Two new species of *Dacampia* (*Ascomycota, Dacampiaceae*), with a key to and synopsis of the known species of the genus

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Two new lichenicolous fungi in the genus *Dacampia* are described: *D. muralicola* sp. nov. from the apothecia of *Protoparmeliopsis muralis* (syn. *Lecanora muralis*) in Turkey, and *D. rhizocarpicola* sp. nov. from thalli of *Rhizocarpon obscuratum* in the UK. The new species differ from those previously recognized in the genus in the size and septation of the ascospores, as well as in occurring on unrelated hosts. A new combination *D. leptogiicola* comb. nov. (syn. *Pleospora leptogiicola*) is also made. A key to the seven accepted species of *Dacampia* is presented, along with line drawings of their ascospores.

**Key words:** Lecanora, lichenicolous fungi, lichens, Pleospora, Protoparmeliopsis, Rhizocarpon, Turkey, UK.

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**Introduction**

Lichenicolous fungi which grow obligately on lichens as commensals, parasites, or saprobes, continue to be a source of novel genera and species, with over 1500 species now known (Lawrey and Diederich, 2003), and 3-4000 species estimated worldwide (Hawksworth, 2001). Geographical regions and lichen hosts that have not previously been searched for these specialized fungi are most likely to yield some of the anticipated "missing" species, and this has proved to be true in the case of Turkey from which one new genus and five new species have recently been described (Halici *et al.*, 2005, 2007; Halici and Hawksworth, 2007; Hawksworth and Halici, 2007). Here we describe a further lichenicolous species new to science from Turkey, which belongs to the genus *Dacampia* (*Ascomycota, Dacampiaceae*). In addition we also provide a brief description of a further new species, that has the largest ascospores yet discovered in the genus from the UK; this species has been known to D.L.H. for 16 years, but publication was delayed in the hope of finding more material. As this latter species has still not been refound, we also formerly name it here as it can be easily recognized from the data obtained. Further, since no key to all the known species of *Dacampia* has previously been published, we also present one here along with a synopsis of the species, and make some general remarks about the genus and its relationships. A new combination into the genus is also made.

**Taxonomy**

*Dacampia muralicola* Halici & D. Hawksw., *sp. nov.*

(Figs 1, 2E)

*Mycobank:* 511068.

*Etymology:* The specific epithet recalls the species epithet of the host lichen on which the new fungus grows.

*A Dacampia engeliana similis, sed differt in ascomata solo 95–120 µm et ascosporis*
5-7 transseptis et 1(-2) longiseptatis, 21-26(-31.5) × (7-)
9-12.5(-14.5) μm.

Typus: Turkey: Gaziantep: Kizilyazi, 37º09'N, 37º15'E, alt. 955 m, on apothecia of Protoparmeliopsis
muralis on calcareous rocks, 7 June 2004, M. G. Halici
MGH 0.2267 (Herb. Erciyes Universitesi, Kayseri –
holotypus).

Ascomata perithecia, immersed with only
the uppermost part visible, arising singly,
scattered over areas of the host apothecia, the
infections not in necrotic patches or otherwise
delimited; individual perithecia subglobose,
black, shiny, smooth, lacking setae, ostiolate,
95-120 μm diam; ostiole not papilliform, 30-38
μm wide; exciple composed of 5-8 layers of
angular pseudoparenchymatous cells, textura
angularis, 24-45 μm thick, the individual cells
somewhat radially compressed, reddish brown
to brown, individual cells 10-12.5 × (6-)7-9.5
μm in vertical section and 5-8 μm diam in
surface view, smooth, walls ca 1 μm thick.

Mycelium of sparse hyphae arising from the
lower parts of the ascomata, ramifying into the
host hymenium, septate, smooth, pale reddish
brown, 4.5-5 μm thick. Hamathecium of
cellular pseudoparaphyses, sparse, septate,
branched and anastomosed, 1.5-2 μm thick;
centrum Lugol’s solution (after pre-treatment
with 10% KOH) I –. Asci elongate-clavate,
bitunicate, with a thick-walled apex and a small
internal apical beak when young, but the apical
wall about the same width as the sides at
maturity, discharge not seen, 41-45 × 14-16.5
μm, 8-spored. Ascospores irregularly biseria-
tely arranged and overlapping in the ascus,
broadly ellipsoid, rounded to somewhat broadly
pointed at the apices, muriform, with 3-5(-
7)-transsepta and 1(-2)-longisepta, the number
of both kinds of septa increasing with age,
often slightly constricted at the median septum,
dark brown, cells similarly coloured, smooth,
lacking a conspicuous gelatinous sheath, 21-
26(-31.5) × (7-)9-12.5(-14.5) μm, length/
breadth ratio 1.8-2.2.

Host: In the apothecia of Protopar-
meliopsis muralis (syn. Lecanora muralis). The
infected apothecia appear black due to the
presence of the ascomata of the invading
fungus, but otherwise unharmed so the species
appears to be a biotrophic commensal. The
type collection is also infected with an
unidentified Phoma species that can occur in
the same apothecium, and there is also
superficial torulose mycelium and developing
dark brown (not reddish brown) ascomata
suggestive of a species of Lichenostigma but in
which we could find no ascospores; no
Lichenostigma species is currently known from
Protoparmeliopsis.

Distribution: Turkey (Gaziantep); only
known from the holotype collection.

Notes: This new species is most similar
to Dacampia engeliana, a fungus which
appears to be largely restricted to thalli of
Solorina saccata, though it has also been
mentioned as occurring on Peltigera rufescens
(Bricaud and Roux, 1990). However, that
species differs from D. muralicola in having
ascomata 250-450(-600) μm diam, elongated
cylindrical 4-8-spored asci 140-200 × 10–13.5
μm, and ascospores which have 3(-5)-
transsepta and 1(-2)-longisepta in most cells
and are also (18-)19.5-25(-27) × (8-)8.5-10 μm
(Crivelli, 1983; Hawksworth, 1986; Bricaud
and Roux, 1990). Differences from other
species of the genus so far described are
indicated in the following key.

We speculated whether the associated
Phoma might be an anamorph of D. muralicola,
but we failed to find any physical
connection between the conidiomata and the
ascomata. Further, as no anamorph of any kind
has yet been reported in Dacampia, despite
detailed studies on some species (Wehmeyer,
1961; Crivelli, 1983; Henssen, 1995), we see
no support for such an assumption at this time.

Key to and synopsis of the accepted
species of Dacampia

As no key has been provided to the
currently accepted species of Dacampia, we
provide one here. Outlines of the ascospores of
all seven species keyed out here are included in
Fig 2.

1. Ascomata exceeding 150 μm diam.................. 2
   Ascomata 95-120 μm diam......................muralicola

2(1). Ascospores more than 30 μm in length........ 3
   Ascospores less than 30 μm in length .......... 4

3(2). Asci 8-spored; ascospores 30-36 × 11-16 μm;
   lichenized........................................hookeri
   Asci 2-4-spored; ascospores (30-)34-37.5(-39) ×
   (10-)14.5-16 μm; on Rhizocarpon obscuratum
   ..................................................rhizocarpicola
4(2) Ascospores with 3-5(-6)-transsepta and exceeding 8 µm in width..........................5
Ascospores with 7-transsepta, 21-25 × 5-6.5 µm; on Leptogium burgessii and Pannaria rubiginosa..........................4

5(4) Ascospores mainly with 3-transsepta.....................6
Ascospores 5(-6)-transsepta, (19-)21.5-26 × 8-9 µm; on Peltigera rufescens (not forming necrotic spots)..............................peltigericola

6(5) Ascomata 150-250 µm wide; ascospores (23-)24.5-27 × 11-13 µm; on Peltigera rufescens (forming necrotic spots)..........................rufescentis
Ascomata 250-450(-600) µm wide; ascospores 18-25 × 8-10 µm; on Solorina saccata......engeliana

**Dacampia engeliana** (Saut.) A. Massal., Gen. Lich.: 22 (1854).

Basionym: *Sagedia engeliana* Saut., Bot. Centrabl. 1846: 406 (1846); as “Engeliam”.


**Dacampia leptogiicola** (D. Hawksw.) D. Hawksw., comb. nov.

MycoBank: 511070.


Descriptions: Hawksworth (1975) and Etayo (1994).

Notes: This species was compared to *D. hookeri* in the original account, and while it has narrower ascospores than the other species of the genus, we see not obstacle to a placement in *Dacampia*. The species is clearly no member of *Pleospora* as now interpreted which is even placed in a different family, *Pleosporaceae* (Eriksson, 1981). *Pleospora s. str.* species grow as saprobes on dead herbaceous stems and have a *Stemphylium* anamorph. Further, the ascospores of *Pleospora s. str.* are different, with at least three and often many more transsepta with numerous longisepta and thick gelatinous sheaths (Eriksson 1981; Simmons 1986).


Description: Earland-Bennett *et al.* (2006).


Description: See above.

**Dacampia rhizocarpicola** D. Hawksw., sp. nov.

MycoBank: 511069

*Diagnosis:* Similis Dacamiis hookeris sed differ in ascis 2-4-spori et ascosporiis (30-)34-39 × (10-)14.5 × 16 µm.


*Description:* Ascomata perithecia, carbonaceous, in groups, breaking up. *Hamathecium* of cellular pseudoparaphyses, abundant, (1.5-)2-3 µm wide. *Asci* 2-4-spored. *Ascospores* deep golden brown, surface generally appearing smooth, but verruculose at high magnifications, rounded to somewhat broadly pointed at the apices, muriform, with 4-5-transsepta and 3-4-longisepta, often slightly constricted at the median septum, (30-)34-39 × (10-)14.5 × 16 µm.

Notes: D.L.H. first studied this material back in 1991, but as it was scant he delayed publication in the hope more would be discovered to facilitate a fuller description. As no more specimens have been found, and the fungus is so characteristic in the genus because of its 2-4-spored asci and massive ascospores, it is formally named here. It is hoped this will encourage the search for more material which will enable a more detailed description to be prepared at a later date.

The ascospore sizes are most similar to those of *D. hookeri*, but that species is lichenized (Henssen, 1995) and has constantly 8-spored asci and uniseriately arranged ascospores. Furthermore, this new species is the only known *Dacampia* species on *Rhizocarpon*.

Fig. 1. Dacampia muralicola (from holotype). A. Perithecia, showing the basal mycelial hyphae. B. Surface view of ascomatal wall showing the angular pseudoparenchymatous cells. C. Asci in a vertical section of an ascoma. D. Ascospores. Bars: (A) = 30 µm, (B) = 20 µm, (C-D) = 10 µm.


Descriptions: Vouaux (1913) and Hawksworth (1986).

Discussion

The genus Dacampia is very similar to several other lichenicolous genera placed in the same family, Dacampiaceae (syn. Pyrenidiaceae), notably Clypeococcum, Polycoccum, Pyrenidium, and Weddellomyces. Polycoccum and Pyrenidium have a similar ascomatal structure and wall tissues to Dacampia, but have 1-transseptate, and more than 1-transseptate ascospores, respectively. In Clypeococcum, which has 1-transseptate ascospores, the ascomatal wall tissue is hyphal and not angular-pseudoparenchymatous, while in Weddellomyces the ascospores may be transseptate or muriform, but the upper parts of the ascomatal walls are made up of cephalothecoid plates and break up irregularly to release the ascospores. The current ascospore and ascomatal structure generic concepts in the family need to be tested by molecular phylogenetic methods. However, at the moment there is only one lichenicolous sequence of the family in GenBank, an unpublished LSU rRNA sequence.

from material named as *Polycoccum vernicularium* (AY961601). In the absence of such data on representatives of the other genera, including their type species, we consider it premature to make any changes. We are especially cautious as there are also biological differences: for example, *Polycoccum* species almost always form galls on the host lichens (Hawksworth and Diederich, 1988), while no known *Dacampia* stimulates the production of such structures, and some *Weddellomyces* species can be destructive pathogens killing their hosts.

With the interesting exception of *Pyrenidiurn actinellum*, the lichenicolous species in the *Dacampiaceae* are almost always host specific. This may be partly due to them selectively attacking the fungal partner of the lichen host and penetrating their hyphae, although invasive haustoria are also reported in *Pyrenidiurn* (de los Ríos and Grube, 2000). However, we wonder if *D. leptogiicola* might be an exception and be attacking the photosynthetic partner as this is a *Nostoc* cyanobacterium in both its lichen hosts.

*Dacampia* is biologically interesting as a genus as the type species, *D. hookeri*, is now demonstrated to be an independent lichen (Henssen, 1995). In *D. engeliana*, however, the fungus modifies the host lichen to form a structure not unlike that of *D. hookeri* (de los Ríos and Grube, 2000). The other lichenicolous species in the genus tend to cause limited damage or be commensalistic. In the case of the two species occurring on *Peltigera rufescens*, it is interesting that one forms necrotic patches (*D. rufescens*) and the other has scattered ascomata (*D. peltigericola*). The genus would therefore appear to be an excellent one in which to further explore the different biologies both functionally and ultrastructurally.
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References


