

Phaeohelotium

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A group of at least eight Australasian species are phylogenetically closely related to a specimen accepted by Baral et al. (2013) as *Phaeohelotium monticola*, a putative synonym of the type species of *Phaeohelotium*, *P. flavum*.

These species are found on rotten wood or litter in native forests of New Zealand and Australia, all have large, white (sometimes staining red or yellow with damage) apothecia, usually with a broad, tapering stipe; when dry the apothecia have a yellow or orange hymenium and whitish receptacle, the surface of which has a finely ornamented almost powdery appearance, or a layer of fine, tangled hairs; excipular tissue of large, broad-cylindric to subglobose cells with walls thin, hyaline, nongelatinous, and with an outermost layer of loose, narrow-cylindric, long-celled cells that form almost hair-like elements on the apothecial surface. Asci are thick-walled at the apex, with an amyloid pore comprising two weakly-developed lines confined to the inner half of the wall. Paraphyses quite broad, more or less undifferentiated at the rounded apex. Ascospores often large, elliptic to oblong-elliptic to subfusoid, 0-septate, hyaline (rarely brown after release).

Morphologically this fits the generic concept of Kanouse (1935) and Dennis (1981), except for the hyaline ascospores. Both Baral et al. (2013) and Dennis (1981) regard ascospore colour for these fungi as insignificant at the generic level, as the spores do not become pigmented until following release from the asci.

Macroimages of fresh apothecia:

Helotium pateriforme species complex [see annotation on phylogeny below]

<https://scd.landcareresearch.co.nz/Specimen/PDD%2094748> [apothecia staining red with damage]

<https://scd.landcareresearch.co.nz/Specimen/PDD%20112176>

Helotium tasmanicum species complex [see annotation on phylogeny below]

<https://scd.landcareresearch.co.nz/Specimen/PDD%20111926>

<https://scd.landcareresearch.co.nz/Specimen/PDD%20111541>

Phaeohelotium sp. [see annotation in phylogeny below]

<https://scd.landcareresearch.co.nz/Specimen/PDD%2058559> [dried apothecia only]

Phaeohelotium sp. [PDD 116643, PDD 116645 and PDD 110296, no DNA, see notes below]

<https://scd.landcareresearch.co.nz/Specimen/PDD%20116643>

Superficially, the specimens are sometimes macroscopically similar to *Bisporella* (in the sense of *B. citrina*); both Baral et al. (2013) and Dennis (1981) mention this similarity for *Phaeohelotium*. The loose, hyphal cells on the surface of the apothecium gives some specimens an almost hyaloscyphaceous appearance when fresh.

Baral et al. (2013) expanded the morphological concept of *Phaeohelotium* to include species of the '*Discinella terrestris* complex', species with a putatively mycorrhizal lifestyle, fruiting on soil in association with *Eucalyptus*, *Leptospermum*, *Kunzea* and *Nothofagus*. The excipular tissue of the species in the *D. terrestris* complex have somewhat thickened, gelatinous walls, the ascus apex has an amyloid ring that extends through the entire wall or is in only the outer part of the wall, and the ascospores are brown prior to release from the asci (Baral et al. 2013). The phylogeny they used to support their wider concept resolved the saprobic *P. monticola* and *P. geogenum*, and the mycorrhizal *P. undulatum*, *P. succineoguttulatum* and *P. confusum*, as monophyletic. The phylogeny presented here, incorporating more species than treated by Baral et al. (2013), shows their concept of the genus to be polyphyletic, the species of the '*Discinella terrestris* complex' being phylogenetically distinct from the specimen they accept as *P. monticola*.

Dennis (1958) described and illustrated the Tasmanian fungus *Helotium pateriforme* and his description matches closely the morphology of PDD 116637. Another collection accepted by Beaton as *H. pateriforme* from Victoria, Australia (K(M) 89115) is annotated as being pure white when fresh. Dennis (1958) noted the similarity of *H. pateriforme* to *Helotium uliginosum* var. *cortisedum* (= *Helotium cortisedus* (P. Karst.) Dennis) in apothecial structure, and his illustration of *H. uliginosum* var. *cortisedum* (Dennis 1956) shows the large-celled, more or less globose excipular cells with an outer layer of loose, narrow cells. The specimens from Australia and New Zealand in Clade 1 in the phylogeny below are referred here to the '*Helotium pateriforme* species complex'. All were collected from fallen, rotten wood. Although there appear to be four phylogenetically distinct sister species amongst the sequenced specimens, morphologically they are all very similar. The surface of the receptacle is almost hairy (especially noticeable when dry), the 0-septate, hyaline ascospores are about 21–36 × 5–8.5 μm, elliptic-fusoid, tapering to the narrowly rounded ends, sometimes slightly twisted. Some

specimens with apothecia that stain yellow or red with damage.

Dennis (1958) noted that *Helotium tasmanicum* Rodway differs from *H. pateriforme* only in its smaller ascospores. The specimens in Clade 2 in the phylogeny below are referred here to the '*H. tasmanicum* species complex'. They differ from *H. pateriforme* in the ascospores being smaller, $11\text{--}17 \times 3.5\text{--}4.5 \mu\text{m}$, and in being oblong elliptic with rounded ends. The apothecia are more robust with a broader stipe, and the dry apothecia have a receptacle surface that appears powdery rather than hairy. All were collected from rotting litter of twigs and leaves. Again, there appear to be several phylogenetically distinct, morphologically indistinguishable sister species in this clade.

A species from New Zealand (PDD 58559) is sister to *P. monticola* in the phylogeny below. This appears to be an undescribed species, with spores similar in size to *H. tasmanicum* but with more narrowly rounded ends, and with an apothecium macroscopically similar to *H. pateriforme*.

Dennis (1958) recombined *Cenangium recurvum* Rodway in *Phaeohelotium*. Although his illustration shows ectal excipular cells with the same large, more or less globose, thin-walled cells as the other species discussed here, the surface of the receptacle lacks the loose, hyphal layer typical of these other species. In addition, Rodway (1925) described the apothecia as being dark chestnut brown, in contrast to the consistently white apothecia of the species discussed above.

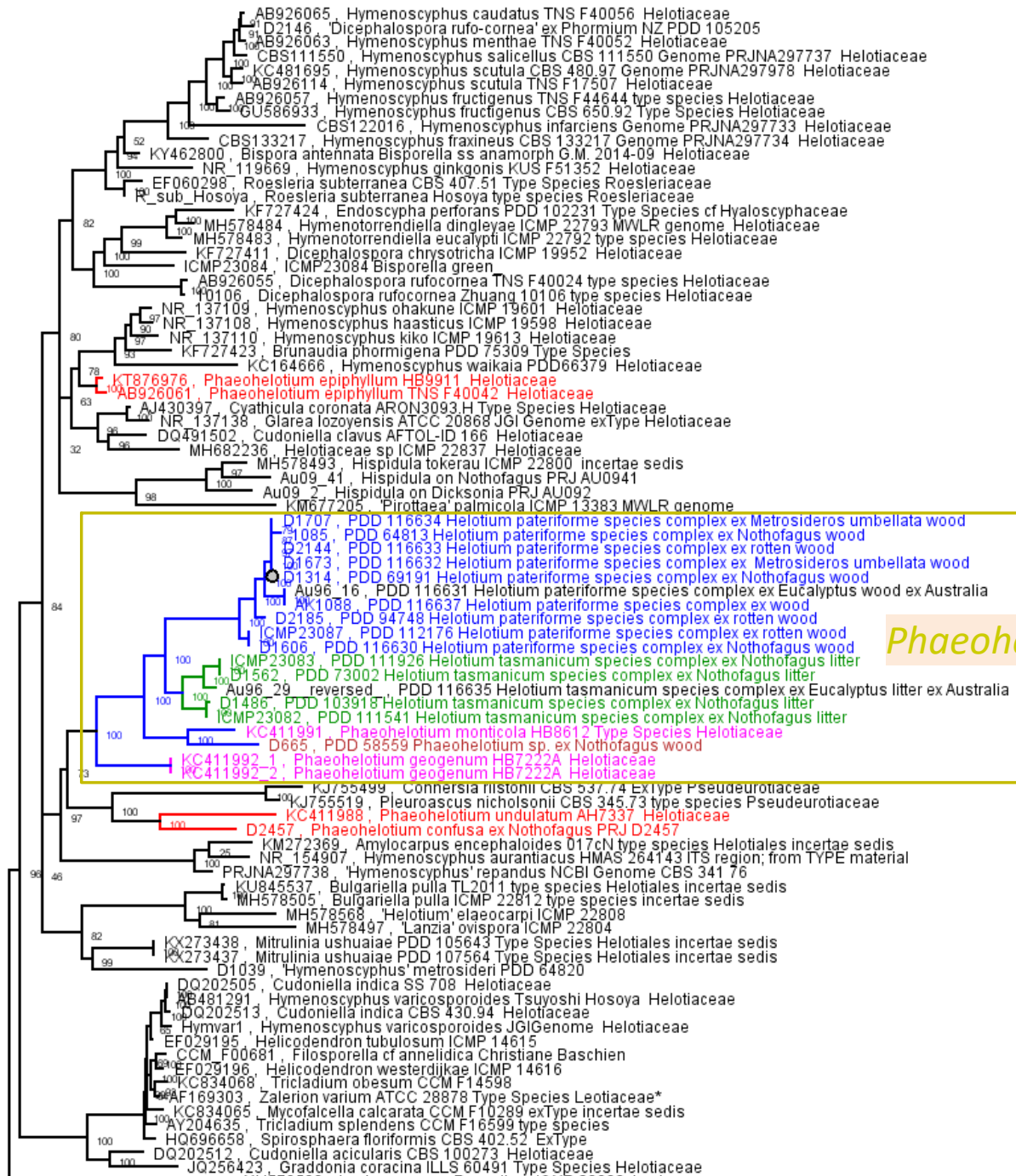
Baral H-O, Galán R, Platas G, Tena R 2013. *Phaeohelotium undulatum* comb. nov. and *Phaeoh. succineoguttulatum* sp. nov., two segregates of the *Discinella terrestris* aggregate found under *Eucalyptus* in Spain: taxonomy, molecular biology, ecology and distribution. *Mycosystema* 32: 386–428.

Dennis WG 1956. A revision of the British Helotiaceae in the herbarium of the Royal Botanic Gardens, Kew, with notes on related European species. *Mycological Papers* 62: 1–216.

Dennis RWG 1958. Critical notes on some Australian Helotiales and Ostropales. *Kew Bulletin* 13: 321–358.

Dennis RWG 1981. *British Ascomycetes*. Cramer, Vaduz.

Rodway L 1925. Tasmanian discomycetes. *Papers and Proceedings of the Royal Society of Tasmania*. 1924: 90–122.



Phylogeny an ITS gene tree incorporating the *Phaeohelotium* sequences from New Zealand and Australia into an ITS alignment from Johnston et al. Leotiomyces phylogeny, IMA Fungus (in press).

The saprophytic *P. monticola* and *P. geogenum* in purple, the congeneric New Zealand and Australian species in green, blue and brown, the '*Phaeohelotium*' clades phylogenetically distinct from *Phaeohelotium monticola* in red.

Other specimens with no DNA that probably represent the same genus

Helotium pateriforme species complex - PDD 116641, PDD 116642, PDD 64813, PDD 64658, PDD 70083 (ex podocarp), PDD 82913, PDD 116644, PDD 116638

Helotium tasmanicum species complex - PDD 58561, PDD 57528, PDD 66202

Phaeohelotium sp. cf PDD 58559 - PDD 45602

Phaeohelotium sp. PDD 116643, PDD 116645 and PDD 110296 look like they represent another *Phaeohelotium* sp. but they have no DNA data. This species is microscopically similar to *H. pateriforme*, but macroscopically the dried apothecia look more like those of *H. tasmanicum*; found on rotting wood.