Two new pathogenic ascomycetes in *Guignardia* and *Rosenscheldiella* on New Zealand’s pygmy mistletoes (*Korthalsella: Viscaceae*)

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Abstract: Two new pathogens, *Guignardia korthalsellae* and *Rosenscheldiella korthalsellae*, are described from New Zealand’s pygmy mistletoes (*Korthalsella, Viscaceae*). Both form ascomata on living phylloclades with minimal disruption of the tissue. Fungal hyphae within the phylloclade are primarily intercellular. *Guignardia korthalsellae* disrupts a limited number of epidermal cells immediately around the erumpent ascoma, while the ascomata of *Rosenscheldiella korthalsellae* develop externally on small patches of stromatic tissue that form above stomatal cavities. *Rosenscheldiella* is applied in a purely morphological sense. LSU sequences show that *R. korthalsellae* as well as another New Zealand species, *Rosenscheldiella brachyglottidis*, are members of the Mycosphaerellaceae sensu stricto. Genetically, *Rosenscheldiella*, in the sense we are using it, is polyphyletic; LSU and ITS sequences place the two New Zealand species in different clades within the Mycosphaerellaceae. *Rosenscheldiella* is retained for these fungi until generic relationships within the family are resolved. Whether or not the type species of *Rosenscheldiella*, *R. styrae*, is also a member of the Mycosphaerellaceae is not known, but it has a similar morphology and relationship to its host as the two New Zealand species.

Key words: ITS, LSU, Mycosphaerellaceae, Phaeocryptopus, phylogeny.

Taxonomic novelties: *Guignardia korthalsellae* A. Sultan, P.R. Johnst., D.C. Park & A.W. Robertson, sp. nov.; *Rosenscheldiella korthalsellae* A. Sultan, P.R. Johnst., D.C. Park & A.W. Robertson, sp. nov.

INTRODUCTION

The pygmy mistletoes of New Zealand belong to the genus *Korthalsella* in the family *Viscaceae*. Species of *Korthalsella* are leafless, aerial hemiparasites, having terete or flattened internodes with minute, unisexual flowers borne on the tip of internodes in the axis of rudimentary leaves or on specialised inflorescence branches. *Korthalsella* has an unusual, scattered, and discontinuous distribution with high levels of species and sectional diversity in Malesia extending from Hawaii, the Marquesas and Henderson Island in the east, to Ethiopia and Madagascar in the west, and from Japan in the north, to Australia and New Zealand in the south (Barlow 1983, Molvray 1997, Burrows 1996). Barlow (1997) estimated that there may be as many as 25 species. Molvray (1997) reduced the number of species to eight; however, her classification is not generally accepted and was not adopted by Barlow (1997) or Wagner et al. (1999) in monographs of the floras of Malesia and Hawaii respectively.

New Zealand is home to three pygmy mistletoe species, *Korthalsella salicornioides*, *K. clavata*, and *K. lindsayi*, although there is debate about the taxonomic status of the latter two as separate species (see Danser 1940, Molvray 1997, Molvray et al. 1999). *Korthalsella salicornioides* mainly occurs on *Leptospermum scoparium* and *Kunzea* sp. (*Myrtaceae*) and has also been recorded on the introduced *Erica lusitanica* and *E. vagans* (*Ericaceae*, Bannister 1989). *Korthalsella clavata* is known on *Aristolochia fruticosa* (*Eleocarpaceae*), *Coprosma propinqua*, *C. wallii* (*Ericaceae*), and *Discaria toumatou* (*Rhamnaceae*). While the main host for *K. lindsayi* is *Melicoipe simplex*, it also occurs on *Coprosma* spp., *Lophomyrtus obcordata* (*Myrtaceae*), and *Myrsine divaricata* (*Myrsinaceae*). *Korthalsella salicornioides* occurs throughout the North and South Islands and on Stewart Island. *Korthalsella clavata* and *K. lindsayi* occur throughout the South Island and the southern half of the North Island. *Korthalsella salicornioides* may have an even broader range. Barlow (1996) reports it from New Caledonia; Molvray (1997) includes *K. madagascarica* from Madagascar as a synonym of *K. salicornioides*. *K. salicornioides* is classified as “at risk-sparse” in the threatened and uncommon plants list for New Zealand (de Lange et al., 2004) and *K. clavata* is regarded as a regionally threatened plant in Wellington Conservancy (Anonymous 2001).

The only fungi reported previously from *Korthalsella* have been from Hawaii, specifically *Cucurbitaria obducens* (as *Teichospora obducens*), *Echidnodes visci* (Petrak 1953), *Meliola visci* (Stevens 1925), and *Pleospora* sp. (Kleijonas et al. 1979).

This paper describes two new stem parasites on *Korthalsella* spp. from New Zealand. The phylogenetic position of *Rosenscheldiella korthalsellae* sp. nov. and another New Zealand species, *R. brachyglottidis*, is determined on the basis of ITS and LSU sequences. The genus was placed in the *Venturiaceae* by Kirk et al. (2008), although Sivanesan & Shivas (2002) referred it to the *Mycosphaerellaceae* in a paper in which they described *R. dyssoxyl*, a species with erumpent ascomata morphologically reminiscent of typical *Mycosphaerella* spp.
**MATERIALS AND METHODS**

**Morphological studies**

Specimens were examined from dried collections; ascii and ascospores are described from squash mounts following rehydration in water or 3% KOH. Ascomata and conidiomata were sectioned at a thickness of about 10 μm using a freezing microtome and sections were mounted in lactic acid for light microscopy. All collections have been deposited in the New Zealand Fungal and Plant Disease Herbarium (PDD).

**Molecular analyses**

**Guignardia**

DNA was extracted using REDExtract-N-Amp Plant PCR Kits (Sigma, USA) from small pieces of tissue taken from within three individual fruiting bodies from three different infected plants stored as dried herbarium specimens, following the removal of the upper surface of the fruiting body. The tissue was ground in extraction buffer with a plastic pestle in the Eppendorf tube, then DNA extraction and PCR were carried out following the manufacturer's instructions. ITS sequences were obtained separately from each extract following the methods of Johnston & Park (2005) using ITS1F and ITS4 amplification primers (White et al. 1990, Gardes & Bruns 1993). Using ClustalW (Larkin et al. 2007) our newly generated ITS sequences were aligned with sequences deposited in GenBank from taxa representing the genetic diversity of Phyllosticta as reported by Okane et al. (2003) and Rodrigues et al. (2004) (Table 1). Botryosphaeria dothidea was selected as the outgroup following Crous et al. (2006b) who showed Phyllosticta sensu stricto to be monophyletic and have a sister relationship with Botryosphaeria. Taxa in more distantly related clades of the Botryosphaeriaceae could not be reliably aligned. The 599-bp-long alignment has been deposited in TreeBase. A 70-bp segment near the start of the alignment could not be reliably aligned and was excluded from the analyses as was the 5.8S part of the alignment, because this was not available for all of the sequences deposited in GenBank, leaving 425 characters in the analyses. Phylogenetic analyses were performed using Bayesian maximum likelihood in MrBayes 3.1.2 (Huelsenbeck & Ronquist 2001) and a heuristic maximum likelihood analysis in PAUP v. 4.01b (Swoford 2002) with the GTR+I+G model, selected using the AIC method in MrModelTest v. 2.3 (Posada & Crandall 1998, Posada & Buckley 2004). The Bayesian analysis was run with two chains for 10 M generations, trees sampled every 1 000 generations with a burn-in of 10%. Bayesian posterior probabilities were obtained from 50% majority rule consensus trees. The PAUP ML analysis used addition sequence random and TBR branch swapping with 100 replicates to avoid local optima. A bootstrap analysis used the ML tree as a starting tree; each of the 100 bootstrap samples run with a single replicate.

**Rosenscheldiella**

DNA was extracted from dried herbarium specimens using the same methods as for Guignardia. Tissue was extracted separately from seven individual pseudothecia taken from several different plants collected from two separate sites for Rosenscheldiella korthalsellae and from individual pseudothecia taken from three different leaves from a fresh collection of R. brachyglottidis (PDD 94939). ITS sequences were generated using the same primers as Guignardia and LSU using LROR and LR5 (Bunyard et al. 1994, Vilgalys & Hester 1990). Our newly generated ITS and LSU sequences were aligned with sequences deposited in GenBank from taxa representing the genetic diversity of Mycosphaerellaceae as reported in recent papers (e.g. Arzanlou et al. 2008, Crous et al. 2006a, 2007) as well as the specimens that formed the closest matches for R. brachyglottidis and R. korthalsellae in a GenBank BLAST search. In all cases the fungi included in the analysis had both ITS and LSU sequences available from the same voucher specimen, and the vouchers are available through public collections (Table 2). Davidiella tassiana was chosen as the outgroup following Crous et al. (2007) who showed the Davidiellaceae to be basal within the Capnodiales to Mycosphaerellaceae plus Teratosphaeriaceae. The alignment has been deposited in TreeBase. Several short segments within the ITS could not be reliably aligned and these were excluded from subsequent analyses, leaving 1384 characters. Phylogenetic analyses followed the procedure described for Guignardia using the GTR+I+G model as selected by MrModelTest.

**RESULTS AND DISCUSSION**

**Phylogenetic analyses**

**Guignardia**

Identical sequences were obtained from all three fruiting bodies of Guignardia korthalsellae; one has been deposited as GenBank FJ655899. Phylogenetic analysis shows that G. korthalsellae groups most closely with the Vitaceae-associated G. bidwellii, the Eugenia-associated P. eugeniae, and the Muehlenbeckia-associated P. beaumarisii (Fig. 1).

**Rosenscheldiella**

For both of the species of Rosenscheldiella sequenced, all samples from each of the species had matching DNA sequences, making it unlikely that a contaminating fungus had been sequenced.

Based on these sequences R. brachyglottidis and R. korthalsellae are members of the Mycosphaerellaceae sensu Crous et al. (2007, 2009). Micromorphologically these two species are similar to Mycosphaerella, with fissitunicate, fasciculate asci, hamathelial elements lacking or poorly developed, and ascospores 1-septate, slightly constricted at septum, upper cell slightly wider than the lower. However, the anatomy of the ascomata and their relationship to the host tissue is unusual for the Mycosphaerellaceae. In both R. brachyglottidis and R. korthalsellae, as well as R. styracis, the type species of the genus, groups of pseudothecia develop externally to the host leaf or phylloclade on small pads of stromatic tissue that develop superficially from hyphae growing through the stoma. Within the leaf, the substomatal cavity is tightly packed with hyphae, but otherwise the hyphae are confined to leaf tissue in the immediate vicinity of the fruiting body and are always intercellular. Unusual for Mycosphaerellaceae, the host leaves show little or no symptoms beyond the presence of the fruiting bodies. This relationship to the host leaf with development of pseudothecia superficially on small pads of stromatic tissue growing from stoma is the same as has been described for Phaeocryptopus gaeumanni, a pathogen of Douglas fir (Stone et al. 2008). Like Rosenscheldiella, Phaeocryptopus is a member of the Mycosphaerellaceae (Winton et al. 2007).

Although Rosenscheldiella brachyglottidis, R. korthalsellae, and Phaeocryptopus gaeumanni share a similar morphology,
they are phylogenetically distinct within the Mycosphaerellaceae. Of the taxa sampled in this study, *R. korthalsellae* forms a sister relationship with *Mycosphaerella aurantiicola*, *M. buckinghamiae* and *M. pini*, *P. gaemmunicola* forms a sister relationship with *Mycosphaerella heimii*, and *R. brachyglottidis* forms no close relationship with other sampled species (Fig. 2). The distinctive biology and morphology shown by these three species has evolved several times within the Mycosphaerellaceae. These fungi are retained in Rosenscheldiella and Phaeocryptopus for the time being, awaiting resolution of generic relationships within the family.

| *Fungus* | Isolate voucher number | GenBank accession number | Host and geographic origin of voucher |
|----------|------------------------|--------------------------|--------------------------------------|
| Guignardia aesculi | CBS 756.70 | AB095504 | Aesculus hippocastanum, Netherlands |
| Guignardia bidwellii | IFO 9466 | AB095509 | Parthenocissus tricuspidata, Japan |
| Guignardia citricarpa | IMI 304799 | AY042917 | Citrus aurantianum, India |
| Guignardia gauthieriae | CBS 447.70 | AB095506 | Gauthieria humifusa, Netherlands |
| Guignardia korthalsellae | PDD 94684 | FJ655899* | Korthalsella lindsayi, New Zealand |
| Guignardia mangiferae | IFO 33119 | AB041233 | Rhododendron sp., Japan |
| Guignardia philiprina | CBS 174.77 | AB095507 | Cryptomera japonica, Netherlands |
| Guignardia vaccinii | CBS 447.68 | AF312014 | Taxus baccata, USA |
| Phyllosticta beeticola | CBS 116456 | AY251078, AY342092 | CCA-treated Douglas-fir pole, USA |
| Phyllosticta brevissima | CBS 776.97 | AF312010 | Pyrola sp., USA |
| Phyllosticta bidwellii | IFO 9466 | AB095509 | Oxycoccus macrocarpus, Netherlands |
| Phyllosticta communis | CBS 110500 | AY725531, DQ246256 | Eucalyptus globulus, Australia |
| Phyllosticta glomerata | CBS 445.82 | AY042925 | Eugenia aromatica, Indonesia |
| Phyllosticta hypoglossis | CBS 432.92 | AY249232 | Ruscus aculeatus, Italy |
| Phyllosticta korshalsellae | CBS 776.97 | AF312011 | Brachyglottis stellatifoliata, South Africa |
| Phyllosticta podocarpi | CBS 111947 | AF312013 | Podocarpus lanceolata, South Africa |
| Phyllosticta pyrolae | IFO 32652 | AB041242 | Erica carnea, Japan |
| Phyllosticta spinarum | IMI 070028 | EU042907 and AY042908 | Japan |
| Phyllosticta teleomorpha | CBS 292.90 | AF312009 | Chamaeacynapius pisifera, France |

*Sequences newly generated for this study.

1Names used are those cited in GenBank.

Table 2. Isolates included in the phylogenetic analyses of Rosenscheldiella.

| *Fungus* | Isolate voucher number | GenBank accession number | Host and geographic origin of voucher |
|----------|------------------------|--------------------------|--------------------------------------|
| Cercospora beticola | CBS 116456 | AY640527, DQ676091 | Beta vulgaris, Italy |
| Davidelia tassiana | STE-U 5101 | AY251078, AY342092 | CCA-treated Douglas-fir pole, USA |
| Mycosphaerella aurantiicola | CBS 110500 | AY725531, DQ246256 | Eucalyptus globulus, Australia |
| Mycosphaerella buckinghamiae | CBS 112175 | EU707856, EU707856 | Buckinghamia sp., Australia |
| Mycosphaerella colombianensis | CMW 11255 | DQ239933, DQ204745 | Eucalyptus sp., Colombia |
| Mycosphaerella communis | CBS 110976 | AY725537, DQ246261 | Eucalyptus sp., South Africa |
| Mycosphaerella fori | CMW 9096 | DQ267561, DQ204749 | Eucalyptus grandis, South Africa |
| Mycosphaerella gaemmunicola | CBS 100305 | EU019297, EU019297 | Trichinum aestivum, The Netherlands |
| Mycosphaerella graminicola | CMW 8554 | DQ267564, DQ204624 | Eucalyptus globulus, Chile |
| Mycosphaerella helminthoides | CPC 15429 | EU882122, EU882141 | Eucalyptus sp., Thailand |
| Mycosphaerella heterodera | CBS 111169 | AY725550, DQ246260 | Eucalyptus globulus, Zambia |
| Mycosphaerella pini | ATCC 28973 | EF114684, EF114697 | Pinus ponderosa, USA |
| Mycosphaerella punctata | CBS 113031 | EU167582, EU167582 | Syzygium cordatum, South Africa |
| Mycosphaerella walkeri | CMW 20332 | DQ267593, DQ267574 | Eucalyptus globulus, Chile |
| Phaeocryptopus gaemmunicola | CBS 267.37 | EF114685, EF114698 | Pseudotsuga menziesii, South Africa |
| Pseudocercospora natalensis | CBS 110669 | DQ303077, DQ267576 | Eucalyptus nitens, South Africa |
| Pseudocercospora paraguayensis | CBS 111286 | DQ267602, DQ204764 | Eucalyptus nitens, Brazil |
| Pseudocercospora vitis | CPC 11595 | DQ073923, DQ073923 | Vitis vinifera, South Africa |
| Readeriella novae-zelandiae | CBS 114357 | DQ267603, DQ204629 | Eucalyptus botryoides, New Zealand |
| Rosenscheldiella brachyglottidis | PDD 94939 | GQ355335*, GQ355334* | Brachyglottis repanda, New Zealand |
| Rosenscheldiella korthalsellae | PDD 94885 | GQ355332*, GQ355333* | Korthalsella lindsayi, New Zealand |
| Teratosphaeria mexicana | CBS 110502 | AY725558, DQ204237 | Eucalyptus globulus, Australia |
| Teratosphaeria rubida | CBS 116005 | AY725572, EU019304 | Eucalyptus globulus, Australia |

*Sequences newly generated for this study.

1Names used are those cited in GenBank.

2ATCC: American Type Culture Collection, Virginia, USA; CBS: Centraalbureau voor Schimmelcultures, Utrecht, The Netherlands; DAR, Plant Pathology Herbarium, Orange, Australia; IFO: Inst. for Fermentation Culture Collection, Osaka, Japan; IMI: International Mycological Institute, CABI, United Kingdom; PDD: The New Zealand Fungal Herbarium, Landcare Research, Auckland, New Zealand; ETH: ETH Culture Collection, Swiss Federal Institute of Technology, Zurich, Switzerland.
Fig. 1. Maximum likelihood tree from the PAUP analysis (Ln = –2273.3147) based on ITS sequences from Guignardia korthalsellae (PDD 94884, GenBank FJ655899) and GenBank data from other species of Guignardia and Phyllosticta, (Table 1) representing the genetic diversity accepted for these fungi by Okane et al. (2003) and Rodrigues et al. (2004). Bootstrap values shown above the branches where greater than 50% and Bayesian posterior probabilities below the branches where 0.90 or above. Tree rooted with Botryosphaeria dothidea as outgroup.

Fig. 2. Maximum likelihood tree from the PAUP analysis (Ln = –5475.66915) based on LSU and ITS sequences from Rosenscheldiella brachyglottidis and R. korthalsellae, together with GenBank data from related Mycosphaerella species (Table 2). Bootstrap values shown above the branches where greater than 50% and Bayesian posterior probabilities below the branches where 0.90 or above. Tree rooted with Davidiella tassiana as outgroup.
Etymology: korthalsellae refers to the genus of the host plant.

**TAXONOMY**

**Guignardia korthalsellae** A. Sultan, P.R. Johnst., D.C. Park & A.W. Robertson, *sp. nov*. MycoBank MB514115. Figs 3, 4.

*Holotypus: New Zealand*, Wanganui, vic. Palmerston North, Coles Bush, living internodes of *Korthalsella lindsayi*, 22 Nov. 2008, A. Sultan, PDD 94922.
Ascomata and conidiomata 0.15–0.40 mm diam, black, globose, erumpent, with a single, round, apical, nonpapillate ostiole, solitary or often coalescing, gregarious, developing on flattened, leaf-like internodes of living plants, rarely associated with obvious chlorotic or necrotic symptoms, indistinct chlorotic halos sometimes seen on heavily infected leaves. Fruiting bodies develop within epidermal
layer, breaking down 3–4 epidermal cells, with immediately adjacent hypodermal cells pushed aside. Otherwise, host tissue disrupted to a minimal extent, fungal hyphae within plant restricted to plate-like layers of hyaline, thin-walled hyphae developing between 2–3 layers of host hypodermal cells and between cuticle and epidermal cells adjacent to fruiting bodies. Ascomatal and conidiomatal wall 20–25 μm thick, comprising 4–5 layers of short-cylindric cells 3–5 μm diam, with cell walls slightly thickened, hyaline in lower part, darkened in upper part, innermost layers of cells narrower, thinner-walled; cells adjacent to ostiole angular to globose with walls thick and dark. Groups of fruiting bodies may be entirely ascomatal, entirely conidiomatal, or have a mixture of both forms. Spermatial conidiomata sometimes also present. Asci clavate, bitunicate, 65–100 × 18–20 μm, attenuated at base to a short stipe, 8-spored. Ascospores ellipsoid, 19–27.5 × 8–11 μm, hyaline, 0-septate, no gelatinous sheaths or caps observed. Pseudoparaphysoid-like elements broad-cylindric, thin-walled, absent in mature ascomata.

Conidiogenous cells lining entire inner layer of conidiomata, solitary, cylindrical to lageniform, 6–14 × 4.5–5 μm, wall not thickened at single, apical conidiogenous locus. Conidia 13–15 × 7–9 μm, ellipsoid to clavoid, apex broadly rounded, base truncate, 0-septate, hyaline, surrounded by a thin gelatinous sheath, with a gelatinous, tapering apical appendage (4–)6–9(–20) μm long.

Spermatial state Leptodothiorella with conidiogenous cells cylindric, 7.5–10 × 3–5 μm, wall thickened at single, apical conidiogenous locus, in groups of 2–3 on a single, short-cylindric basal cell. Microconidia 5.5–7 × 2 μm, straight, dumbbell-shaped, 0-septate, hyaline.

Habitat: On living internodes of Korthalsella lindsayi. Ascomata more common in summer, conidiomata in winter and spring. A macroscopically similar fungus was observed on K. clavata, but no collections were made and its identity was not confirmed.

Distribution: New Zealand.

Additional specimens examined. New Zealand, Wanganui, vic. Palmerston North, Coles Bush, living internodes of Korthalsella lindsayi, Oct. 2008, A. Sultan, PDD 94884; Wanganui, vic. Palmerston North, Coles Bush, living internodes of K. lindsayi, 23 Dec. 2008, A. Sultan, PDD 95152; Bay of Plenty, Paengaroa Scenic Reserve, living internodes of K. lindsayi, Oct./Nov. 2008, A. Sultan, PDD 94900; Mid Canterbury, Christchurch, Riccarton Bush, on living internodes of K. lindsayi, 11 Apr. 1996, R.C. Close, PDD 65803.

Notes: This fungus is probably common on Korthalsella lindsayi throughout its range. No Guignardia or Phyllosticta spp. have been previously reported from Korthalsella. Phyllosticta phoradendri reported on Phoradendron, another member of the Viscaceae from California (Bonar 1942), was not accepted in the genus by van der Aa & Vanev (2002); these authors considered it to be probably an Asteromella-like species. De Lange (1997) reported a Phyllosticta sp. on the loranthaceous mistletoe Ileostylus micranthus in New Zealand. We could find no literature report or voucher specimen to support this record and suspect it may have been a miscitation of the host of PDD 65803. K. lindsayi, the only mistletoe-associated specimen of Phyllosticta available in 1997.

Guignardia and its anamorph Phyllosticta is monotypic within the Botryosphaeriaceae (Crous et al. 2006b). Within Guignardia, G. korthalsellae is genetically distinct from the geographically widespread, biologically unspecialised G. mangiferae and from all other Guignardia spp. represented in recent phylogenetic studies (Fig. 1). However, many species have no molecular data available, and acceptance of the species described here as new is based in part on its host preference. Although recent studies (e.g. Rodrigues et al. 2004) have shown that some Phyllosticta species isolated as symptomless endophytes may have a broad host range, the biological relationship between these fungi and the hosts from which they have been isolated is poorly understood. In a study based on herbarium specimens, van der Aa (1973) considered most Phyllosticta species to be host specialised pathogens. Guignardia korthalsellae develops within living host tissue but causes minimal damage. This apparently highly developed biological relationship supports the likelihood of host specialisation in this case.

Rosenscheldiella brachyglottidis G.F. Laundon & Sivan. in Laundon, New Zealand J. Bot. 9: 619. 1972 [1971]. Fig. 5.

Ascomata develop within denseomentum of hairs on underside of leaves, no visible symptoms on upper surface. Ascomata with one or a small number of black-walled pseudothecia, up to about 0.1 mm diam, held on a stroma-like structure comprising a small group of hyaline to pale brown, globose to angular cells that arise from hyphae growing through leaf stomata. Ascomata generally develop in gregarious groups of 10–20, forming patches up to about 5 mm diam. Hyaline, thin-walled fungal hyphae ramify amongst leaf tomentum adjacent to ascomata. Internally, host substomatal cavity packed with hyaline, thin-walled fungal hyphae, extensive plates of hyphae between host cells close to substomatal cavity. Hamathecium lacking. Ascis fissitunicate, subacaceous with a small basal foot, 8-spored. Ascospores 16–22 × 5–6 μm, ellipsoid, 1-septate, slightly constricted at median septum, hyaline.

Specimens examined. New Zealand. Wellington, Levin, Waiopuhe Reserve, on Brachyglottis repanda, 27 Dec. 1969, G.F. Laundon, PDD 50728, holotype; Wellington, Levin, Waiopuhe Reserve, on B. repanda, 5 Apr. 1969, G.F. Laundon, PDD 50727; Auckland, Waitakere Ranges, roadside near Rose Hellaby House, on B. repanda, 8 Dec. 2008, P.R. Johnston & E.M. Gibellini, PDD 94939.

Rosenscheldiella korthalsellae A. Sultan, P.R. Johnst., D.C. Park & A.W. Robertson, sp. nov. MycoBank MB514116, Fig. 6.

Etymology: korthalsellae refers to genus of the host plant.

Holotypus: New Zealand, Rangitikei, vic. Taihape, Paengaroa Scenic Reserve, on living internodes of Korthalsella lindsayi, 3 Nov. 2008, A. Sultan, PDD 94885.

Ascomata develop superficially, with one to several globose, dark-walled pseudothecia forming on small pads of reddish stromatic tissue above stomata in host phylloclade, stroma forming from hyphae that emerge through stomata. Infected areas of host with large numbers of stromatic pads and their associated pseudothecia. Basal stroma comprising more or less globose cells 5–7 μm diam, with walls thin, pale, encrusted with small, reddish crystals. Irregular, short strands of hyphae, 3–5 μm diam with reddish contents, radiating away from stromata across host surface. Stromata arise from hyphae that extend through phylloclade stomata from substomatal cavity packed with hyaline, thin-walled fungal cells. Hyphae within phylloclade otherwise sparse and intercellular, confined to immediate area around ascomata. Pseu dothecia initially reddish, darker with age, 100–150 μm diam, in vertical section wall...
15–20 μm thick, comprising 4–5 layers of short-cylindric cells, towards inside of wall cells narrower and hyaline, towards outside wider, walls encrusted with dark brown material. Ostiole apical, round, non-papillate, surrounded by a few short-cylindric, outwardly projecting cells. *Hamathecium* of short-cylindric to globose cells arranged amongst asci more or less in loose columns. *Asci* 55–70 × 12–14 μm, fissitunicate, cylindric to clavate with a short, foot-like base, 8-spored, overlapping 2–3 seriate. *Ascospores* 21.5–27 × 4.5–6 μm, cylindric, straight, hyaline, 1-septate, upper cell slightly wider than lower, slightly constricted at septum.
Fig. 6. Rosenscheldiella korthalsellae. A. Infected internodes. B. Detail showing immature, reddish ascomata. C. Detail of B. D. Infected internode densely covered with mature, blackish ascomata. E. Detail of D. F. Ascoma in vertical section, pseudothecium on pad of stromatic tissue developing above stoma. G. Pad of stromatic tissue above stoma, fungal hyphae packing substomatal cavity but otherwise sparse within the internode. H. Detail of G. I. Hymenium, squash mount showing loose, more or less globose cells of hamathecial tissue. J. Detail of hamathecial cells. K. Asci. L. Ascospores. PDD 94565. Scale bars: A, B, D = 2 mm; C, E = 0.5 mm; F = 100 μm; G, I, K = 20 μm; H, J, L = 10 μm.

Habitat: On living internodes of all three Korthalsella spp. in New Zealand.

Distribution: New Zealand, probably common throughout the range of its host species.

Other specimens examined. New Zealand, Mackenzie, Lake Ohau, on Korthalsella clavata, Jan. 2009, A.W. Robertson, PDD 95153; Mid Canterbury, Banks Peninsula, Price’s Valley, on K. lindsayi, 2 Sep. 1995, J.E. Braggins, PDD 65042; Mid Canterbury, Castle Hill, on K. clavata, 17 Jan. 2008, A. Sultan & A.W. Robertson, PDD 95150; South Canterbury, Peel Forest, on K. lindsayi, 22 June 1995, B.P.J. Molloy, PDD 35039; Taupo, vic. Motuoapa, on K. salicornioides, 3 Apr. 2008, A.
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Sultan, PDD 95151; Wanganui, vic. Palmerston North, Coles Bush, living internodes of *K. lindsayi*, 22 Nov. 2008, S. Amir, PDD 94923.

Notes: The only species of *Rosenscheldiella* previously reported from a viscaceous mistletoe is *R. phoradendri* known from El Salvador on *Phoradendron robustissimum*. Based on the published description (Jenkins & Limber 1952), *R. phoradendri* has larger ascospores, 35–48 × 13–16 μm, than our new species.

*Rosenscheldiella styracis* (Henn.) Theiss. & Syd., Ann. Mycol. 13: 645. 1915. Fig. 7.

Ascomata develop on lower surface of leaf, comprising 10–30 globose, dark-walled pseudothecia in confluent groups up to 0.7 mm across. *Pseudothecia* develop on extensive stromatic pads of globose cells with thick, dark walls that form amongst thick-walled, multi-lobed hairs on lower surface of leaves. Stromatic pads appear to arise from hyphae growing through stomata, but this not clearly seen. Within leaf, fungal hyphae confined to area immediately adjacent to ascomata. *Hamathecium* lacking. *Asci* fissitunicate, cylindric, about 110 × 20 μm, 8-spored. *Ascospores* 32.5–36 × 7–7.5 μm, cylindric, tapering slightly to rounded ends, 1 median septum, slightly constricted at septum, hyaline.

Specimen examined: Uruguay, Dept. Treinta y Tres, Tacuari, on *Styrax leprosus*, Nov. 1933, W.G. Herter, Reliquiae Petrakianae 105, PDD 38182. Although not the type, this specimen is considered authentic.

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