
Rediscovery and redescription of the genus *Uleoporthe* (*Melanconidaceae*)

Paul F. Cannon

CABI Bioscience, Bakeham Lane, Egham, Surrey TW20 9TY, UK; e-mail: p.cannon@cabi.org

Cannon, P.F. (2001). Rediscovery and redescription of the genus *Uleoporthe* (*Melanconidaceae*). *Fungal Diversity* 7: 17-25.

Uleoporthe orbiculata which is the only species of the genus *Uleoporthe* (*Melanconidaceae*, *Diaporthales*) is redescribed from recently dead leaves of *Cybianthus fulvopulverulentus* (*Myrsinaceae*) from savanna vegetation in upland western Guyana. Its placement in the *Melanconidaceae* is discussed, and contrasted with other leaf-inhabiting members of the family. Holotype material of *U. orbiculata* has been lost, so the species name is lectotypified from a duplicate collection.

Key words: *Ascomycota*, biotrophic fungi, *Cybianthus fulvopulverulentus*, *Diaporthales*, Guyana, *Melanconidaceae*, *Myrsinaceae*, *Uleoporthe orbiculata*.

Introduction

The *Melanconidaceae* is one of the two main families of the *Diaporthales* (*Ascomycota*) (Hawksworth *et al.*, 1995). As currently circumscribed, it is probably polyphyletic, and its classification is artificial and largely based on a small number of characters such as spore septation and pigmentation which are now regarded as suspect in phylogenetic terms. Its relationship with the *Valsaceae*, the other principal family of the *Diaporthales*, is uncertain, and there have been suggestions (e.g. Arx, 1979) that the *Melanconidaceae* might be derived from dothidealean ancestors. Modern concepts of the family are mostly based on the work of Barr (1978), which concentrated on temperate taxa and was largely restricted to teleomorph data. Barr (1978) divided the currently accepted *Melanconidaceae* into two families, the *Melanconidaceae sensu stricto* and the *Pseudovalsaceae*, based on stromatal characters. This division was questioned by Cannon (1988) as unacceptably artificial, though further data have not supported the suggestion made in this paper of merging the *Phyllachorales* with the *Diaporthales*. Nevertheless, a number of biotrophic tropical taxa such as *Diatractium*, *Rikatlia* and *Bioporthe* (Cannon, 1989, 1993) remain difficult to assign to one or other of these orders. Molecular data are needed to resolve these and many

other questions of relationships in the *Ascomycota*, though difficulties in culturing biotrophic taxa currently restrict the information obtainable from these sources.

Materials and methods

Dried preserved herbarium collections were rehydrated before examination. Squash mounts were prepared by dissection of the stromata in water using a sharp scalpel, and transferring the swollen contents of ascomata and conidiomata to mounting media (water and lactofuchsin). For the latter mountant, slides were warmed to aid penetration of the stain and to remove air bubbles before being sealed with Gylceel. Sections were hand-cut using a new scalpel blade. All measurements and microscopic illustrations were of material mounted in lactofuchsin. The illustrations were prepared using an Olympus digital camera.

Taxonomy

Uleoporthe orbiculata (Syd.) Petr., *Annales Mycologici* 39: 280 (1941).

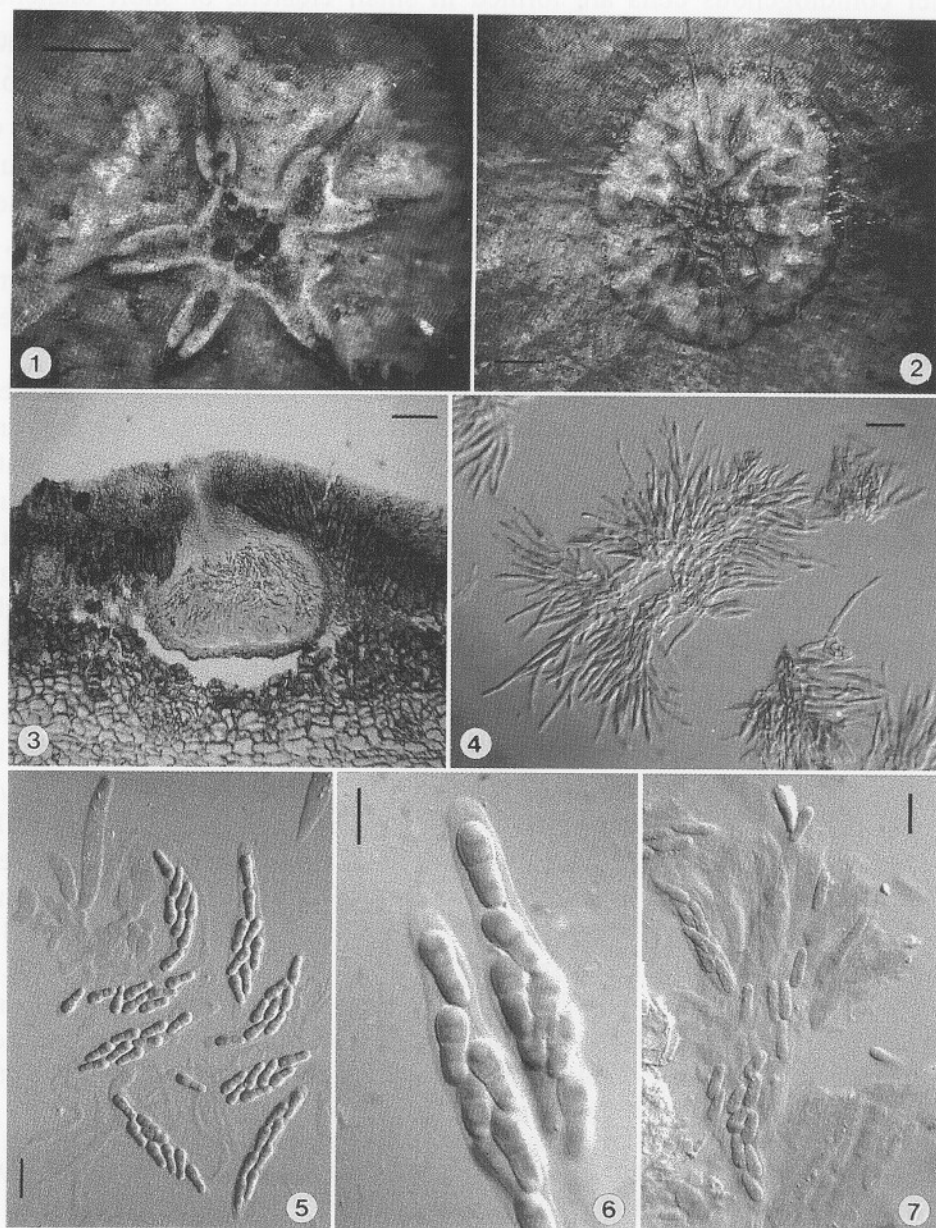
(Figs. 1-7).

≡ *Valsonectria orbiculata* Syd., in Syd. and P. Syd., *Annales Mycologici* 14: 86 (1916).

≡ *Phylloporthe orbiculata* (Syd.) E. Müll., in Müller and Arx, *Beiträge zur Kryptogamenflora der Schweiz* 11(2): 775 (1962).

Stromata 3-5 mm diam, roughly circular in external view, epigenous and occupying the upper epidermal and palisade layers of the leaf, the affected host tissue hypertrophied, strongly erumpent, at first with a simple stellate split but sometimes later with a more complex system of branched splits, sometimes coalescing, the included host tissue yellow-brown at the surface (dried material) with a poorly to well-defined black line surrounding the stroma and with internal eustromatic tissue visible through the splits. Upper part of stroma composed of a layer to 120 µm thick of thick-walled glassy hyaline cells intermediate between *textura globulosa* and *angularis* with cells 5-8 µm diam, inserted between the epidermis and palisade layers, also completely occluding the epidermal cells but without significantly disrupting their walls, the palisade layer largely intact but strongly tanned. Stromatal tissue surrounding the ostioles and exposed fungal tissues strongly melanized but with similarly shaped cells.

Conidiomata formed as locules within the upper part of the central region of the stroma, 70-120 µm diam, irregularly shaped, ostiolate, the walls thin (usually < 10 µm) and composed of 2-3 layers of irregularly pigmented, mid brown, rather thin-walled *textura epidermoidea*. *Conidiophores* poorly differentiated, composed of small thin-walled ± ellipsoidal cells on which



Figs. 1-7. *Oleoporthe orbiculata* (BPI 747567). 1. Surface view of stroma cut away to reveal internal organization. 2. Surface view of stroma. 3. Vertical section through ascoma. 4. Squash mount of conidiogenous cells and conidia. 5. Asci, ascospores and paraphyses. 6. Detail of asci and ascospores; note the asci with large doliiform apical rings. 7. *Oleoporthe orbiculata* (lectotype, W). Asci (somewhat degraded) and ascospores (most are slightly immature). Bars: 1 = 1000 μm , 2 = 500 μm , 3 = 100 μm , 4, 5, 7 = 20 μm , 6 = 10 μm .

either conidiogenous cells are formed in small clusters, or short branched chains of cells (no more than 2-3) are formed with conidiogenous cells formed as side branches below septa. *Conidiogenous cells* 12.5-17 ($\mu = 15.4, \sigma = 1.65, n = 10$) \times 2.5-4 μm , rather irregular in form, usually narrowly flask-shaped or gradually tapering, with both percurrent and sympodial proliferation, minute slightly flared collarettes present where percurrent proliferation has taken place, periclinal thickening very inconspicuous. *Conidia* 8.5-11.5 ($\mu = 10.0, \sigma = 1.03, n = 10$) \times 2.5-3.5 ($\mu = 2.9, \sigma = 0.52, n = 10$) μm , ellipsoidal to fusiform, the apex acute to obtuse and the base narrowly truncate, fairly thick-walled, hyaline, aseptate, smooth, without gelatinous sheath or appendages.

Ascomata surrounding the conidiomata but more deeply embedded, arranged underneath of radial splits in the upper surface of the host leaf and inserted between the palisade layer and mesophyll, 320-450 μm diam, oblate, surrounded laterally by stromatic tissue. *Neck* to 250 μm long, conical and usually slightly eccentric, conspicuously periphysate, the periphyses to 25 μm long and 2 μm diam. *Ascomatal wall* composed of 5-6 layers of strongly flattened cells, appearing pale brown and rather degraded in the body of the ascoma but thicker-walled, hyaline and refractive in the neck region, where many more layers are apparent. *Asci* and paraphyses formed from a subhymenial layer of thin-walled amorphous flattened cells. *Paraphyses* copious and \pm persistent, to 6 μm diam, swollen at the base and gradually tapering, very thin-walled. *Asci* 70-88 ($\mu = 79.9, \sigma = 5.84, n = 10$) \times 13-16 ($\mu = 14.9, \sigma = 1.21, n = 10$) μm , narrowly clavate, short-stalked to almost sessile, apparently evanescent at the base in some circumstances, rather thick-walled, not fissitunicate, the apex rounded and sometimes slightly attenuated, with a conspicuous iodine-negative refractive almost globose apical ring structure 3-4 μm diam. and 2.5-3 μm thick, 8-spored. *Ascospores* arranged biserially, 14.5-18.5 ($\mu = 16.8, \sigma = 0.92, n = 20$) \times 5.5-7.5 ($\mu = 6.4, \sigma = 0.42, n = 20$) μm , clavate with a single median to slightly suprmedian septum, the upper cell ellipsoidal and the lower cylindrical-ellipsoidal, thick-walled, hyaline, smooth, each cell usually biguttulate, without a gelatinous sheath or appendages.

Typification: VENEZUELA, Miliquebe, Rio Cuquenau, in living leaves of a species of *Myrsinaceae*, February 1910, E. Ule 3389 [S, **holotype**, lost and presumed destroyed; W!, **isotype**, here designated **lectotype**].

Hosts: *Cybianthus fulvopulverulentus* (*Myrsinaceae*), an unnamed species of *Myrsinaceae*.

Known distribution: Guyana and Venezuela.

Other material examined: GUYANA, Cuyuni-Mazaruni Region VII, Mazaruni Subregion VII-2, Imbaimadai, 5° 43'N, 60° 18'N, 450m alt., savanna on white sand, on recently fallen leaves of *Cybianthus fulvopulverulentus*, 15 February 1987, G.J. Samuels 4578 [BPI 747567].

Uleoporthe orbiculata, the only representative of the genus *Uleoporthe* known to date, is based on the name *Valsonectria orbiculata* Syd., *Valsonectria* is now considered to be a member of the *Thyridiaceae* (Hawksworth *et al.*, 1995), and its type is clearly not congeneric with *U. orbiculata*. This was recognized by Petrak (1941) who noted similarities with *Bioporthe* and *Phylloporthe* (both now placed in the Diaporthales) in the course of establishing his new genus. Links with *Phylloporthe* were further explored by Müller (in Müller and Arx, 1962), who placed the two generic names into synonymy. However, Barr (1978) pointed out clear differences in stromatal structure between the two genera, and it is not likely that they are closely related. *Phylloporthe* has strongly erumpent stromata composed almost totally of fungal tissue, short-stalked asci which are evanescent at the base, and apparently lacks interascal tissue although the ostiole is conspicuously periphysate.

Uleoporthe belongs within the *Melanconidaceae* as circumscribed by Hawksworth *et al.* (1995); diagnostic features for this family include perithecial ascomata (sometimes with convergent necks) surrounding a coelomycetous anamorph within a common stroma which is leaf- or bark-inhabiting, short-stalked asci with a prominent iodine-negative but refractive ring, and thick-walled septate ascospores. The hardly eccentric ascomatal necks of this species would make it difficult to assign to a family of the Diaporthales as accepted by Barr (1978). Her placement of *Uleoporthe* as a member of *Gnomoniaceae* tribe *Stegophoreae* is not accepted here; the other members of that group have hardly any stromatic development, and the type genus of the tribe at least has an small acervular and probably spermatial anamorph. Other genera placed in this tribe by Barr (1978) belong elsewhere, notably *Linocarpon* which was recently placed in the *Hyponectriaceae* (Hawksworth *et al.*, 1995), but probably does not belong there either (Wang and Hyde, 1999).

Uleoporthe orbiculata has quite prominent paraphyses, which at one point were considered to be lacking in the *Diaporthales*, but have now been noted in many genera, including *Diaporthe* itself (Cannon, 1988; Uecker, 1989). The fungus is almost certainly biotrophic at least for a large part of its life cycle. Its original collection was stated to have originated from living leaves, and although the Guyanese material is from fallen host leaves, they are clearly hardly degraded and the tissues immediately around the stromata show no signs of necrosis.

Determining the relationships of *Uleoporthe* within the *Melanconidaceae* is problematic, partly because many genera are defined artificially. In addition, the classification has developed over the years based almost exclusively on

temperate taxa which may show different patterns of evolution to tropical forms, and with little reference to anamorph characters. Most species appear to be saprobes, either primary colonizers of recently dead tissue or developing following an endophytic phase. A few taxa are, however, known to be biotrophic and/or leaf-inhabiting, and these have received particular attention in the search for related genera.

The following genera are contrasted with Uleoporthe:

Anisomyces Theiss. and Syd. (Theissen and Sydow, 1914; Petrak, 1947) with the type species *A. nectrioides* (Rehm) Petr. is known from leaves of *Paullinia* (*Sapindaceae*) from tropical America. *Anisomyces* contains species with brown apiosporous ascospores formed in ascomata in a clypeate pseudostroma. No anamorph is known.

Bioporthe Petr. (in Sydow and Petrak, 1929); type and only species *B. brenesii* Petr., from living leaves of *Tournefortia* (*Boraginaceae*) from Costa Rica. This fungus differs from *Uleoporthe*, with weakly stromatic ascomata which are at least sometimes arranged in valsoid groups with convergent ostioles, elongate cylindrical to dumb-bell shaped ascospores and it apparently lacks an anamorph. Petrak (1965) contrasted *Bioporthe* with *Plagiostigme* and *Plagiophiale*, following the decision by Müller and Arx (1962) to place *Bioporthe* into synonymy with *Plagiostigme*.

Diatractium Syd. (in Sydow and Sydow, 1921), with type *D. cordianum* (Ellis and Kelsey) Syd., was monographed by Cannon (1989). The two constituent species are biotrophic, the ascomata are largely similar, and both have well-developed paraphyses. However, though the ascomata are arranged in valsoid clusters stromatic tissue is less well-developed than in *Uleoporthe orbiculata*, and the filiform and isthmoid ascospores are completely different. The anamorph of *D. cordiana* is much smaller than that of *U. orbiculata*, and is probably spermatial rather than disseminative in function. *Diatractium* probably belongs in the *Melanconidaceae*, but Cannon (1989) identified numerous parallels between this fungus and the *Phyllachoraceae*.

Dicarpella Syd. (in Sydow and Sydow, 1921) is based on *D. bina* (Harkn.) Syd. and P. Syd., which forms necrotic spots on leaves of *Quercus* species in the southern USA. It has reduced stromata with separately erumpent ostioles and was placed in the *Pseudovalsaceae* by Barr (1978). The genus is characterized by aseptate ascospores contained within 2- to 8-spored asci, and one species appears linked to a *Harknessia* anamorph. This suggests a relationship with *Wuestneia* Auersw. (Reid and Booth, 1989) which are mostly twig-inhabiting and have ascomata with convergent ostioles.

Lambro Racib. (Raciborski, 1900), typified by *L. insignis* Racib., is a necrotrophic parasite of leaves of *Sterculia* (*Sterculiaceae*) from Indonesia. It has a broadly similar stromatic structure to *Uleoporthe orbiculata*, but lacks paraphyses, has small ascospores which are septate near the base, and apparently lacks an anamorph (Müller and Arx, 1962). *Lambro* was placed in the *Gnomoniaceae* by Barr (1978), which is now considered a synonym of the *Valsaceae*, rather than the *Melanconidaceae*.

Phylloporthe Syd. (Sydow, 1925; type *P. vernoniae* Syd. from *Vernonia* leaves from the neotropics) is similar to *Lambro*, but has strongly erumpent, almost superficial stromata, lacks paraphyses and has thin-walled ascospores. It was also placed in the *Gnomoniaceae* by Barr (1978) and is unlikely to be closely related to *Uleoporthe*, despite the synonymy proposed by Müller (in Müller and Arx, 1962).

Plagiophiale Petr. (1955) is based on *Sphaerella eucarpa* P. Karst., which was combined into *Wettsteinina* (Dothideales: *Pleosporaceae*) by Müller and Arx (1950) and into *Plagiostigme* by Müller (1965). The most recent opinion on the relationships of this fungus is that of Shoemaker and Babcock (1987), who accepted it as a species of *Wettsteinina*. They described the species with scattered saprobic perithecial ascomata, presumably fissitunicate asci and large thick-walled 3-septate ascospores. The application of Karsten's name seems to have been in doubt bearing in mind the clear disagreements as to features of the fungus it represents, and Shoemaker and Babcock (1987) unambiguously lectotypified the name as a species of *Wettsteinina*. The fungus actually described by Petrak (1955) is a true member of the *Melanconidaceae* (Barr, 1978), which was given the name *Plagiostigme petrakii* E. Müller (1965) and combined into *Plagiophiale* by Petrak (1965). It appears that an acceptable generic name for this fungus is not available.

Plagiostigme Syd. (Sydow, 1925), type *P. couraliae* Syd., was based on a collection from Costa Rica on living and moribund leaves of *Couralia rosea* (*Bignoniaceae*). It has an at least partially biotrophic habit and asci and ascospores which are largely similar to those of *Uleoporthe orbiculata*, but stromatic tissue is all but absent and the ascospores have prominent apical gelatinous appendages.

Pseudothis Theiss. and Syd. (Theissen and Sydow, 1914) contains the single species *P. coccodes* (Lév.) Theiss. and Syd., a pantropical biotrophic parasite of legume leaves. It has strongly erumpent dark stromata and very distinctive dark brown thick-walled ascospores, quite different to those of *Uleoporthe*.

Acknowledgements

Gary Samuels (USDA Beltsville) is thanked for drawing attention to the Guyanese collection of *Uleoporthe orbiculata*, and the curators of BPI and W are gratefully acknowledged for the loan of collections.

References

- Arx, J.A. von (1979). Ascomycetes as fungi imperfecti. In: The Whole Fungus (ed B. Kendrick). National Museum of Natural Sciences, Ottawa, Canada: 201-213.
- Barr, M.E. (1978). The *Diaporthales* in North America, with emphasis on *Gnomonia* and its segregates. Mycologia Memoir 7: 1-232.
- Cannon, P.F. (1988). Proposal to merge the *Phyllachorales* with the *Diaporthales*, with a new family structure. Systema Ascomycetum 7: 23-43.
- Cannon, P.F. (1989). Studies on fungi with isthmoid ascospores: the genus *Diatractium*. Mycological Research 92: 327-334.
- Cannon, P.F. (1993). Ascomycetes with banded spores. The genus *Rikatlia* gen. nov. Systema Ascomycetum 11: 83-93.
- Hawksworth, D.L., Kirk, P.M., Sutton, B.C. and Pegler, D.N. (1995). Ainsworth & Bisby's Dictionary of the Fungi edn 8. CAB International, Wallingford, UK: 616p.
- Müller, E. (1965). Beobachtungen an Ascomyceten. Sydowia 18: 86-105.
- Müller, E. and Arx, J.A. von (1950). Einige Aspekte zur systematik pseudosphäraler Ascomyceten. Berichte der Schweizerische Botanische Gesellschaft 60: 329-397.
- Müller, E. and Arx, J.A. von (1962). Die Gattungen der didymosporen Pyrenomyceten. Beiträge zur Kryptogamenflora der Schweiz 11(2): 1-922.
- Petrak, F. (1941). Mykologische Notizen XIV (nos 931-1000). Annales Mycologici 39: 251-349.
- Petrak, F. (1947). Über die Gattungen *Phaeoapiospora* Sacc. & Syd. und *Anisomyces* Theiss. & Syd. Sydowia 1: 35-40.
- Petrak, F. (1955). *Plagiophiale* n. gen., eine neue Gattung der sphaerialen Ascomyzeten. Sydowia 9: 585-587.
- Petrak, F. (1965). Über die Gattungen *Plagiostigme* Syd., *Bioporthe* Petr. und *Plagiophiale* Petr. Sydowia 18: 380-387.
- Raciborski, M. (1900). Parasitische Algen und Pilze Java's. II. Teil, 46 pp.
- Reid, J. and Booth, C. (1989). On *Cryptosporella* and *Wuestmeia*. Canadian Journal of Botany 67: 879-908.
- Shoemaker, R.A. and Babcock, C.E. (1987). *Wettsteinina*. Canadian Journal of Botany 65: 373-405.
- Sydow, H. (1925). Fungi in itinere costaricense collecti. Pars prima. Annales Mycologici 23: 308-429.
- Sydow, H. and Petrak, F. (1929). Fungi costaricensis a cl. Prof. Alberto M. Brenes collecti. Series prima. Annales Mycologici 27: 1-86.
- Sydow, H. and Sydow, P. (1921). Notizen über einige interessante oder wenig bekannter Pilze. Annales Mycologici 18: 178-187.
- Theissen, F. and Sydow, H. (1914). Dothideazeen-Studien - II. Annales Mycologici 12: 268-281.
- Uecker, F.A. (1989). A timed sequence of development of *Diaporthe phaseolorum* (Diaporthaceae) from *Stokesia laevis*. Memoirs of the New York Botanical Garden 49: 38-50.

Fungal Diversity

Wang, Y.Z. and Hyde, K.D. (1999). *Hyponectria buxi* with notes on the *Hyponectriaceae*.
Fungal Diversity 3: 159-172.

(Received 14 February 2001, accepted 10 April 2001)