

Description of *Avesicladiella* gen. nov. (hyphomycetes) for two undescribed leaf litter microfungi

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The new hyphomycete genus *Avesicladiella* with two species, *A. britannica* sp. nov., type species, and *A. microsperma* sp. nov., is described and illustrated. Both species are leaf litter microfungi. The genus closely resembles *Vesicladiella*, *Circinotrichum*, *Gyrophthrix*, *Ceratocladium* and *Vermiculariopsiella*, several hyphomycete genera with comparable characters such as superficial hyphal networks; production of setae; absence of conidiophores; lageniform or ampulliform conidiogenous cells; and hyaline, aseptate conidia produced in clusters around the apices of conidiogenous cells. The new genus differs from these by its hyaline, septate setae, typical 'phialidic' conidiogenous cells, and hyaline, aseptate cylindrical conidia.

Key Words—*Avesicladiella*; *Avesicladiella britannica*; *Avesicladiella microsperma*; leaf litter fungi.

The genus *Pulvinotrichum* Gamundí, Arambarri & Giaiotti was erected for a minute sporodochial hyaline hyphomycete, *P. album* Gamundí, Arambarri & Giaiotti, on leaf litter of *Nothofagus dombeyi* from South America (Arambarri et al., 1981). Later, a second species, *P. capitatum* Sutton, was added by Sutton (1989). In the same year, Summerbell et al. (1989) synonymized *Pulvinotrichum* with *Cylindrodendrum* Bonord. The type species, *P. album*, was said to be the same as *Cylindrodendrum album* Bonord. and this was later confirmed by Crous et al. (1994).

For the second species, *P. capitatum* Sutton, Crous et al. (1994) erected a new genus *Vesicladiella* Crous & Wingfield because it was shown not to be congeneric with *Cylindrodendrum*. The genus is characterized by having thick-walled, non-septate setae (referred to as stipe extensions in the original account) that terminate in thin-walled vesicles, discrete, phialidic (sensu Sutton, 1980) conidiogenous cells with single loci, and hyaline, aseptate, cylindrical conidia. The genus was said to be related to *Cylindrodendrum*, *Cylindrocladium* Morgan, *Cylindrocladiella* Boesewinkel and *Falcocladium* Silveira et al. but differs from them by the morphology of its conidiomata and setae.

During a comparative study of endophytes and epiphytes from evergreen woody plants, two minute hyphomycetes with similar characters were collected, one on *Fagus* sp. from China and the other on *Ilex aquifolium* L. from the UK. These two fungi share some common characters with *Vesicladiella* such as superficial colonies with hyaline and thick-walled setae, discrete, phialidic conidiogenous cells with single loci, and hyaline, aseptate, cylindrical conidia. However they differ from

it by having non-stromatic conidiomata, and no terminal thin-walled vesicles on the setae. Thus a new generic name is proposed for them.

***Avesicladiella* W. P. Wu, B. Sutton & Gange, gen. nov.**

Coloniae effusae, superficiales, albae, minutae. Mycelium partim superficiale, partim immersum, ex hyphis hyalinis vel pallide brunneis septatis ramosis laevibus tenuitunicatis in reticulo superficiali formatis compositum. Setae erectae, rectae, hyalinae, rigidae, cylindricae, apicem versus deminutae, septatae, crassitunicatae, laeves, ad basim tumidae, ad apicem obtusae vel acutae. Conidiophora absentia. Cellulae conidiogenae discretatae, determinatae, monolocis, phialidicae, lageniformes, ampulliformes, ad basim crassiores et ad apicem angustiores, apicem versus leniter et inaequaliter curvatae, sine proliferationibus percurrentibus, ex hyphis reticulorum formatae. Conidia holoblastica, solitaria, sicca, hyalina, aseptata, cylindrica, plus minusve fusiformia, utrinque extrema obtusa.

Species typica: *Avesicladiella britannica* W. P. Wu, B. Sutton & Gange sp. nov.

Colonies effuse, superficial, white, minute. Mycelium partly superficial and partly immersed, composed of hyaline to pale coloured, septate, branched, thin-walled, smooth hyphae, forming a hyphal network on the leaf surface, with some short branches formed laterally on the hyphae; superficial and immersed hyphae are connected by very narrow penetration hyphal structures. Setae erect, straight, hyaline, rigid, cylindrical, tapering towards the apex, septate, thick-walled, smooth, base slightly swollen, apex obtuse to acute. Conidiophores absent. Conidiogenous cells discrete, determinate,

monolocar, phialidic, lageniform, ampulliform, with a wider base and a narrower apex, apices slightly curved to one side, without percurrent proliferations, formed from hyphae within the network. Conidia holoblastic, solitary, dry, hyaline, aseptate, cylindrical, slightly fusiform, with both ends obtuse.

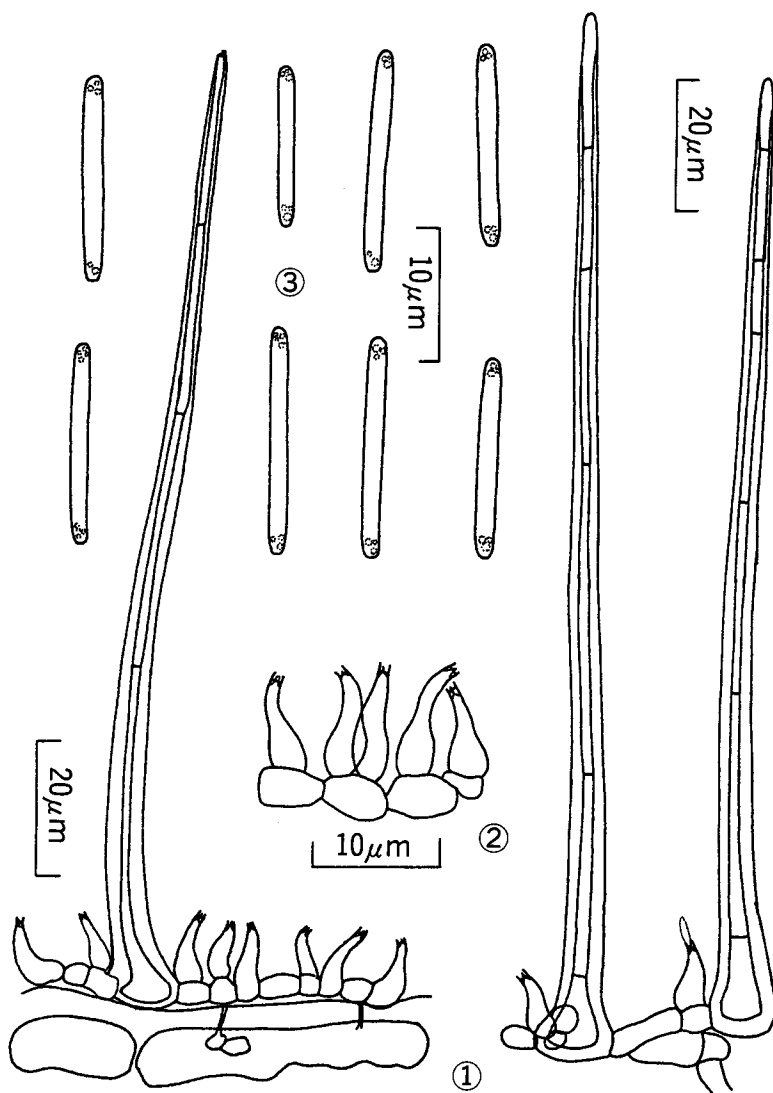
Species typica: *Avesicliadiella britannica* W. P. Wu, B. Sutton & Gange sp. nov.

Avesicliadiella britannica W. P. Wu, B. Sutton & Gange, sp. nov. Figs. 1–3

Coloniae effusae, aggregatae, superficiales, albae, minutae. Mycelium partim immersum et partim superficiale, ex hyphis hyalinis vel pallide brunneis septatis ramosis tenuitunicatis laevibus 2–3 μm latis in reticulo superficiali formatis ramosis brevibus et cellulis conidiogenis lateraliter formatis compositum. Setae erectae, rec-

tae, hyalinae, rigidae, cylindricae, apicem obtusum versus deminutae, 3–5(–7)-septatae, 90–150 μm longae, crassitunicatae, laeves, ad basim parietibus 2–2.5 μm crassis, apicem versus tenuioribus, ad basim leniter tumidae, 8–12 μm crassae, supra basim 4–5.5 μm crassae. Conidiophora absentia. Cellulae conidiogenae discretae, determinatae, monolocas, phialidicae, lageniformes, ampulliformes, ad basim usque ad 3 μm crassae, collo longo 1 μm lato, ad apicem leniter et inaequaliter curvatae, canalibus angustatis et collulis minutis, sine proliferationibus percurrentibus, ex hyphis reticuli formatae. Conidia holoblastica, solitaria, sicca, hyalina aseptata, cylindrica, leniter fusiformia, utrinque extrema obtusa, 15–19 \times 1.5–1.8(–2) μm .

In foliis emortuis *Ilicis aquifolii* L., UK: Surrey, Egham, Huntersdale, 8 June 1996, Wenping Wu, IMI 372453, holotypus.



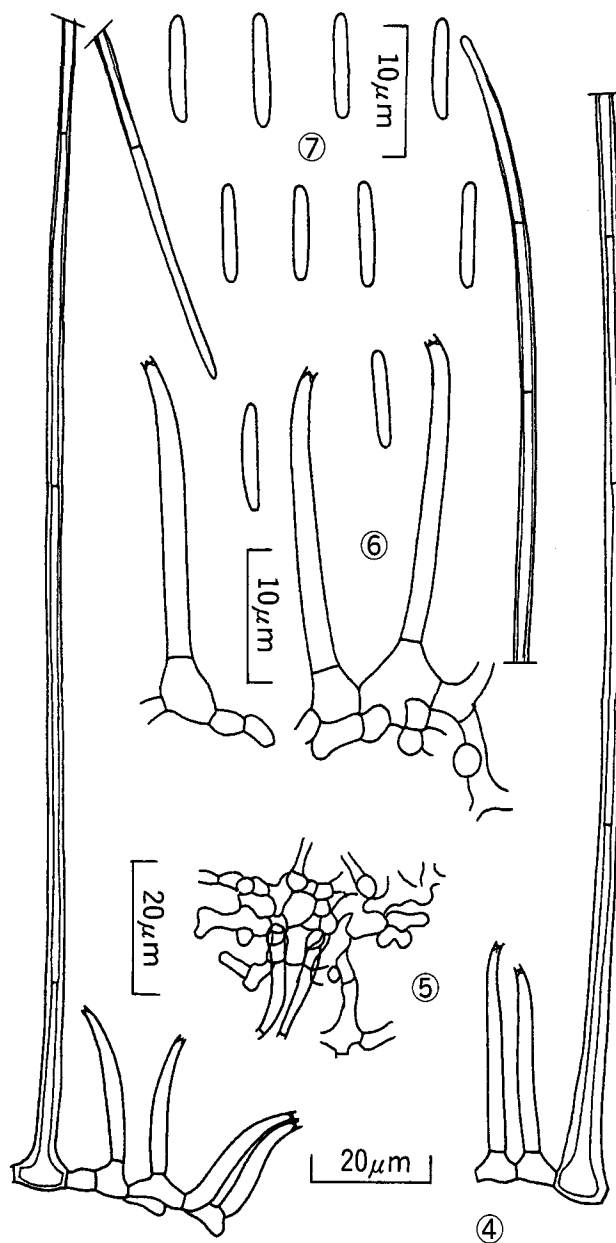
Figs. 1–3. *Avesicliadiella britannica*.

1. Hyaline, septate, thick-walled smooth setae growing together with conidiogenous cells from superficial hyphal networks.
2. Conidiogenous cells.
3. Conidia. (all from holotype).

Colonies effuse, aggregated, superficial, white, minute. Mycelium partly superficial and partly immersed, composed of hyaline to pale coloured, septate, branched, thin-walled smooth hyphae, forming a hyphal network on the leaf surface, some short branches and conidiogenous cells formed laterally on the hyphae, 2–3 μm wide. Setae erect, straight, hyaline, rigid, cylindrical, tapering towards the obtuse apex, 3–5(–7)-septate, 90–150 μm long, thick-walled, smooth, walls 2–2.5 μm thick at the base, becoming thinner towards the apices, base slightly swollen, 8–12 μm wide, 4–5.5 μm wide just above the base. Conidiophores ab-

sent. Conidiogenous cells discrete, determinate, monolocar, phialidic, lageniform, ampulliform, at the base up to 3 μm wide, and with a long narrow neck up to 1 μm wide, apices slightly curved, with a narrow channel and minute collarette, without percurrent proliferations, formed directly from hyphae within the network. Conidia holoblastic, solitary, dry, hyaline, aseptate, cylindrical, slightly fusiform, with both ends obtuse, 15–19 \times 1.5–1.8(–2) μm .

Specimen examined: On dead leaves of *Ilex aquifolium* L., UK: Surrey, Egham, Huntersdale, 8 June 1996, Wenping Wu, IMI 372453 (holotype).



Figs. 4–7. *Avesicladiella microsperma*.

4. Hyaline, septate, thick-walled smooth setae growing together with conidiogenous cells from superficial hyphal networks. 5. Superficial hyphal networks. 6. Conidiogenous cells. 7. Conidia.

Avesicliadiella microsperma W. P. Wu, B. Sutton & Gange, sp. nov. Figs. 4–7

Coloniae effusae, sparsae, dispersae, albae, minutae, superficiales. Mycelium superficiale ramosum, septatum, laeve, tenuitunicatum, hyalinum, 2–2.5 μm latum. Setae erectae, rectae vel leniter flexuosae, hyalinae, 3–5-septatae, in parte inferiori crassitunicatae et apicem versus tenuitunicatae, laeves, 150–240 μm longae, ad basim leniter tumidae et 4–6 μm crassae, supra basim 2–3 μm crassae, apicem obtusae usque ad 1.5 μm crassae. Conidiophora absentia. Cellulae conidiogenae discretae, determinatae, monolocis, phialidicae, subcylindricae, lageniformes, hyalinae, laeves, tenuitunicatae, 10–25 μm longae, ad basim 2–3 μm crassae, usque ad apicem 1.5 μm crassae et leniter et inaequaliter curvatae. Conidia holoblastica, ad apicem cellularum, conidiogenerum fasciculata, solitaria, sicca, hyalina, aseptata, cylindrica, laevia, tenuitunicata, utrinque extrema obtusa, eguttulata, 6–9 \times 1–1.5 μm .

In foliis emortuis *Fagi* sp., China: Yunnan Prov., Kunming, 24 Nov. 1995, Wenping Wu W956c, IMI 372454, holotypus.

Colonies effuse, sparse, scattered, white, minute. Mycelium superficial, branched, septate, smooth, thin-walled, hyaline, 2–2.5 μm wide. Conidiomata sporodochial or widely applanate, superficial, separate, sessile, setose, powdery. Setae erect, straight or slightly flexuous, hyaline, 3–5-septate, thick-walled in the lower part and becoming thin-walled towards the apex, smooth, 150–240 μm long, bases slightly swollen up to 4–6 μm wide, 2–3 μm wide just above the base, apices obtuse, narrower up to 1.5 μm wide. Conidiophores absent. Conidiogenous cells discrete, determinate, monolocular, phialidic, subcylindrical, lageniform, hyaline, smooth, thin-walled, 10–25 μm long and 2–3 μm wide at the bases, up to 1.5 μm wide at the apices, apices slightly curved towards one side. Conidia holoblastic, formed in clusters around the apices of conidiogenous cells, solitary, dry, hyaline, aseptate, cylindrical, smooth, thin-walled, ends rounded, eguttulate, 6–9 \times 1–1.5 μm .

Specimen examined: On dead leaves of *Fagus* sp., China: Yunnan Province: Kunming, 24 Nov. 1995, Wenping Wu, W956c, IMI 372454, holotype; On dead leaves of *Fagus* sp., China: Yunnan Province: Kunming, 24 Nov. 1995, Wenping Wu (W949b), IMI 372455.

These two new species differ in several characters. In *A. britannica*, the setae are shorter (up to 140 μm long) but wider (4–5.5 μm), the conidiogenous cells are short (6–10 μm) and always curved, and conidia are much longer (15–19 μm long). In *A. microsperma*, the setae are much longer (up to 240 μm) but narrower (2–3 μm), the conidiogenous cells are longer (10–25 μm) and only slightly curved at the apices, and conidia are much shorter (6–9 μm long) than those in *A. britannica*.

Discussion

In addition to *Vesicliadiella*, *Ceratocladium* Corda, *Circinotrichum* Nees, *Gyrothrix* (Corda) Corda and *Vermiculariopsiella* Bender are four other genera related to

Avesicliadiella in the hyphomycetes (Hughes, 1951; Pirozynski, 1962; Ellis, 1971; Nawawi et al., 1990). All produce a superficial hyphal network, sterile setae, discrete conidiogenous cells, and hyaline, aseptate conidia formed in clusters around the apices of conidiogenous cells. These features are also present in the new genus described here. The separations between these genera are based on a few distinct characters. *Ceratocladium* differs by its encasing hyphae on the setae and from these hyphal cells the conidiogenous cells are produced, but in both *Circinotrichum* and *Gyrothrix* the fertile areas are mainly restricted to the superficial hyphal network. *Circinotrichum* is distinguished from *Gyrothrix* by only one character, that is the unbranched setae in *Circinotrichum* and branched setae in *Gyrothrix* (Pirozynski, 1962; Ellis, 1971), but the distinction has been questioned by Kendrick (1980) and Kirk (1981). Pirozynski and Patil (1970) tended to include *Ceratocladium* in *Gyrothrix* but no formal repositions have been made so far and the problem needs further study. Conidiogenesis and its interpretation have been questioned in this group of fungi and this is mainly due to the minute size of the conidiogenous cells. 'Anellidic' and 'phialidic' conidiogenesis have been described and illustrated by different authors (Pirozynski, 1962; Sutton, 1980, 1993). Recently, SEM studies on two species of *Circinotrichum* showed that their conidiogenous cells were 'phialidic' sensu Sutton (Sutton, 1980; Nakagiri and Ito, 1995). The genus *Circinotrichum* and *Gyrothrix* were monographed by Pirozynski (1962). However many more species have been described since then in both *Circinotrichum* (Pirozynski and Patil, 1970; Hughes and Pirozynski, 1971; Pirozynski and Hodges, 1973; Varghese and Rao, 1978; Sutton, 1980; Kirk, 1981; Zucconi and Onofri, 1986; Rao and Varghese, 1988; McKenzie, 1993) and *Gyrothrix* (Munjal and Lall, 1966; Hughes and Pirozynski, 1971; Cunningham, 1974; Rambelli et al., 1981; Mercado Sierra and Mena Portales, 1986; Rao and de Hoog, 1986; Zucconi and Onofri, 1989; Sutton, 1993). In all these genera the setae are dark brown or at least dark brown at the bases; the conidiogenous cells are never typical 'phialides' with clear narrow channels and collarettes; and conidia are usually slightly curved, with excentric bases and are produced in wet spore masses. These features are quite different from *Avesicliadiella*.

Considering the unbranched setae, *Avesicliadiella* is mostly similar to the genus *Circinotrichum*. Pirozynski (1962) revised this genus and several more species were subsequently added. The new genus described here differs by its hyaline setae, typical phialidic conidiogenous cells with slightly curved apices, and hyaline, aseptate, cylindrical conidia which are produced in dry spore masses. Most species in the genus *Circinotrichum* produce more or less curved conidia but Kirk (1981) described one species, *Circinotrichum britannicum* Kirk, also with straight conidia. One undescribed species which possibly belongs to *Circinotrichum* has been found recently in China and this may be intermediate between *Circinotrichum* and *Avesicliadiella*. In this undescribed

species the setae are mostly dark brown but some sub-hyaline and thick-walled setae are produced and the conidiogenous cells are typical phialides.

Mahabalella Sutton & Patil, *Rhynchosporina* von Arx and *Pseudomicrodochium* Sutton are three minute hyphomycete genera with some shared characters but all differ from *Avesicladiella* in some respects (Ellis, 1971, 1976; Sutton, 1975; Carmichael et al., 1980). In *Mahabalella*, both setae and conidiogenous cells are very similar to *Avesicladiella* but conidia have appendages at both ends. *Rhynchosporina* and *Pseudomicrodochium* are quite similar to *Avesicladiella* but differ in conidial morphology and development of conidiogenous cells, and moreover in both genera no setae develop (Sutton, 1975; Carmichael et al., 1980).

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