

RESEARCH ARTICLE

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# Fungi Silvicolae Novazelandiae: 10

Peter Gadgil\* and Margaret Dick

## Abstract

**Background:** Descriptions of five species of fungi recorded on trees and shrubs are given in this paper. Three species are recorded from New Zealand for the first time, a new combination is proposed for one species and the fifth species has been recorded only once before. The fungi are:

**Fungal species described:** Corticolous Ascomycota: *Rugonectria castaneicola* (W.Yamamoto & Oyasu) Hirooka & P.Chaverri on *Quercus robur* Linnaeus × *canariensis* Willdenow.

Foliicolous Ascomycota: *Acrospermum gaubae* Petrak on *Banksia ericifolia* Linné fil. × *spinulosa* J.E.Smith and on *B. spinulosa* J.E.Smith; *Dictyothyrium hibisci* (F.Stevens) comb. nov. on *Hibiscus rosa-sinensis* Linnaeus.

Foliicolous coelomycetes: *Pestalotiopsis adusta* (Ellis & Everhart) Steyaert on *Macadamia tetraphylla* L.A.S.Johnson; *Septoriella halensis* B.Sutton & Melnik on *Pachystegia insignis* (Hooker fil.) Cheeseman.

**Keywords:** Fungi; New Zealand; Fungal descriptions; Trees; Shrubs

## Background

The purpose of this series of papers is to provide descriptions of fungi recently recorded on trees and shrubs in New Zealand. Most of these records come from specimens sent to the Forest Health Reference Laboratory at this Institute (the New Zealand Forest Research Institute trading as Scion) for identification. In this tenth paper of the series, descriptions are provided of three ascomycetous and two coelomycetous fungi. For examination, sections were cut using a freezing microtome. Sections and squash preparations were mounted in lactophenol.

The location record of local specimens examined is followed by the name of the arbitrarily defined geographic region (Crosby et al. 1998) in which the specimen was collected. The account of the New Zealand distribution of an organism is based principally on herbarium (NZFRI-M) records and on the database maintained by the New Zealand Forest Research Institute and is presented for each geographical region, with the number of records for that region in parentheses.

## Descriptions of Fungi

### Corticolous Ascomycota

*Rugonectria castaneicola* (W.Yamamoto & Oyasu) Hirooka & P.Chaverri (Figures 1a, b & c)

\* Correspondence: Peter.Gadgil@scionresearch.com

New Zealand Forest Research Institute Ltd. (Scion), Private Bag 3020, Rotorua, New Zealand

*Studies in Mycology* 68: 73, 2011.

≡ *Neonectria castaneicola* (W.Yamamoto & Oyasu) T. Kobayashi & Hirooka, *Journal of General Plant Pathology* 71: 126, 2005.

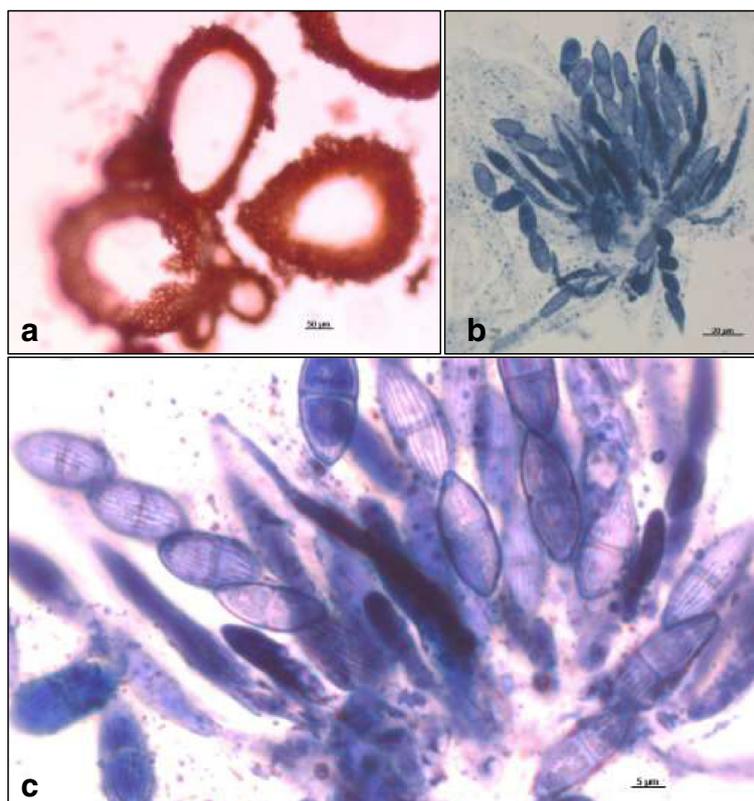
= *Rugonectria sinica* W.Y.Zhuang, Z.Q.Zeng & W.H. Ho, *Mycosystema* 31: 467, 2012.

Anamorph: *Cylindrocarpon castaneicola* T.Kobayashi & Hirooka, *Journal of General Plant Pathology* 71: 126, 2005.

Ascomata on cankers on stems, stromatic, perithecial, gregarious in groups of 5 to 40, globose, surface covered in warts, bright scarlet red, 0.2 – 0.4 mm. in diameter, ostiole papillate, surrounded by a small, dark disc, on a dark brown stroma. Perithecial wall in two layers, outer layer of angular, reddish cells with hyaline warts, inner layer of hyaline, elongated cells, one or two cells thick, total wall thickness (40)-60-(80) μm. Asci clavate, 4-spored, uniseriate, (60)-66-(80) × (8)-9-(11) μm. Ascospores elliptical, 1-septate, not constricted at the septum, (16)-18-(22) × (6)-8-(10) μm, striate, hyaline to yellowish. Conidia not seen in nature. Macroconidia from culture on carnation-leaf agar fusiform, curved or straight, 4-5-septate, (40)-55-(65) × (5)-6-(8) μm, with a broad, rounded apex and tapering base, smooth, hyaline.

**Habitat:** Cankers on living stem of *Quercus robur* Linnaeus × *canariensis* Willdenow.

**Specimen examined:** on cankers on stem of *Quercus robur* × *canariensis*, Carbine Road, Auckland (Auckland), 4.iii.2011, B.J. Rogan, NZFRI-M 5734.



**Figure 1** *Rugonectria castaneicola*. **a** T.S. Ascomata (Bar = 50  $\mu$ m). **b** Asci (Bar = 20  $\mu$ m). **c** Ascospores (Bar = 5  $\mu$ m).

*New Zealand distribution*: Auckland (1).

*Rugonectria castaneicola* has been recorded on cankers on stems of *Castanea crenata* Siebold & Zuccarini (Yamamoto et al. 1957) and has been shown to be a wound pathogen causing perennial cankers on stems of *Abies veitchii* Lindley and *Acer crataegifolium* Siebold & Zuccarini (Kobayashi et al. 2005). The fungus has also been found on cankered stems of many broadleaf species including *Quercus* spp. (Hirooka et al. 2005).

This is the only record of *R. castaneicola* from New Zealand. The infected tree has been removed (Ho et al. 2014) and the fungus has not been recorded in New Zealand since that time.

#### Foliicolous Ascomycota

*Acrospermum gaubae* Petrak (Figures 2a, b, c & d)

*Sydowia* 9: 564, 1955.

Anamorph not known.

Leafspots none. Ascomata perithecial, solitary, superficial, seated loosely on the underside of leaves among leaf hairs without a firm point of attachment, doliiiform to nearly cylindrical, surface covered in large scales, reddish brown, becoming darker in KOH, flattened apically, ostiolate, (320)-400-(450)  $\mu$ m high, diameter (170)-200-(240)  $\mu$ m at base and (110)-140-(190)  $\mu$ m at the top. Perithecial wall in two layers: outer layer of angular cells with reddish

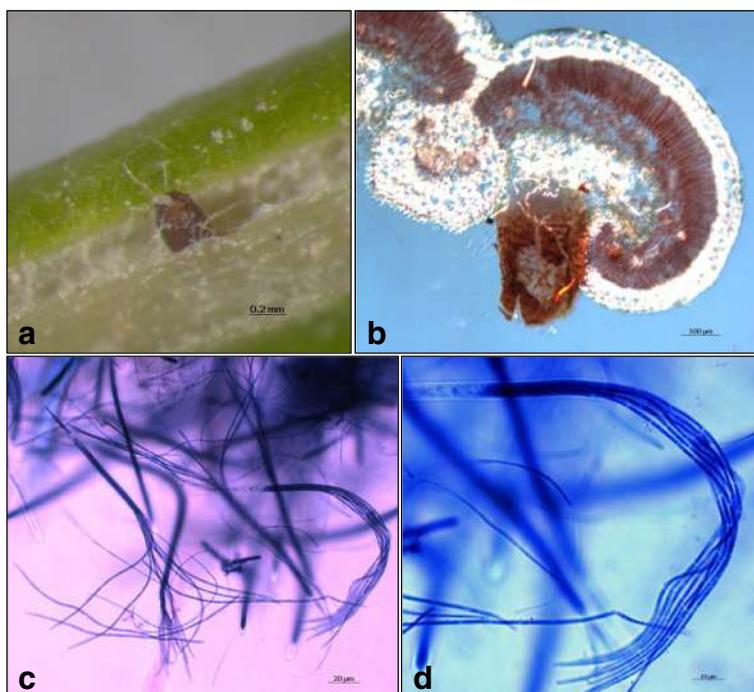
brown walls with the outermost cells forming scales, 15–20  $\mu$ m wide; inner layer of hyaline, thin-walled, elongate cells, 5–15  $\mu$ m wide. Asci unitunicate, 4–8-spored, long clavate, without specialised apical discharge mechanism, thin-walled, evanescent at maturity, (150)-180-(220)  $\times$  6–7  $\mu$ m. Ascospores fusiform, rounded at one end and tapering at the other, multiseptate, (115)-140-(160)  $\times$  1–2  $\mu$ m, sometimes disarticulating, parallel and twisted round each other in the ascus, hyaline, smooth.

*Habitat*: Superficial among leaf hairs on the underside of living leaves of *Banksia spinulosa* J.E.Smith and *B. ericifolia* Linné fil.  $\times$  *spinulosa* J.E.Smith.

*Specimens examined*: on living leaves of *Banksia ericifolia*  $\times$  *spinulosa*, Te Rapa South, Hamilton (Waikato), 10.xi.2008, J.A. Bartram, NZFRI-M 5514; on living leaves of *B. spinulosa*, Seymour St., Picton (Marlborough Sounds), 27.i.2010, M. Hansen, NZFRI-M 5727.

*New Zealand distribution*: Waikato (1), Marlborough Sounds (1).

The Investigation and Diagnostic Centre of the Plant Health and Environment Laboratory of the former Ministry of Agriculture and Forestry (now Ministry for Primary Industries) did a molecular analysis on DNA extracted from ascomata of this fungus but found no match with any of the registered sequences. A search of the literature and use of various keys led us to the revised family



**Figure 2** *Acrospermum gaubae*. **a** Ascoma on leaf (Bar = 0.2 mm). **b** T.S. Ascoma (Bar = 100 µm). **c** Asci and ascospores (Bar = 20 µm). **d** Ascospores (Bar = 10 µm).

*Acrospermataceae* (Minter et al. 2007) and the genus *Acrospermum*. A search in *Index Fungorum* yielded the names of 66 species and subspecies in *Acrospermum*. We then began to examine the protologues of each of these names. That for *Acrospermum gaubae*, described by Petrak (1955) from *Banksia ericifolia* from Pigeon House Mountain in the Budawang Range, New South Wales, Australia, matched our collections well, except that the New Zealand specimens are larger. A comparison is given in Table 1.

This is the first record of *A. gaubae* in New Zealand; indeed, apart from the initial report of Petrak (1955), it appears to be the only other record of the fungus in the literature. *Acrospermum gaubae* is purely superficial and causes no damage to its hosts.

*Dictyothyrium hibisci* (F.Stevens) comb.nov. (Figures 3a, b, c & d)

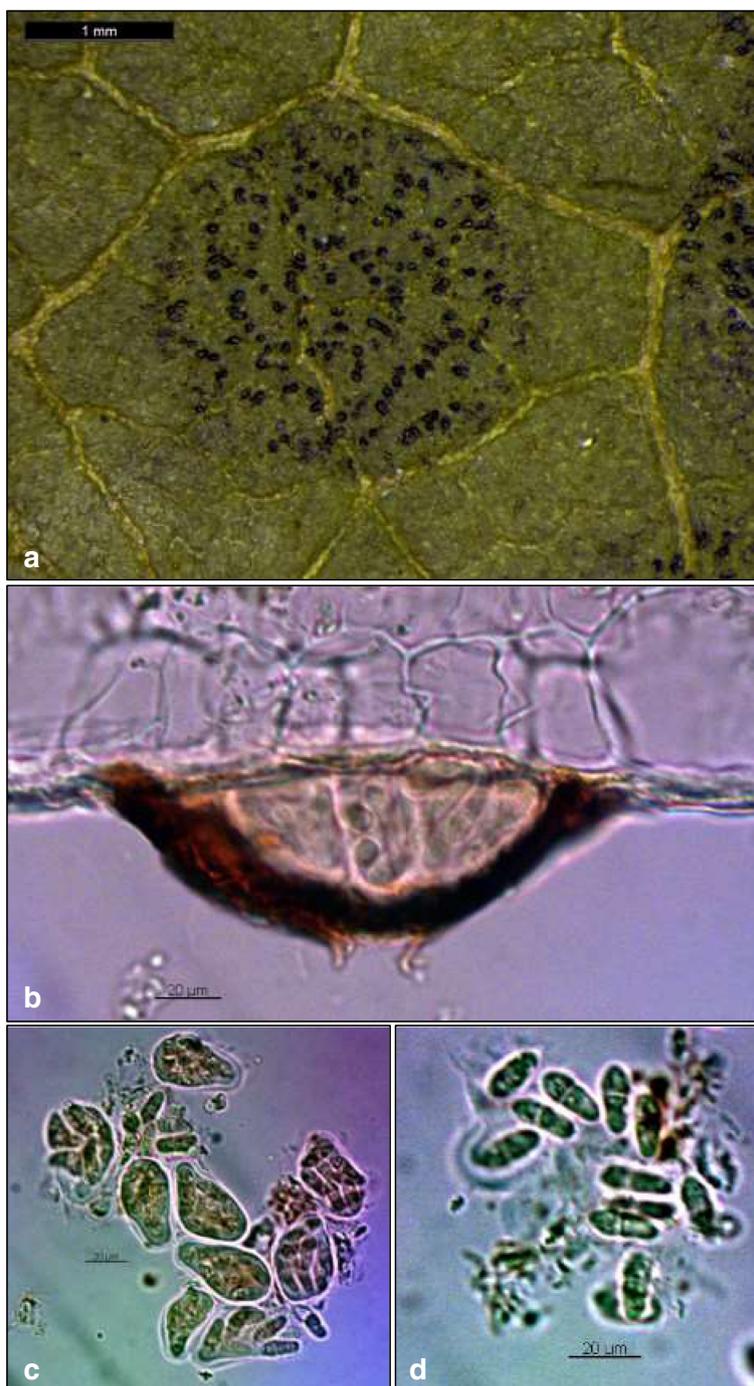
≡ *Microthyriella hibisci* F.Stevens, *Bernice P. Bishop Museum Bulletin* 19: 88, 1925

Anamorph not known.

Leaf spots none. Ascوماتa thyriothecial, scutate, roughly circular, superficial, densely gregarious, arranged in approximately concentric circles, appressed closely to the cuticle, superficial mycelium absent; on upper surfaces of leaves. Upper wall of thyriothecium composed of dark brown angular cells forming a reticulum, basal wall not seen, (100)-105-(120) µm in diameter × (30)-36-(40) µm high, ostiole distinct, (16)-17-(20) µm in diameter, occasionally with two or three smaller secondary ostioles. Asci ovate to globose conical, 8-spored, (19)-21-(23) × (12)-13-(14)

**Table 1** Characteristics of *Acrospermum gaubae*

Character	Petrak (1955)	NZFRM 5514
Perithecia	Hypophyllous, solitary, reddish brown, lageniform, broadly attached to leaf hairs, ostiolate, 100-300 µm high, 130-170 µm broad at the base. Wall 25-35 µm wide, parenchymatous, outer layer of reddish cells, inner layer subhyaline.	Hypophyllous, solitary, reddish brown, doliiform to cylindrical, seated among leaf hairs, ostiolate, 320-450 µm high, 170-240 µm broad at base. Wall 20-35 µm wide, outer layer of angular cells with reddish brown walls, inner layer of hyaline, elongated cells.
Asci	Elongate cylindrical, rounded at the top, 4-spored, 110-140 × 6-7 µm.	Elongate clavate, without apical discharge mechanism, 4-8-spored, 150-220 × 6-7 µm.
Ascospores	Filiform, multiseptate, disarticulating.	Filiform, multiseptate, sometimes disarticulating, 115-160 × 1-2 µm.
Host	<i>Banksia ericifolia</i>	<i>Banksia ericifolia</i> × <i>spinulosa</i>



**Figure 3** *Dictyothyrium hibisci*. **a.** Thyrrothelial ascomata on leaf surface (Bar = 1.0 mm). **b.** T.S. Ascoma (Bar = 20 µm). **c.** Asci and ascospores (Bar = 20 µm). **d.** Ascospores (Bar = 20 µm).

µm. Ascospores fusiform, 1-septate with the upper cell larger than the lower cell, (10)-12-(13) × (4)-5-(6) µm, smooth, hyaline.

*Habitat:* Living leaves of *Hibiscus rosa-sinensis* Linnaeus.

*Specimens examined:* On living leaves of *Hibiscus rosa-sinensis*, Rapahoe House, Gloucester Park Road, Onehunga, Auckland (Auckland), 19.ix.2012, J. Goodenough, NZFRI-M

5764; on leaves of *Hibiscus* sp., Meiland Place, West Auckland, Auckland (Auckland), 20.ix.2001, J.A. Bartram, NZFRI-M 4589; on leaves of *H. rosa-sinensis*, Sunken Garden, Marine Parade, Napier (Hawkes Bay), 23.v. 2003, B.J. Rogan, NZFRI-M 5024.

*New Zealand distribution:* Northland (1), Auckland (2), Bay of Plenty (1), Gisborne (1), Hawkes Bay (1).

This fungus was originally described from Hawaii on *Hibiscus* sp. as *Microthyriella hibisci* (Stevens 1925). According to Müller and von Arx (1962) *Microthyriella* Höhnelt is a synonym of *Schizothyrium* Desmazières. This view is generally accepted (Kirk et al. 2008) and most species previously placed in *Microthyriella* have been transferred to *Schizothyrium*. Müller and von Arx (1962) also pointed out that *Microthyriella hibisci*, did not follow the type of *Microthyriella* and was wrongly placed in that genus. *Microthyriella rickii* (Rehm) Höhnelt, the type species of *Microthyriella* (in common with species in *Schizothyrium*), does not have an ostiole, the whole surface of the shield splitting and allowing the ascospores to escape. As *Microthyriella hibisci* has a distinct ostiole, it does not belong in *Microthyriella* and has to be redispersed to a genus other than *Schizothyrium*. Morphologically, *M. hibisci* belongs to the Micropeltidaceae and all keys (Batista, 1959; Müller and von Arx, 1962; Luttrell 1973; von Arx and Müller 1975) show that it is best placed in *Dictyothyrium* Theissen. Molecular analysis yielded no close matches to any records in Genbank.

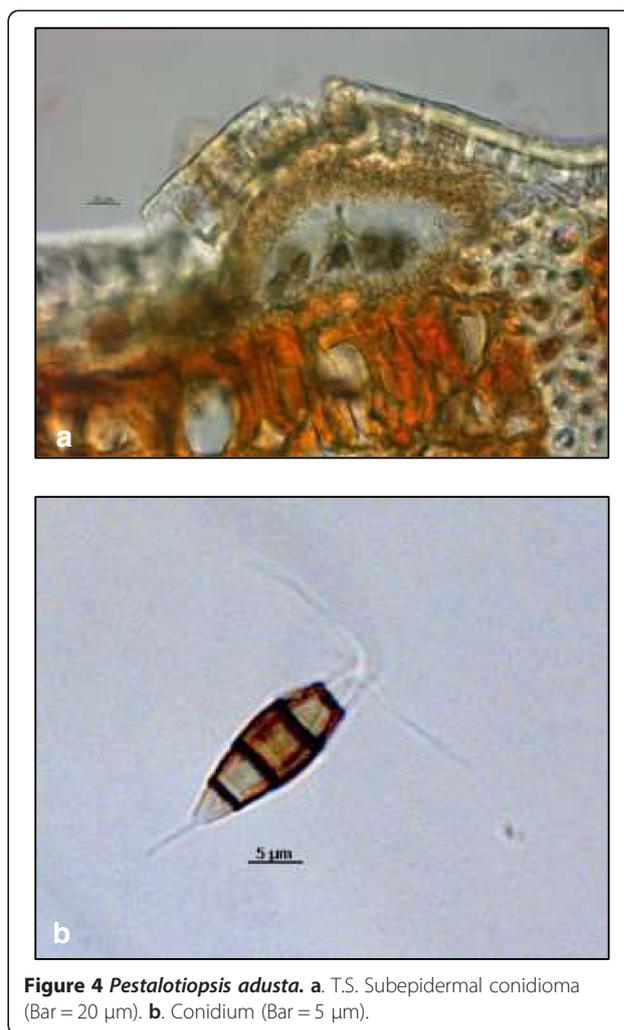
The thyriothecia of the fungus are entirely superficial, the shield-shaped fruiting bodies merely sitting on the leaf surface without a basal wall. No superficial mycelium was seen and there is no penetration of the host tissue. The concentric arrangement of the thyriothecia (Figure 3A) makes the fungus easily recognisable. It is not uncommon in New Zealand. It has also been recorded (as *Microthyriella hibisci*) in Australia (Walker and McLeod 1971).

#### Foliicolous coelomycetes

***Pestalotiopsis adusta*** (Ellis & Everhart) Steyaert (Figures 4a & b)

*Transactions of the British Mycological Society* 36: 82, 1953.

Leafspots roughly circular (5–10 mm in diameter), light brown to grey with a dark brown margin, on both surfaces of leaves but more commonly on the upper surface. Conidiomata acervular, subepidermal, later partly erumpent by the scaling off of an irregular disc-like portion of the epidermis exposing a black mass of conidia, scattered, 100–150 µm in diameter, acervular stroma composed of brown angular cells. Conidiogenous cells annelidic, hyaline, subcylindrical, up to 25 µm long. Conidia fusiform, 4-septate, straight or slightly curved, (20)–22–(24) × (5)–7–(8) µm, bearing apical appendages, basal cell obconic, hyaline, (2)–3–(4) µm long with a pedicel 6–7 µm long, 3 median cells subcylindrical, concolorous, olivaceous brown, not or slightly constricted at the septa, together (14)–16–(19) µm long, apical cell conical, hyaline, (4)–5–(6) µm long, bearing a crest of 2–3



**Figure 4** *Pestalotiopsis adusta*. **a.** T.S. Subepidermal conidioma (Bar = 20 µm). **b.** Conidium (Bar = 5 µm).

(mostly 3) divergent, tubular, hyaline, filiform, flexuous, 18–20 µm long appendages.

**Habitat:** Living leaves of *Macadamia tetraphylla* L.A. S. Johnson.

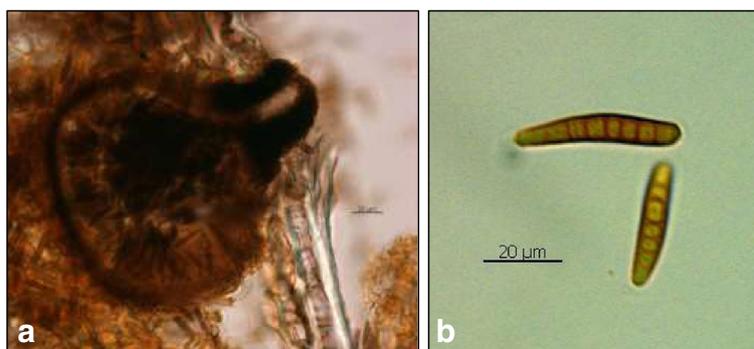
**Specimen examined:** On living leaves of *Macadamia tetraphylla*, Puketutu Island, Mangere, Auckland (Auckland), 26.vi.2012, C. Inglis, NZFRI-M 5742.

**New Zealand distribution:** Auckland (2).

*Pestalotiopsis adusta* has been recorded once before on *Macadamia tetraphylla* from Titirangi, Auckland in 1976 (PDD 34322). The fungus is cosmopolitan but is more common in the sub-tropical and sub-temperate regions. It has a very wide host range; Guba (1961) listed 27 angiospermous species in 21 families (7 in the Rosaceae) as hosts. In New Zealand, it has been found on necrotic patches on living leaves of *M. tetraphylla* but the damage has been minor.

***Septoriella halensis*** B. Sutton & Melnik (Figures 5a & b) *Mikologia i Fitopatologia* 33: 369, 1999.

Leaf spots grey to straw-coloured with a broad dark brown margin, roughly circular, up to 5 mm in diameter,



**Figure 5** *Septoriella halensis*. **a.** T.S. Subepidermal Conidioma (Bar = 20 µm). **b.** Conidia (Bar = 20 µm).

on the upper surfaces of leaves. Conidiomata pycnidial, scattered, subepidermal, globose to subglobose, black, (160)-180-(210) × (130)-160-(190) µm, outer wall composed of dark brown angular cells, inner wall of thin-walled, hyaline cells, ostiole central, circular, surrounded by blackish brown, thick walled cells. Conidiophores absent. Conidiogenous cells lining the wall of the conidioma, hyaline, short cylindrical to ampulliform, holoblastic, 5–6 µm long. Conidia fusiform, with an obtuse apex and truncate base, 7-septate, not constricted at the septa, straight or slightly curved, (27)-32-(40) × (4)-5-(6) µm, verruculose, pale brown, bearing a 1–2 µm thick mucoid appendage at the apex and at the base.

**Habitat:** Leaf spots on living leaves of *Pachystegia insignis* (Hooker fil.) Cheeseman.

**Specimen examined:** On living leaves of *Pachystegia insignis*, Newton St., Tauranga (Bay of Plenty), 28. ix.2012, D.L. Brunt, NZFRI-M 5749.

**New Zealand distribution:** Bay of Plenty (1).

The genus *Septoriella* is characterised by mucoid appendage-bearing pale brown multiseptate conidia formed on holoblastic conidiogenous cells (Sutton 1980). The genus was reviewed later by Adrianova and Minter (2007) who recognised 11 species in the genus and

provided a key to them. Only two of the species, *S. halensis* and *S. phragmitis* Oudemans have conidiomata (160–220 µm wide) and conidia (fusiform, 30–45 µm long and 5-7-septate) that are similar to those of the New Zealand fungus (Table 2).

A comparison of the three descriptions shows that the New Zealand fungus cannot be distinguished from *S. halensis*. Use of the key to accepted species of *Septoriella* (Adrianova & Minter 2007) also leads to *S. halensis*.

This is the first record of a species of *Septoriella* in New Zealand. Most of the eleven taxa accepted in the genus are from temperate areas, the only exception being *S. rockiana* (Petra) Nag Raj from Hawaii. Ten species occur on monocotyledon families and only one, *S. viciae* Adrianova & Minter, has been recorded on a plant (*Vicia unijuga* A.Braun) belonging to a dicotyledon family (*Fabaceae*). This record of *S. halensis* on *P. insignis* adds another dicotyledon family (*Asteraceae*) to the list. Most species of *Septoriella* have been recorded on dead or dying leaves or culms and are regarded as saprobes. The New Zealand collections of *P. halensis* were from leaf spots on living leaves of *P. insignis* but whether the fungus was acting as a pathogen or not is not known.

**Table 2** Morphological characters of NZFRI-M 5749, *Septoriella halensis* and *S. phragmitis*

	NZFRI-M 5749 (this paper)	<i>S. halensis</i> (Sutton and Melnik 1999)	<i>S. phragmitis</i> (Nag Raj 1993)
<b>CONIDIOMATA</b>			
Size (µm)	160-210 × 130-190	175 × 200	200-220 × 200-450
Form	Globose to subglobose	Globose to subglobose	Oval to subglobose
Conidiogenous cells	Short cylindrical to ampulliform, 5–6 µm long.	Cylindrical to ampulliform, 5–6 µm long.	Ampulliform, 4–8 µm long.
<b>CONIDIA</b>			
Size (µm)	27-40 × 4-6	30-43 × 3.5-4.5	29-46 × 3.0-3.5
Form	Fusiform	Fusiform	Fusiform
Number of septa	7	(5–6) 7	(3)-5-(7)
Microconidia	Absent	Absent	Present

**Competing interests**

The authors declare that they have no competing interests.

**Authors' contributions**

PG was responsible for the microscopy and MD did the photomicrography. Both authors have an equal share in species identification and preparation of descriptions. All authors have read and approved the final manuscript.

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