORANTES

If cap white with thin pectinate edge then see *R. albolutescens* (section *Heterophyllidia*)

1	Lamellae heavily discoloured with numerous dull brown spots, taste acrid, described with tea-tree. Version with beech may be sp. nov.	<i>R. papakaiensis</i>
1'	Lamellae not discoloured, with tea-tree or beech	2
2	Lamellae acrid or bitter, with tea-tree	3
2'	Lamellae mild, with tea-tree or beech	5
3	Cap cystidia long	4
3'	Cap cystidia shorter, SV strong. Tea-tree	<i>R. allochroa</i>
4	SV strong, spore $Q \geq 1.3$. With what?	<i>R. pirispora</i> ¹
4'	SV weak, spore $Q = 1.2$. Tea-tree	<i>R. littorea</i>
5	Pilocystidia present	6
5'	Pilocystidia absent. Beech and tea-tree	<i>R. cremeochracea</i>
6	Stipe pale greyish pink. Beech	<i>R. solitaria</i> ²
6'	Stipe white	7
7	Spore $Q > 1.2$, with tea tree	<i>R. multicystidiata</i> ³
7'	Spore $Q < 1.2$, with beech (if with tea-tree see <i>R. allochroa</i>)	<i>R. australis</i>

R. papakaiensis and *R. cremeochracea* may be better placed in *Archaeiniae* .

¹ *R. pirispora* - poorly known species from frbs but common in environmental samples

² *R. solitaria* - poorly known species, may not belong in this section but in *heterophyllidia* or *russula* ss

³ *R. multicystidiata* - poorly known species and historically misidentified



R. papakaiensis



R. allochroa



R. littorea








R. cremeochracea



R. australis

COMPACTAE

1	Context rapidly blackening on exposure to air; pileus, lamellae, and stipe blackening when overmature; lamellae acid; FeSO4 greyish green. Beech and tea-tree	R. inquinata
1'	Context unchanging or slowly darkening on exposure to air; lamellae mild	2
2	Pilocystidia present; FeSO4 pallid salmon pink or nil.	3
2'	Pilocystidia absent; FeSO4 greyish green	4
3	Greyish brown to dark brown; spore Q \geq 1.2, length \leq 8 μ m. Beech	R. griseobrunnea
3'	Pale grey; spore Q < 1.2, length \geq 9 μ m. Beech and tea-tree	R. horopito
4	Deep fawn brown to dark brown in centre, shallowly umbilicate, edge deeply inrolled when young, with beech or tea-tree	R. rimulosa
4'	Dark brown, dark reddish brown, or brownish orange in centre, umbilicate, edge not inrolled when young, with beech	R. pseudoareolata

		
R. inquinata	R. griseobrunnea	R. horopito
		
R. rimulosa	R. pseudoareolata	

INGRATULA

1	Taste very hot, smell strong, cap grey or brown and associated with broad range of exotic trees: Quercus, Pinus, Tilia, Populus	R. amoenolens
1'	Always associated with tea-tree or beech	2
2	Pileus orange brown to dark brown, often with red-grey, magenta or vinaceous areolate patches; and/or base with vinaceous fibrils. Tea-tree	R. vinaceocuticulata
2'	Without coloured areolate patches or vinaceous fibrils on stipe base	3
3	Taste mild, with beech, spores winged or spines, some joined	4
3'	Taste hot/acrid/bitter, with beech or tea-tree, spores with nets	5
4	smell of marzipan/cherry laurel/cyanide, spores winged, frb small. Beech	R. riwakaiensis
4'	Without marzipan smell, spores nets/spines, not winged. Beech or tea-tree	R. novae-zelandiae
5	Taste very hot, with tea-tree	R. acrolamellata
5'	Taste bitter or hot, with beech	6
6	Taste bitter/acrid	R. austrofoetida
6'	Taste very hot	R. acrolamellata var. nothofagi

The reliance on hot taste, and the distinction between hot and bitter in this key is problematic. Collections have been made of hot taxa which taste mild, but not vice-versa. There are currently no consistent characters for consistently distinguishing R. novae-zelandiae, R. austrofoetida and R. acrolamellata.



amoenolens



vinaceocuticulata



vinaceocuticulata



riwakaiensis



novaezelandiae



acrolamellata



acrolamellata



austrofoetida



austrofoetida

HETEROPHYLLIDIA

Use also next key to russula and zelandia

1	Cap white to cream, thin flesh at cap edge, strongly pectinate, with tea-tree	R. albolutescens
1'	Cap more strongly coloured	2
2	With introduced trees: quercus, conifers; cap grey, dark green, dark purple	R. grisea
2'	With native trees	3
3	Cap grey, green, purple; always with grey areolate patches . Tea-tree	R. griseoviridis ⁴
3'	Cap without areolate patches	4
4	Stem cream with fine grey ridges, usually with beech	R. griseostipitata
4'	Stem with pink or reddish hue, usually with tea-tree	5
5	Taste mild	R. aucklandica ⁵
6'	Taste bitter	R. pudorina

According to Buyck the subgenus is recognised by mild taste, non-amyloid spot, ramifying and inflated hyphal extremities on cap surface (chains of inflated cells), and non-septate dermatocystidia (when present). Unfortunately some species in the Russula clade also exhibit these, e.g. *R. wilsonii/atroviridis* – which may be incorrectly positioned in my phylogenetic tree, but also other species like *R. roseostipitata* which are definitely correctly positioned. I doubt the group is monophyletic and the corresponding clade contains species with other morphologies.

⁴ A beech version is close and unnamed

⁵ *R. aucklandica* – poorly known species, potential synonym of *R. pudorina*. *R. solitaria* may also key here and is distinguished by spores with $Q \geq 1.2$. See next keys



R. albolutescens



R. griseoviridis



R. grisea



R. grisea



R. grisea



R. griseoviridis



R. griseostipitata
















R. aucklandica



R. pudorina

SUBGENUS RUSSULA, INCLUDING HETEROPHYLLIDIA PP & ZELANDIA

1	With Betula . Cap pink to red. Taste mild.	R. nitida
2	With beech or tea-tree	2
2	Cap dark brown, sometimes pinkish brown. Stem white with low grey ridges . Beech (or mixed)	R. griseostipitata
2'	Cap otherwise coloured. Stem without low grey ridges	3
3	Cap with russet red or dark colours: magenta, violet, green	4
3'	Cap with other colours: bright red, light green/brown/yellow mixtures, coffee, pale purple	6
4	With FeSO ₄ reaction grey or green or cap with very long brown hairs	5
4'	FeSO ₄ pink or nil, cap without long brown hairs (but often with hyaline hairs)	Difficult group – next key
5	Gills cream. FeSO ₄ reaction green. Cap without long brown hairs. Beech	R. roseostipitata
5'	Gills deep yellow. FeSO ₄ reaction pink or gery. Cap with very long brown septate hairs. Beech	R. tricholomopsis
6	Cap bright red, taste mild	7
6'	Cap other colours (including pink, but then hot/acrid)	9
7	Frb very small. Cap elements not like hymenial cystidia. Beech	R. miniata
7'	Frb not very small. Cap elements like hymenial cystidia	8
8	Frb semi-secotioid. Beech	R. kermesina
8'	Frb not semi-secotioid. Beech	R. vivida
9	Frb pink, taste hot/acrid. Beech	R. roseopileata
9'	Frb not pink and/or not hot/acrid	10
10	Pleurocystidia thick-walled. Beech	R. purpureotincta
10'	Pleurocystidia thin-walled. Beech	R. umerensis

		
<p><i>R. roseostipitata</i></p>	<p><i>R. roseostipitata</i></p>	<p><i>R. tricholomopsis</i></p>
		
<p><i>R. tricholomopsis</i></p>	<p><i>R. kermisina</i></p>	<p><i>R. roseopileata</i></p>
		
<p><i>R. purpureotincta</i></p>	<p><i>R. purpureotincta</i></p>	<p><i>R. umerensis</i></p>
		
<p><i>R. umerensis</i></p>	<p><i>R. umerensis</i></p>	<p><i>R. umerensis</i></p>
		
<p><i>R. nitida</i></p>		

KEY TO DIFFICULT DEEPLY COLOURED GROUP (ZEALANDIA) BASED MAINLY ON CAP ELEMENTS AND OTHER MICRO-FEATURES

1	Cap with numerous cystidia-like elements, distinctly amyloid, at least some SV+, basal cells uninflated. Beech.	<i>R. pilocystidiata</i> ⁶
1'	Cap elements SV- (granular effect at most, not all purple)	2
2	Cap elements with uninflated basal cells	3
2'	Cap elements with inflated basal cells	7
3	Cap elements clearly cystidia-like, cap russet coloured. Beech	<i>R. hinewaiensis</i>
3'	Cap elements hair-like	4
4	Cap hairs > 120um, cap with violaceous or green colours	5
4	Cap hairs < 110 um, cap with reddish brown, russet colours	6
5	Cap with dark violaceous colours. Beech or tea-tree	<i>R. atroviridis</i> ⁷
5'	Cap with dark green colours. Tea-tree (only?)	<i>R. wilsonii</i>
6	Cap hairs septate. Tea tree (and beech?)	<i>R. subvinosa</i>
6'	Cap hairs not septate. Tea-tree	<i>R. aucklandica</i>
7	Cap hairs > 120um	8
7'	Cap hairs < 110um	9
8	Cap hairs tapering to apex, spores densely spinulose. Beech	<i>R. griseoviolacea</i> ⁸
8'	Cap hairs not tapering, spores not densely spinulose. Tea tree	<i>R. macnabbii</i>
9	Cap hairs < 5um diam.	10
9'	Cap hairs > 6um diam. Tea-tree	<i>R. pudorina</i>
10	Spore Q < 1.2. Cap hair basal cells not branched. Beech	<i>R. tawai</i> ⁹
10'	Spore Q > 1.2. Cap hair basal cells branched. Beech or tea-tree	<i>R. macrocystidiata</i>

⁶ If acuminate hair-like elements seen and SV cap cystidia then see *R. griseoviolacea* complex

⁷ Current collections named this and in tree have inflated basal cells. JAC13197 sp nov also keys here

⁸ A species complex with some variant less spinulose spores and one SV+

⁹ Material currently labelled *R. atroviridis* keys here. It has cream gills.



R. pilocystidiata



R. hinewaiensis



R. atroviridis



R. wilsonii



R. subvinosa



R. aff. griseoviolacea 2



R. macnabbii



R. macnabbii



R. macnabbii



R. tawai



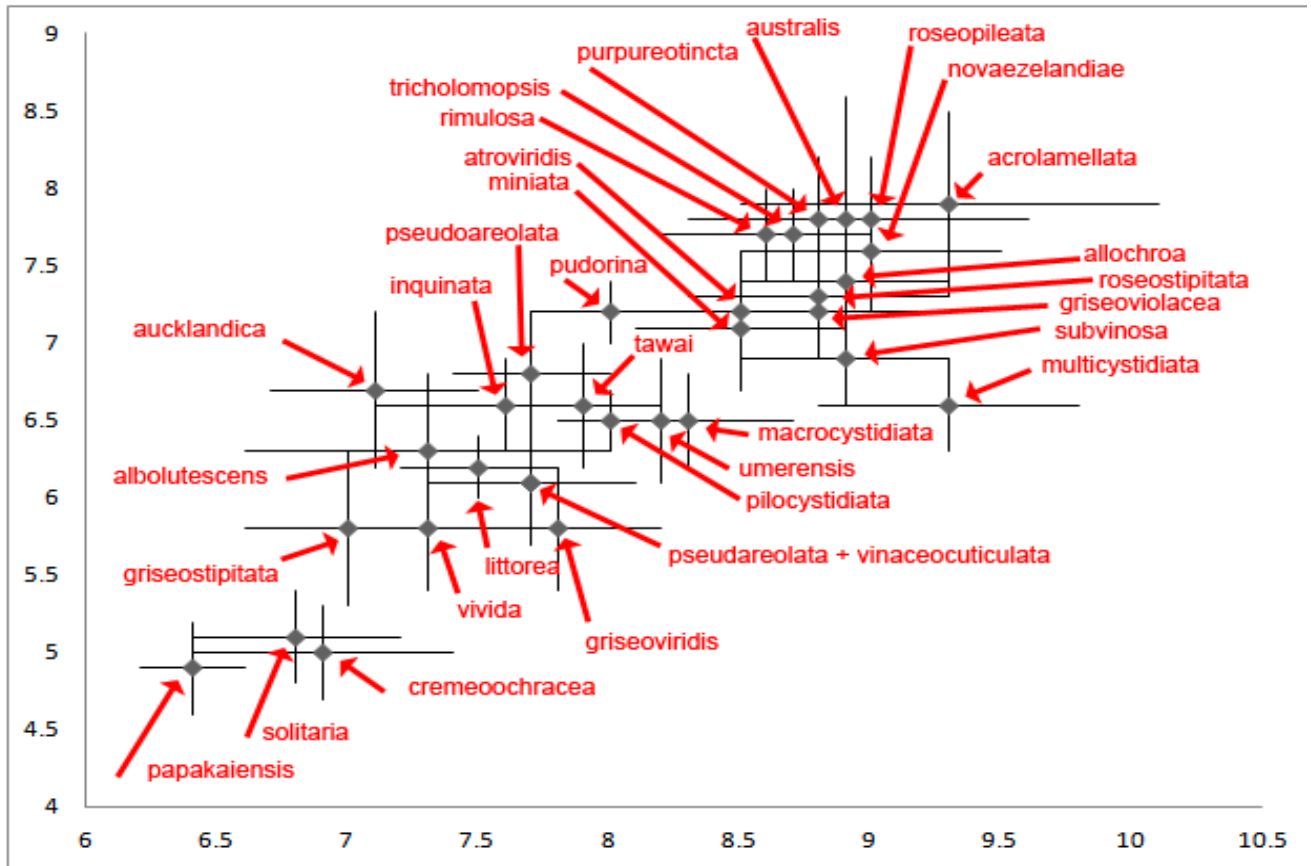
R. macrocystidiata



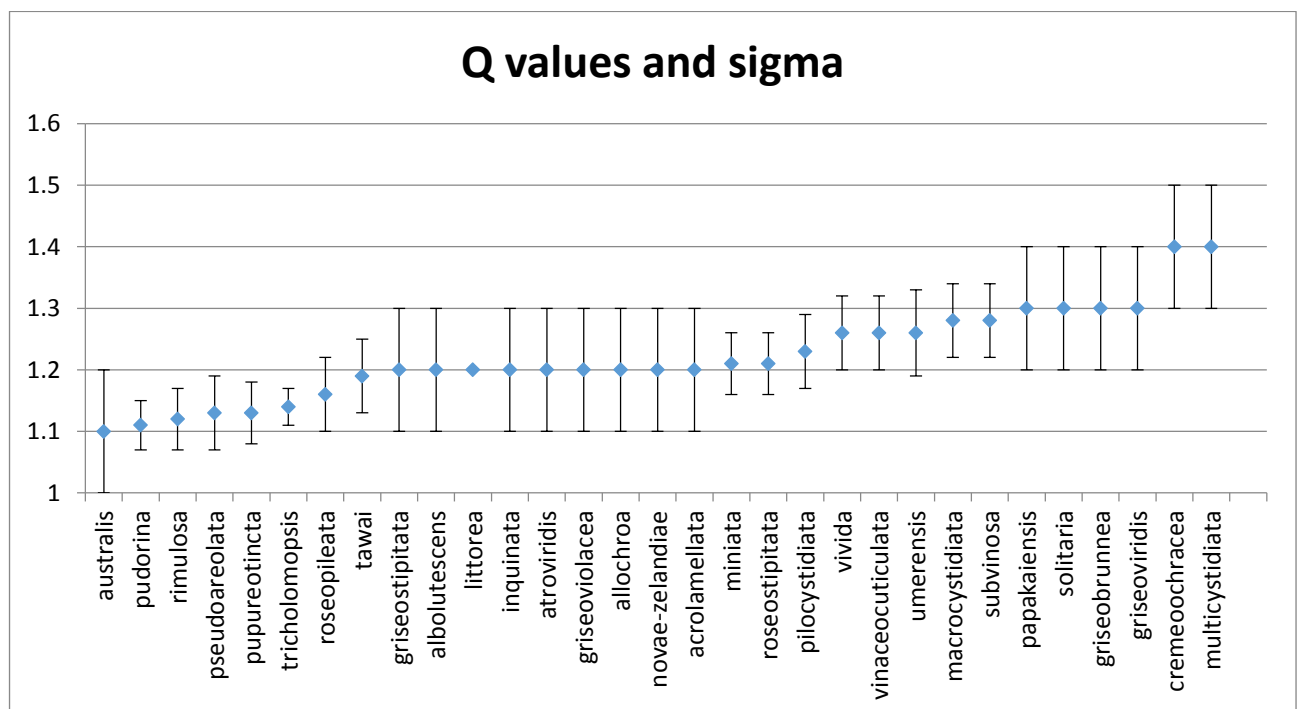
R. macrocystidiata?

KEY CHARACTER SUMMARY

SPORE LENGTH/WIDTH (EXC. ORNAMENTATION AND APICULUS)

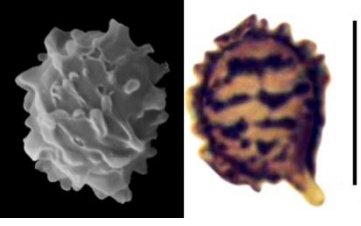
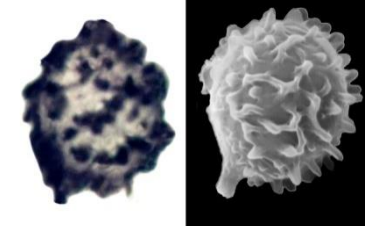
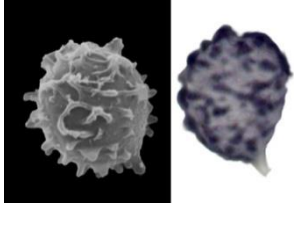
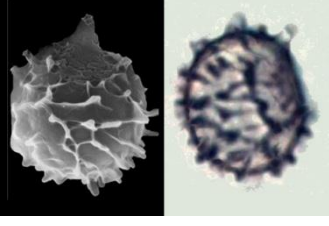
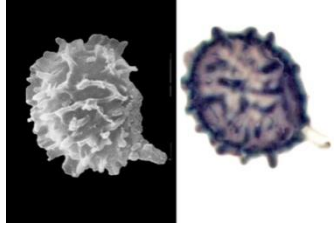
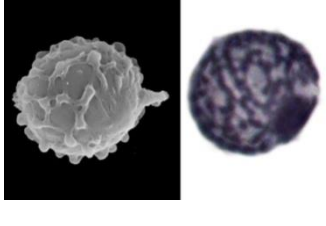
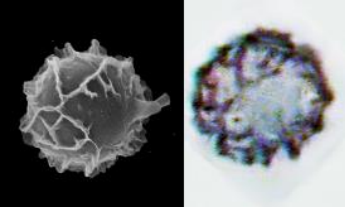
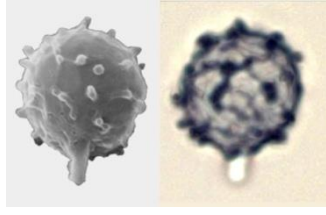
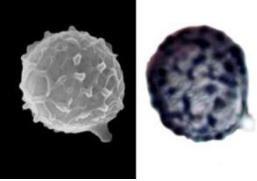

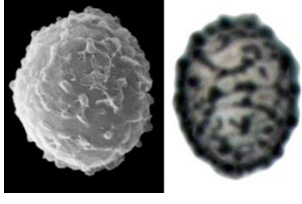
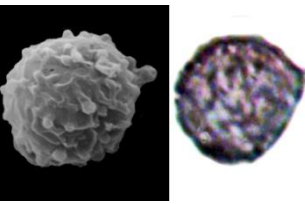


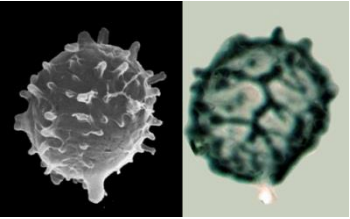
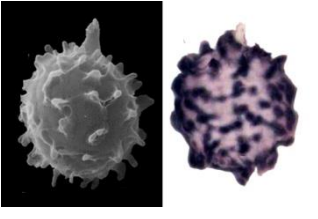
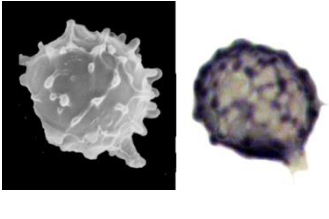
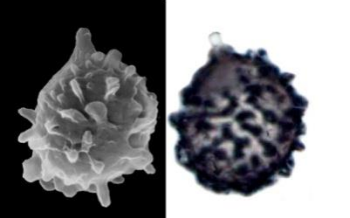
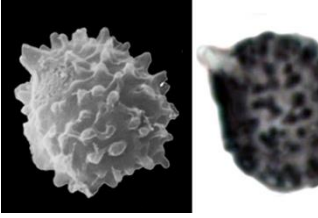
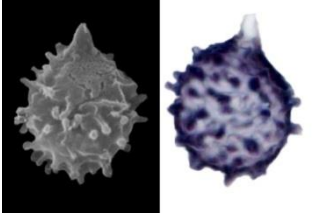
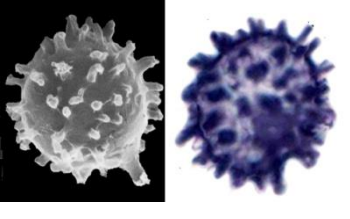
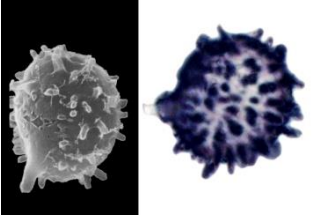
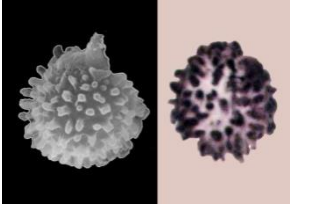
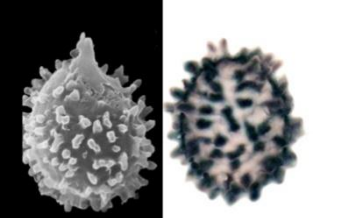
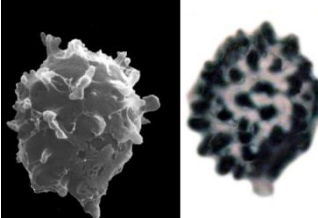
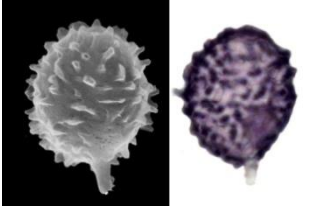
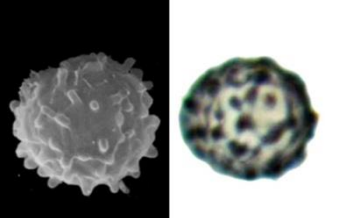
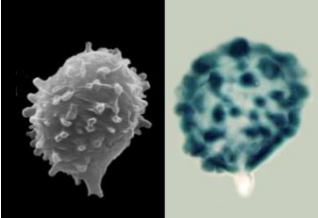
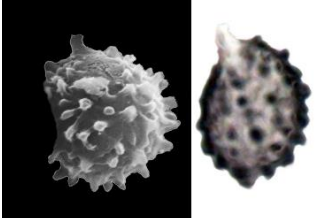
SPORE ECCENTRICITY



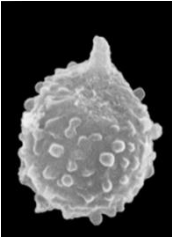



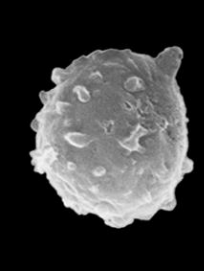
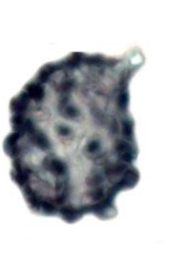
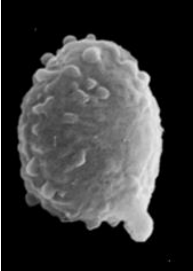



SPORE GROUPS (BASED ON ALL IMAGES)

SEM's thanks to Geoff Ridley

High Nets		
R. allochroa	R. acrolamellata	R. vinaceocuticulata
		
R. subvinosa	R. pilocystidiata	R. pudorina
		
R. aucklandica	R. pseudareolata	
		
Low Nets		
R. inquinata	R. rimulosa	R. griseobrunnea
		
R. albolutescens		
		
Netted Spines		
R. roseopileata	R. tricholomopsis	R. australis

		
R. novaezelandiae	R. atroviridis	R. tawai
		
R. griseoviolacea	R. purpureotincta	R. roseostipitata
Spines		
		
R. macrocystidiata	R. miniata	R. umerensis
		
R. griseoviridis	R. vivida	R. solitaria
Warts		
		
R. littorea	R. multicystdiata	R. griseostipitata

					
R. papakaiensis		R. cremeochracea			
					

Section	Name	Cap col (broadly)	Cap cystidia/hairs (broadly)	sv	length μ	σ	width μ	σ	Q μ	σ	Height	plage	amyloid spot	SG type	Spore col
Compacta 1															A
	littorea	cream to yellow tan	long, not acuminate	yes	7.5	0.3	6.2	0.2	1.2	0	0.7	yes	weak	Warts	
	multicystidiata	cream to yellow tan	like hymenial cystidia	no	9.3	0.5	6.6	0.3	1.4	0.1	0.8	yes	no	Warts	B-C
	solitaria	yellow tan to red tan	long, acuminate	no	6.8	0.4	5.1	0.3	1.3	0.1	0.8	weak	weak	Spines	A
	cremeoochracea	cream to yellow tan	none	no	6.9	0.5	5	0.3	1.4	0.1	0.5	yes	no	Warts	A-B
	papakaiensis	cream to yellow tan	long, not acuminate	yes	6.4	0.2	4.9	0.3	1.3	0.1	1	no	weak	Warts	B-(C)
	pirispora	cream to yellow tan	long, not acuminate	yes	8.2	0.5	5.9	0.3	1.4	0.1	1.3	yes	weak	warts	?
	australis	cream to yellow tan	Long, acuminate?	weak	8.9	0.5	7.8	0.8	1.1	0.1	1.5(2)	yes	yes (black)	Netted Spines	
	allochroa	cream to yellow tan	Long, not acuminate	weak	8.9	0.4	7.4	0.3	1.2	0.1	1.7	no	weak	High Nets	A
Compacta 2															
	inquinata	brown/black	long, not acuminate , brown	no	7.6	0.5	6.6	0.3	1.2	0.1	0.7	yes	no	Low Nets	

Section	Name	Cap col (broadly)	Cap cystidia/hairs (broadly)	sv	length μ	σ	width μ	σ	Q μ	σ	Height	plage	amyloid spot	SG type	Spore col
	rimulosa	dark brown	vermiform, long, a few acuminate	no	8.6	0.4	7.7	0.3	1.1 2	0.0 5	1.2	no	no	Low Nets	A
	pseudoareolata	dark red/brown	vermiform, long, not acuminate	no	7.7	0.3	6.8	0.4	1.1 3	0.0 6	1.2	yes	no	High Nets	
	griseobrunnea	grey/brown	long, not acuminate , brown	no	7.7	0.4	6.1	0.4	1.3	0.1	0.7	yes	no	Low Nets	A
	horopito	grey/brown	long, not acuminate , brown	no	9.7	0.5	8.2	0.6	1.2	0.1	0.5	yes	no	Low nets	?
Ingratula															
	vinaceocuticulata	brown	long, not acuminate	Yes/ no	7.7	0.3	6.1	0.3	1.2 6	0.0 6	1	yes	no/weak	High Nets	B-C
	riwakaiensis	tan	cystidial	yes	8.5	7.5	7.5	0.3	1.1 3	0.1	2.7	yes	no	High wings	?
	acrolamellata	dark tan/orange brown	vermiform, long	yes	9.3	0.8	7.9	0.6	1.2	0.1	1.75	yes	weak	High Net	B-C
	amoenolens	Dark tan	vermiform, long	yes	7.9	0.4	5.8	0.34	1.3 6	0.1	1	yes	?	High Net	?
	novae-zelandiae	dark tan/orange brown	vermiform, long	yes	9	0.5	7.6	0.4	1.2	0.1	0.7	yes	weak	Netted Spines	A-B
	austrofoetida	dark tan/orange	vermiform, long	yes	8.6	0.5	7.1	0.5	1.2	0.1	1.3	yes	no	High Net	?

Section	Name	Cap col (broadly)	Cap cystidia/hairs (broadly)	sv	length μ	σ	width μ	σ	Q μ	σ	Height	plage	amyloid spot	SG type	Spore col
		brown							2						
Heterophyllidia															
	aucklandica	magenta/grey	long, not acuminate	no	7.1	0.4	6.7	0.5	1.1	0.1	0.7	yes	no	High Nets	C-D
	pudorina	magenta/grey	short, not acuminate	no	8	0.3	7.2	0.2	1.1 1	0.0 4	0.5	yes	yes(violet)	High nets	A
	nitida	magenta	long, not acuminate	yes	9.9	0.8	7.9	0.5	1.3	0.1		yes	yes	High nets	E-F
	grisea	Grey/magenta/green	long, not acuminate	yes	7	0.2 8	5.7	0.21	1.2 4	0.1		yes	no	Warts	D-F
	albolutescens	cream to yellow tan	like hymenial cystidia	yes	7.3	0.7	6.3	0.5	1.2	0.1	0.8	yes	no	Low Nets	A-(B)
	griseoviridis	magenta	short, not acuminate	no	7.8	0.4	5.8	0.4	1.3	0.1	0.7	weak	no	Spines	A
	griseostipitata	grey/magenta	long, acuminate	no	7	0.4	5.8	0.5	1.2	0.1	0.5	yes	weak	Warts	A
Russula ss															
	atroviridis	dark magenta/green	long, not acuminate	no	8.5	0.6	7.2	0.4	1.2	0.1	0.7	no	weak (violet)	Netted Spines	
	wilsonii	Dark green	long, not acuminate	no	9.4	0.5	8.0	0.4	1.2	0.1		yes	Yes(grey)	Spines	D-F
	laccata	Pink/grey/green	long, not acuminate	yes	7.8	0.3	6.1	0.3	1.3	0.1		yes	Yes(violet)	Nets	

Section	Name	Cap col (broadly)	Cap cystidia/hairs (broadly)	sv	length μ	σ	width μ	σ	Q μ	σ	Height	plage	amyloid spot	SG type	Spore col
	roseopileata	pink	long, not acuminate	yes	9	0.6	7.8	0.4	1.16	0.06	1.4	yes	weak	Netted Spines	
	umerensis	magenta + multicolor	like hymenial cystidia	no	8.2	0.4	6.5	0.4	1.26	0.07	1	yes	yes(violet)	Spines	
	hinewaiensis	russet	like hymenial cystidia	no	8.4	0.3	7.9	0.4	1.1	0		yes	Yes(violet)	Low nets	
	kermisina	red	like hymenial cystidia	no	8	0.42	5.9	0.36	1.36	0.1	0.6	yes	no	warts	
	vivida	red	like hymenial cystidia	no	7.3	0.4	5.8	0.4	1.26	0.06	1	yes	yes(violet)	Spines	
	pupureotincta	white + multicolour	like hymenial cystidia	no	8.8	0.5	7.8	0.4	1.13	0.05	1.8	yes	yes(violet)	Spines	
Russula NZ															
	tricholomopsis	magenta/grey	long, not acuminate, brown	no	8.7	0.3	7.7	0.3	1.14	0.03	1.7	yes	yes(violet)	Netted Spines	
	mcnabbii	Purple, green, magenta	long, not acuminate	no	8.3	0.35	6.6	0.35	1.26	0.03	0.7	yes	Yes(grey)	Netted spines	
	roseostipitata	magenta/grey	long, not acuminate	no	8.8	0.5	7.3	0.4	1.21	0.05	1.5	yes	yes(violet)	Spines	
	tawai	magenta/grey	long, not acuminate	no	7.9	0.3	6.6	0.4	1.19	0.06	1.5	yes	yes(violet)	Netted Spines	
	subvinosa	magenta/grey	long, not acuminate	no	8.9	0.4	6.9	0.3	1.2	0.0	1.8	yes	weak	High Nets	E

Section	Name	Cap col (broadly)	Cap cystidia/hairs (broadly)	sv	length μ	σ	width μ	σ	Q μ	σ	Height	plage	amyloid spot	SG type	Spore col
									8	6					
	miniata	red	long, not acuminate	no	8.5	0.4	7.1	0.4	1.2 1	0.0 5	1.8	yes	yes(violet)	Spines	
	macrocystidiata	magenta	short, not acuminate	no	8.3	0.4	6.5	0.3	1.2 8	0.0 6	1.5	yes	yes (violet)	Spines	
	griseoviolacea	magenta /grey	long, acuminate	no	8.8	0.6	7.2	0.3	1.2	0.1	1.75	no	yes (dark violet)	Spines	
	pilocystidiata	magenta/grey	long, not acuminate	yes	8	0.2	6.5	0.2	1.2 3	0.0 6	1.1	yes	Yes(grey)	High nets	A-B

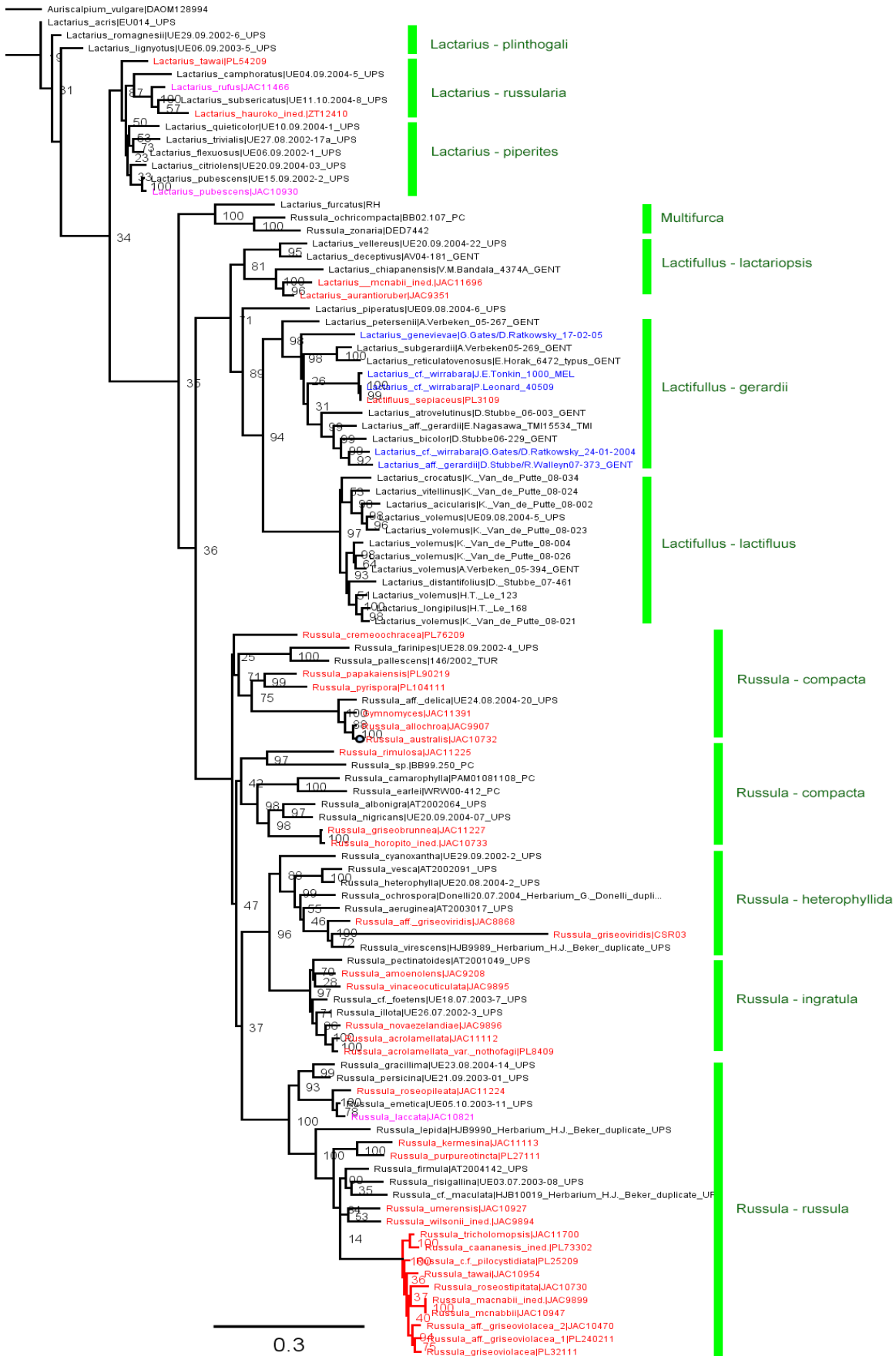
Poorly known and may not have been collected recently – difficult to reconcile

May be misplaced in these sections, despite what trees say.

Problematic species	Characters
atrovirens	Pileus elements hyphae-like, septate, 150 x 6µm, apex narrowed, base cells uninflated, sometimes branched. spores netted spines. SV-
tawai	Pileus elements hyphae-like, septate, apex equal, 130 x 4, basal cells inflated, not branched. Spores netted spines. SV-
macrocystidiata	Pileus elements hyphae/bristle-like, septate, apex equal, 120 x 4, basal cells inflated, branched. Spores netted spines. SV-
pilocystidiata	Pileus elements cystidia-like, septate, 60 x 4, apex equal, basal cells inflated, branched. Spores netted spines. SV+
griseoviolacea	Pileus elements hyphae/bristle-like, septate, 150 x 7, apex narrowed, basal cells inflated, not branched. Spores spines. SV-
pudorina	Pileus elements hyphae/bristle-like, septate, 100 x 7, apex equal, basal cells inflated, not branched. Spores nets. SV-
subvinosa	Pileus elements hyphae-like, septate, 90 x 6, apex acuminate, basal cells uninflated, branched. Spores nets. SV-
aucklandica	Pileus elements hyphae-like, not septate, 90 x 7, apex narrowed, basal cells uninflated, not branched. Spores nets. SV-
Wilsonii	
mcnabbii	
hinewaiensis	
Not problematic	
griseostipitata	Pileus elements hyphae-like, non septate, 90 x 3, apex acuminate, basal cells uninflated, not branched. Spores warts. SV-
roseopileata	Pileus elements cystidia-like, non-septate, 100 x 12, apex club-like, basal cells uninflated, not branched. Spores nets
miniata	Pileus elements hyphae/bristle-like, septate, 120 x 4, apex equal, basal cells inflated, not branched. Spores nets
umerensis	Pileus elements cystidia-like, non-septate, 60 x 4, apex club-like, basal cells uninflated, not branched. Spores netted spines.
purpureotincta	Pileus elements none or hyphae-like, septate, 60 x 4µm, apex narrowed, basal cells uninflated, not branched. Spores spines
roseostipitata	Pileus elements hyphae-like, septate, apex equal, 150 x 5, basal cells inflated, not branched. Spores spines
tricholomopsis	Pileus elements Bristle-like, brown septate, 300 x 4, apex equal, basal cells partially inflated, not branched, amyloid. Spores netted spines

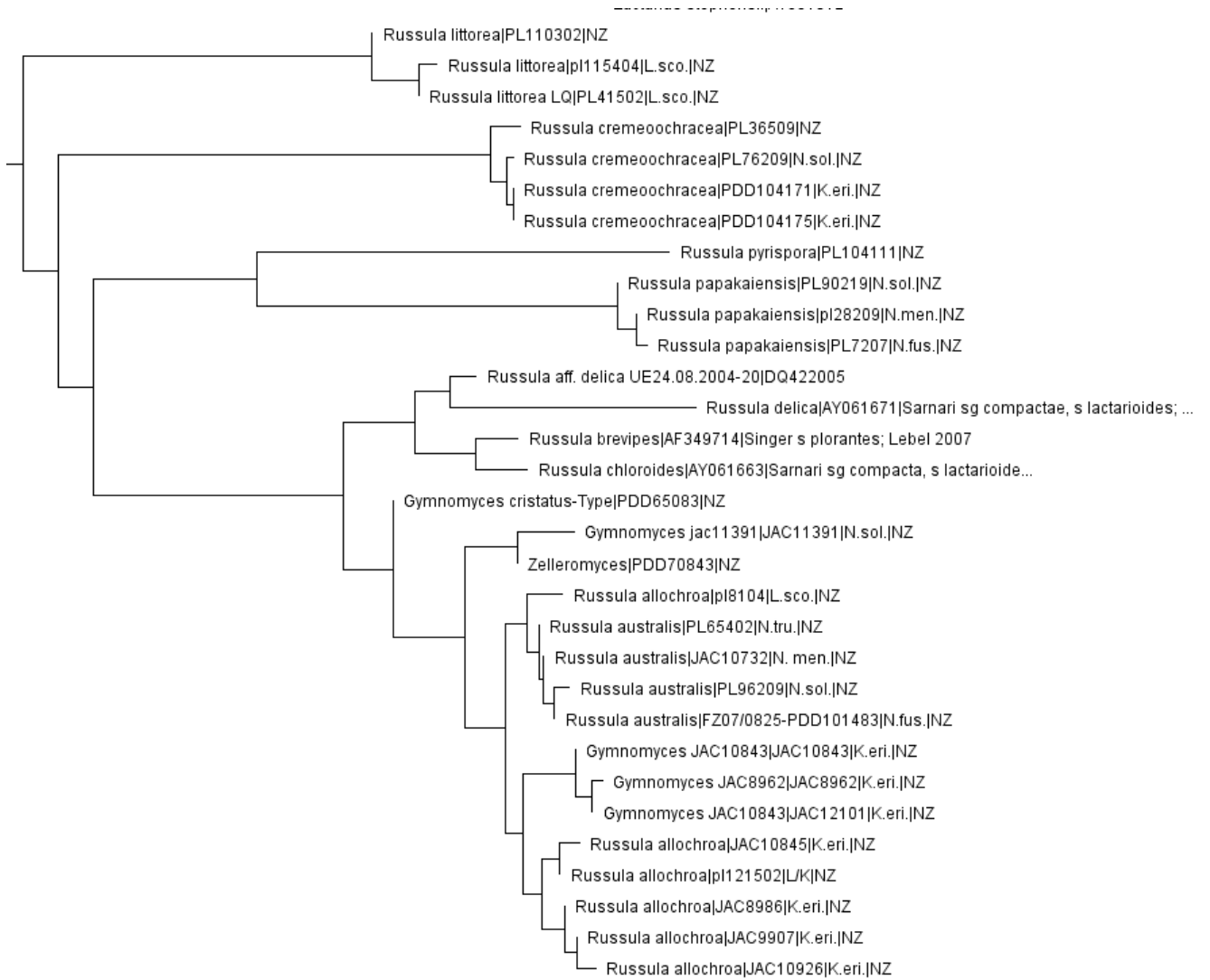
RUSSULA PHYLOGENY

ITS + LSU + RPB2 – GTR InvGamma, partitioned, RaxML.

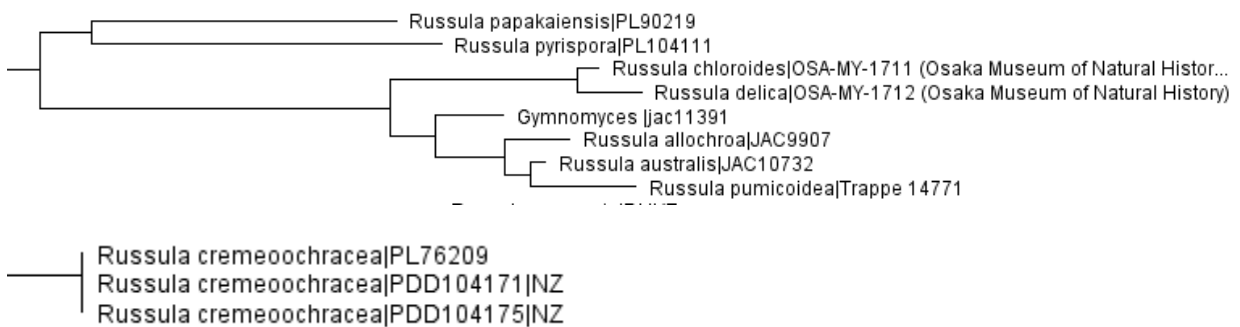


COMPACTAE

ITS

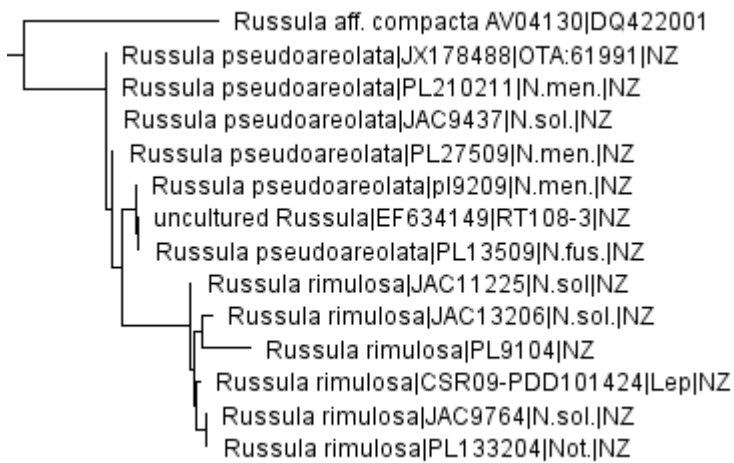
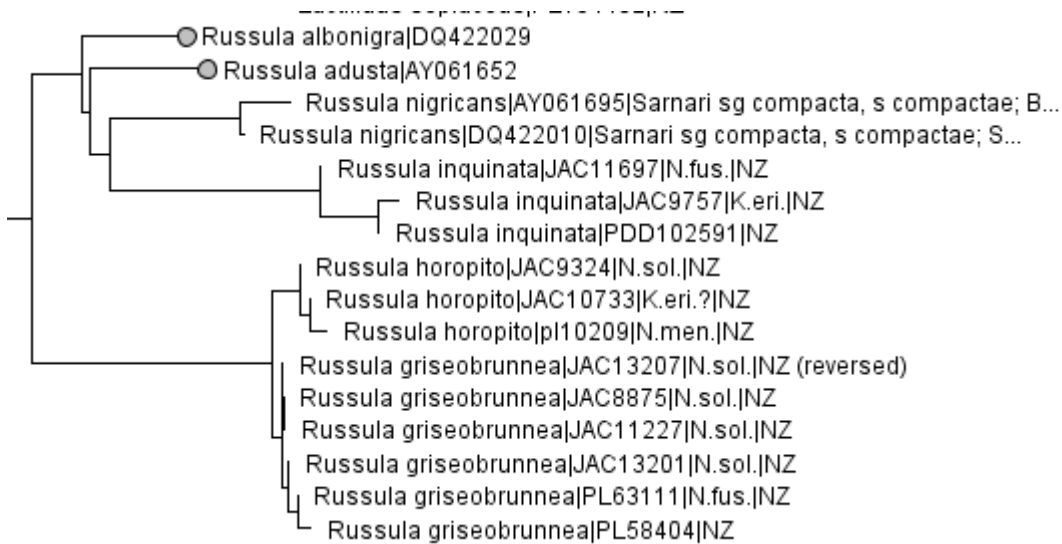


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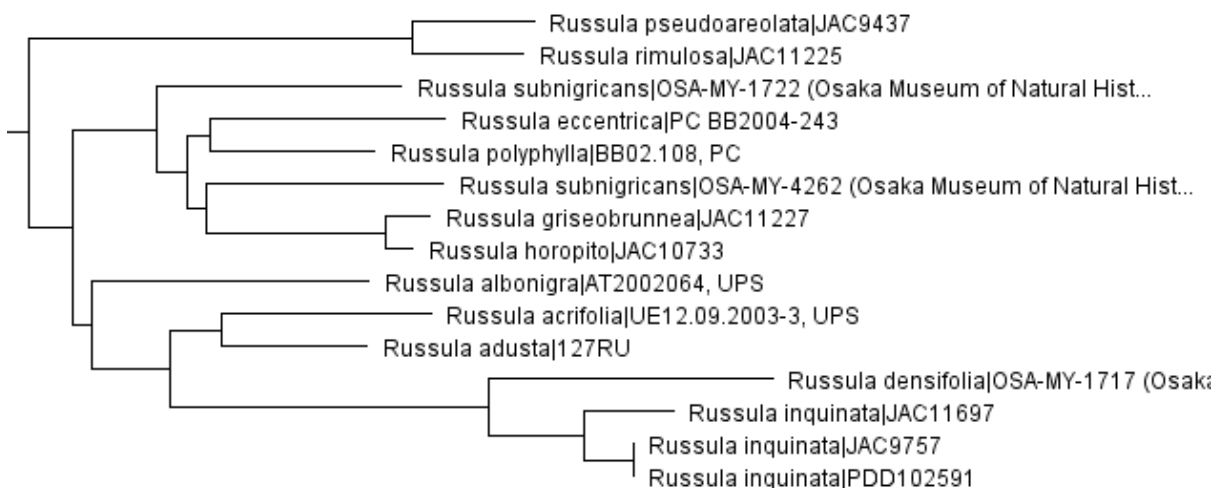


PLORANTES

ITS

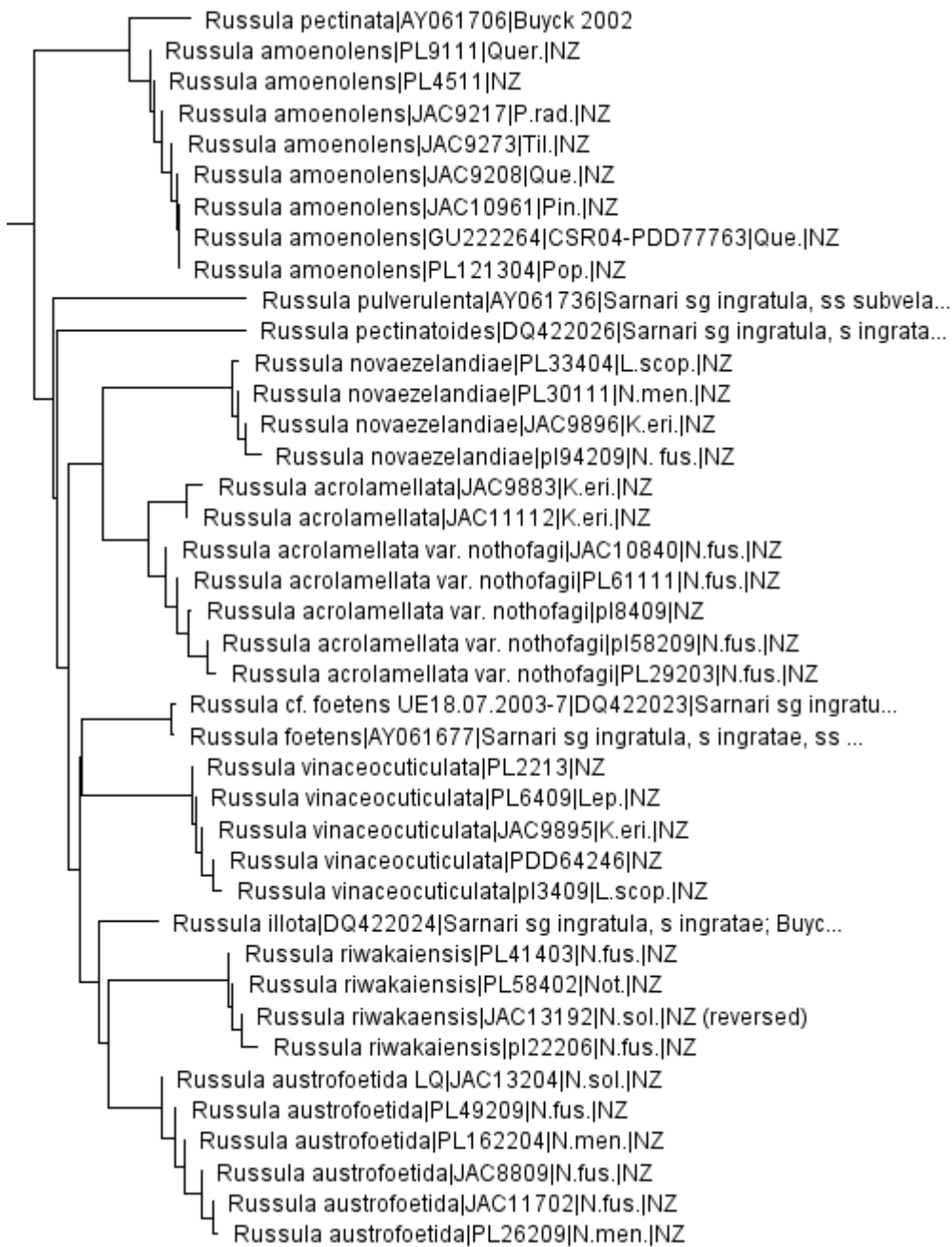


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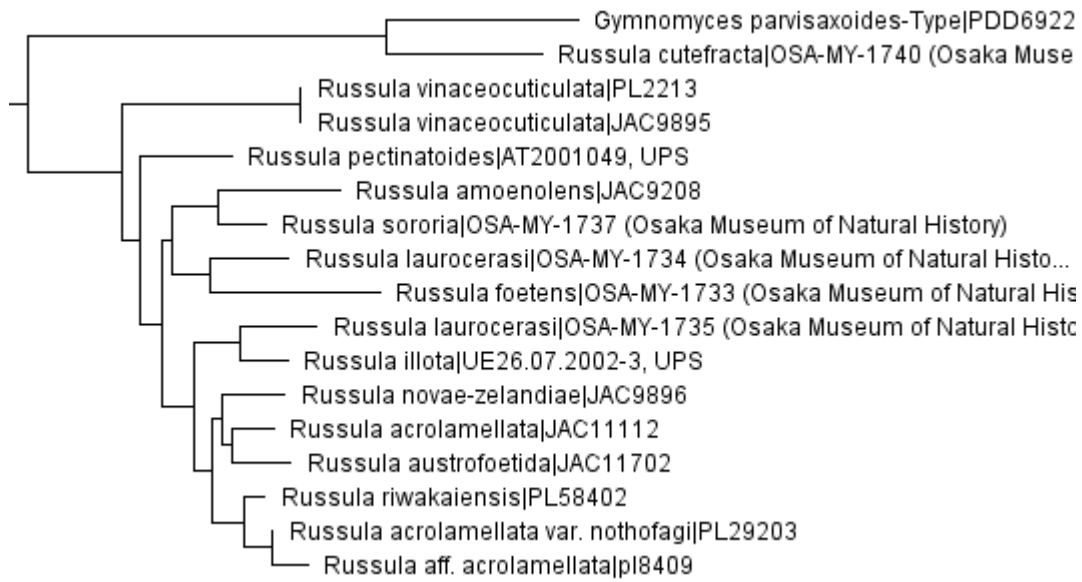


INGRATULA

ITS

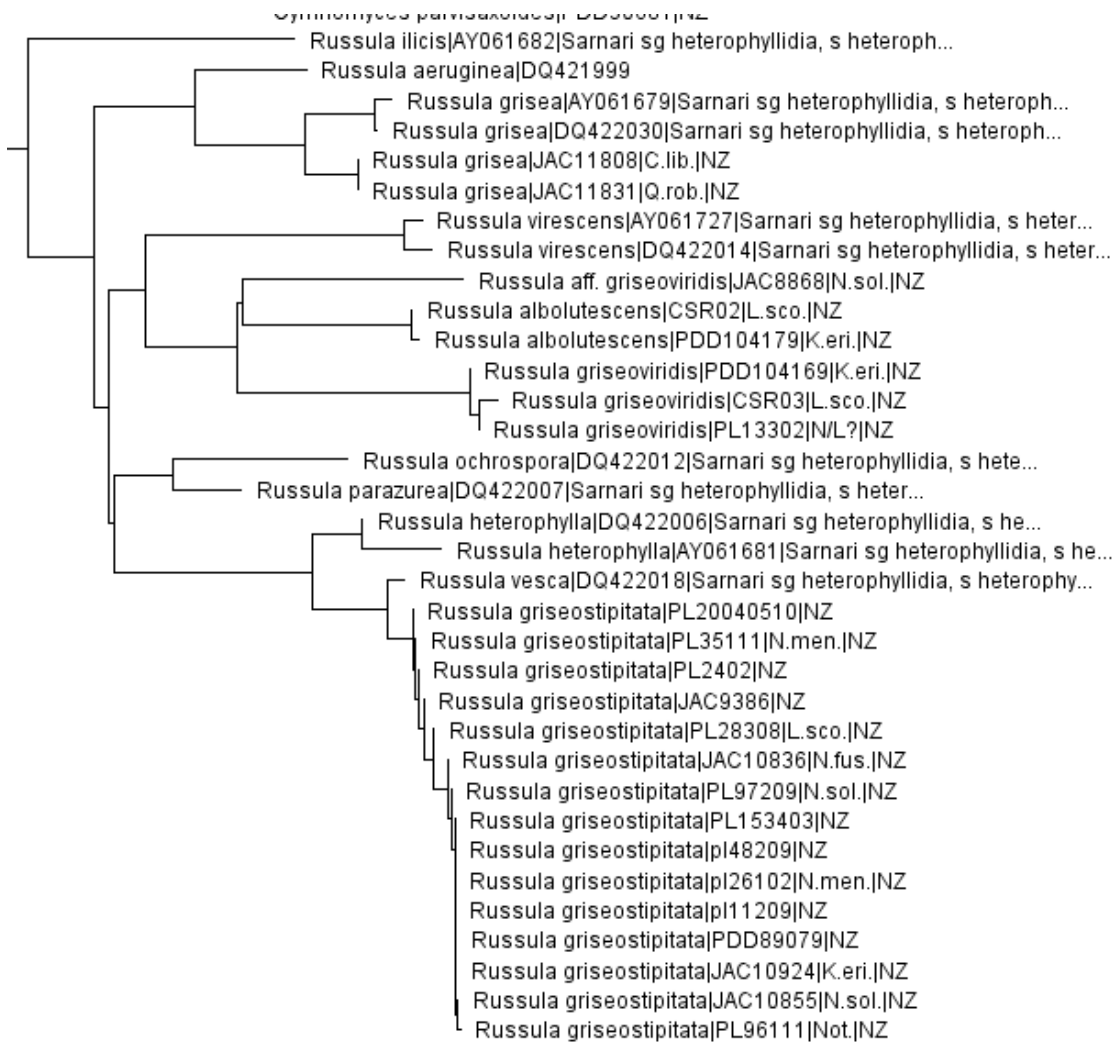


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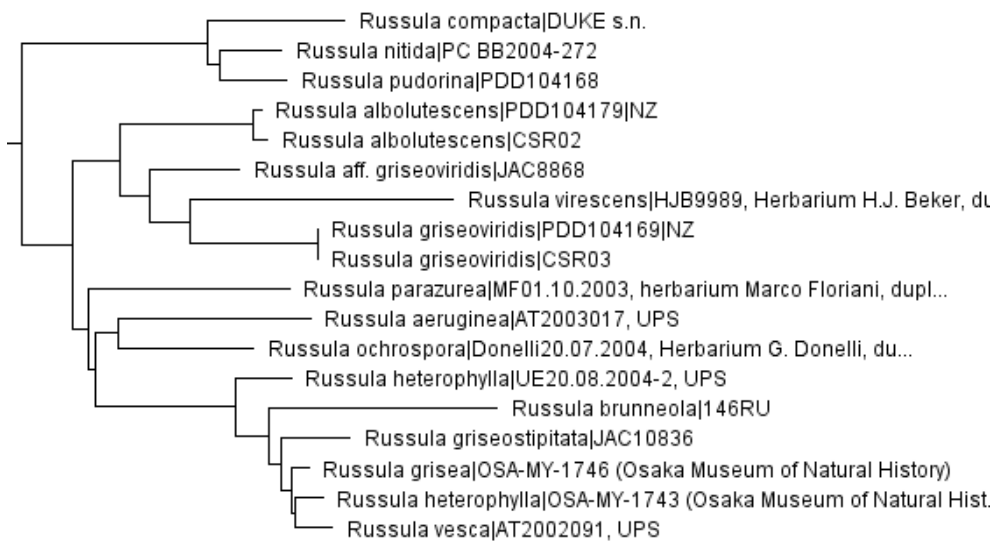


HETEROPHYLLIDIA

ITS

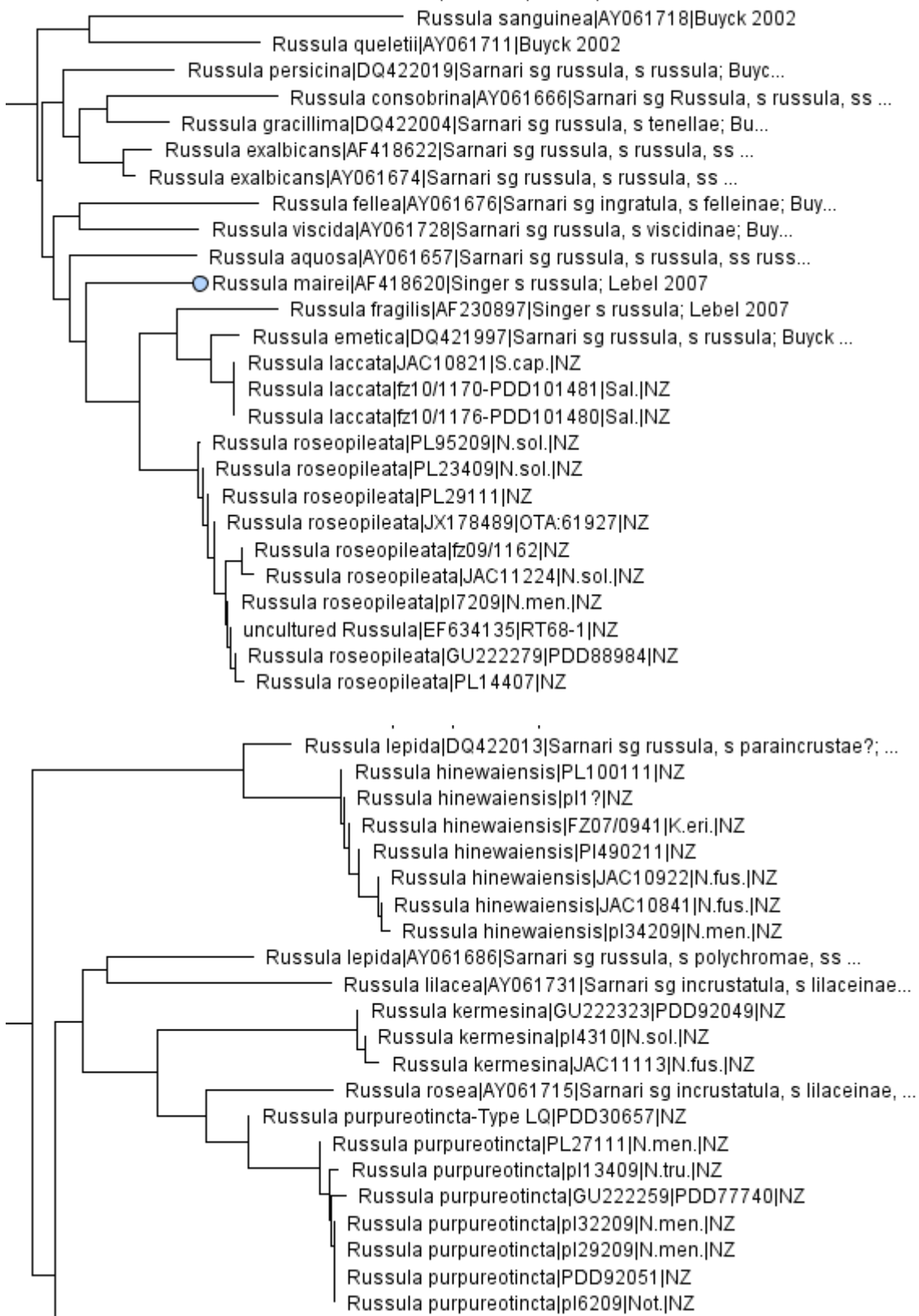


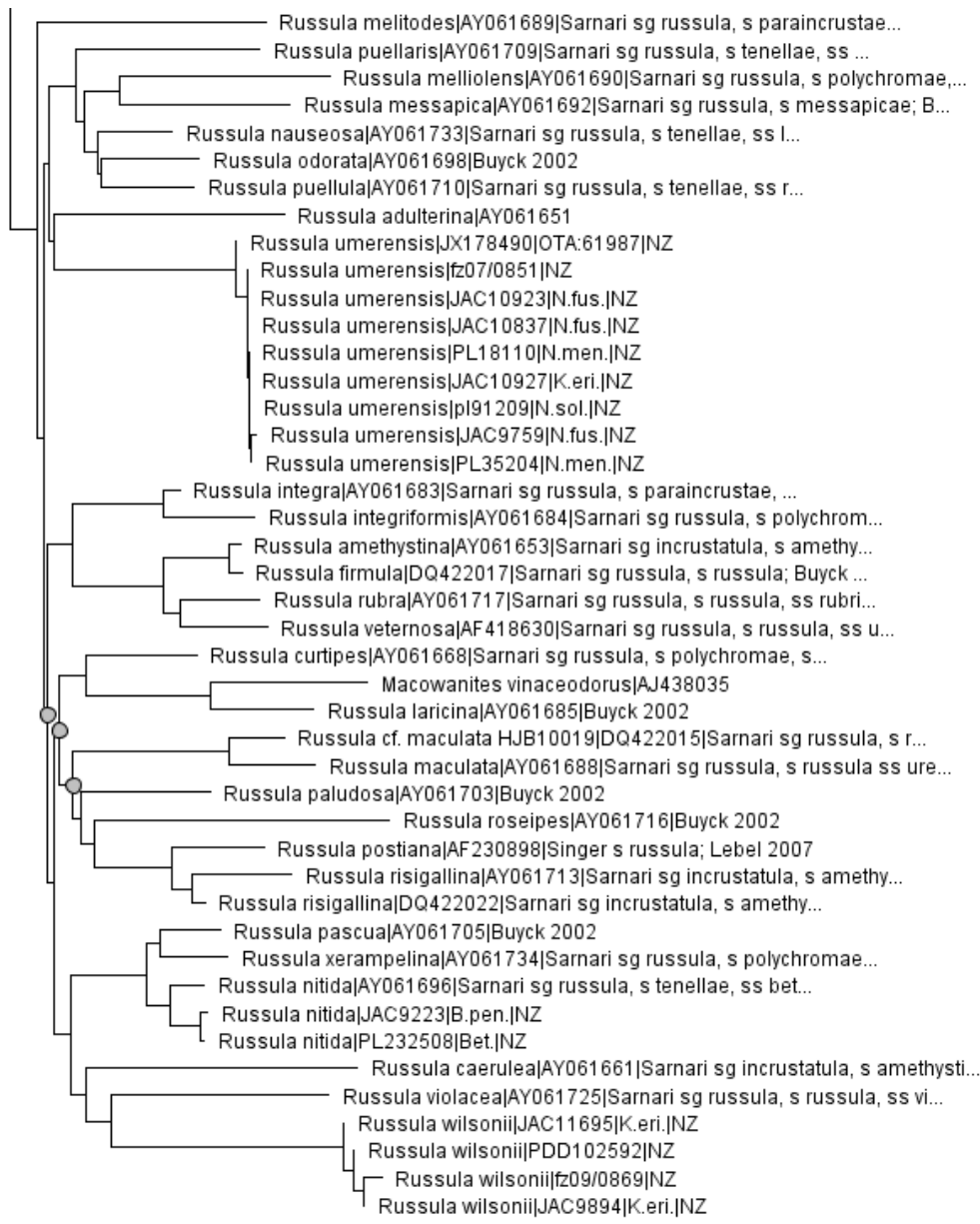
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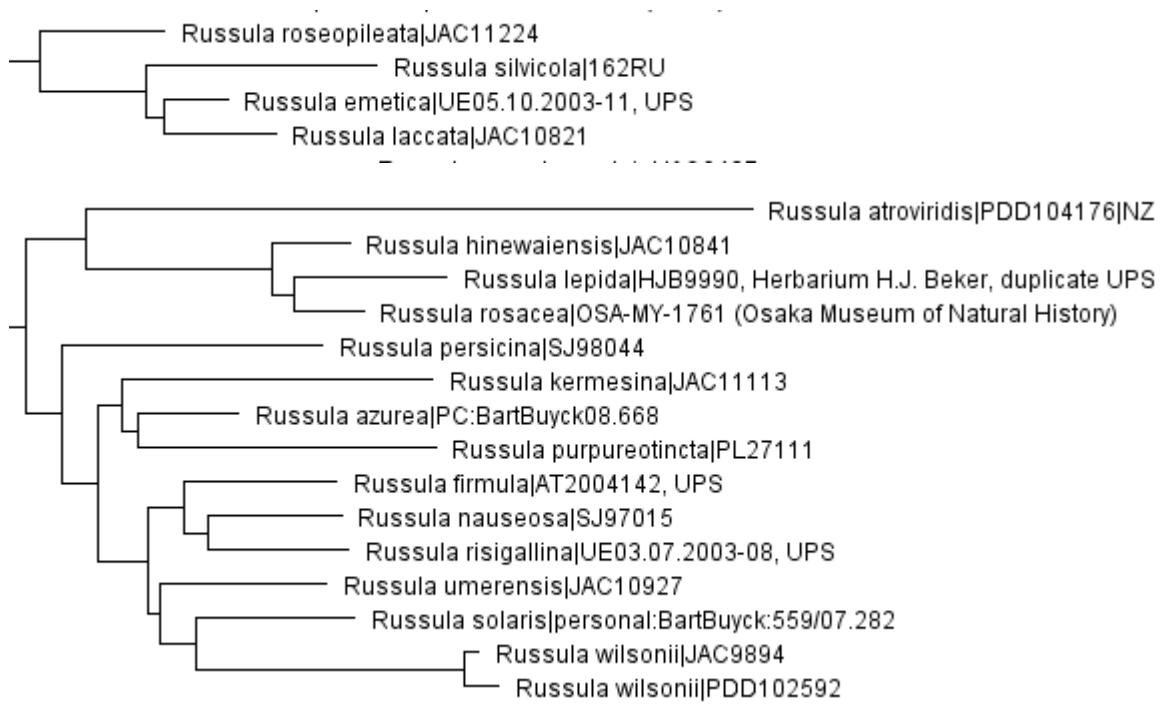
RUSSULA SS

ITS





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