

THE GENUS *CRYPTODISCUS* IN GREAT BRITAIN

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Introduction

Small ascomycetes from various systematic groups are highly diverse and often abundant, but they are seldom collected and generally remain little studied. Amongst them, the discomycete genus *Cryptodiscus* is no exception. Fruitbodies of *Cryptodiscus* are indeed cryptic, as the name suggests, and easy to overlook with apothecia below 1 mm diam. that tend to be persistently sunken in the host tissue. *Cryptodiscus* species are mostly saprotrophs on dead wood. Only recently it has been realised that a few lichenised species, previously referred to the genus *Bryophagus*, also belong here, although having a quite different ecology to typical members of the genus. *Cryptodiscus* species are however not the only fungi with immersed apothecia, and the delimitation of the genus has been unclear in the past. Some other species of *Ostropales* (*Lecanoromycetes*) and even some *Leotiomyces* may look similar and have similar spores.

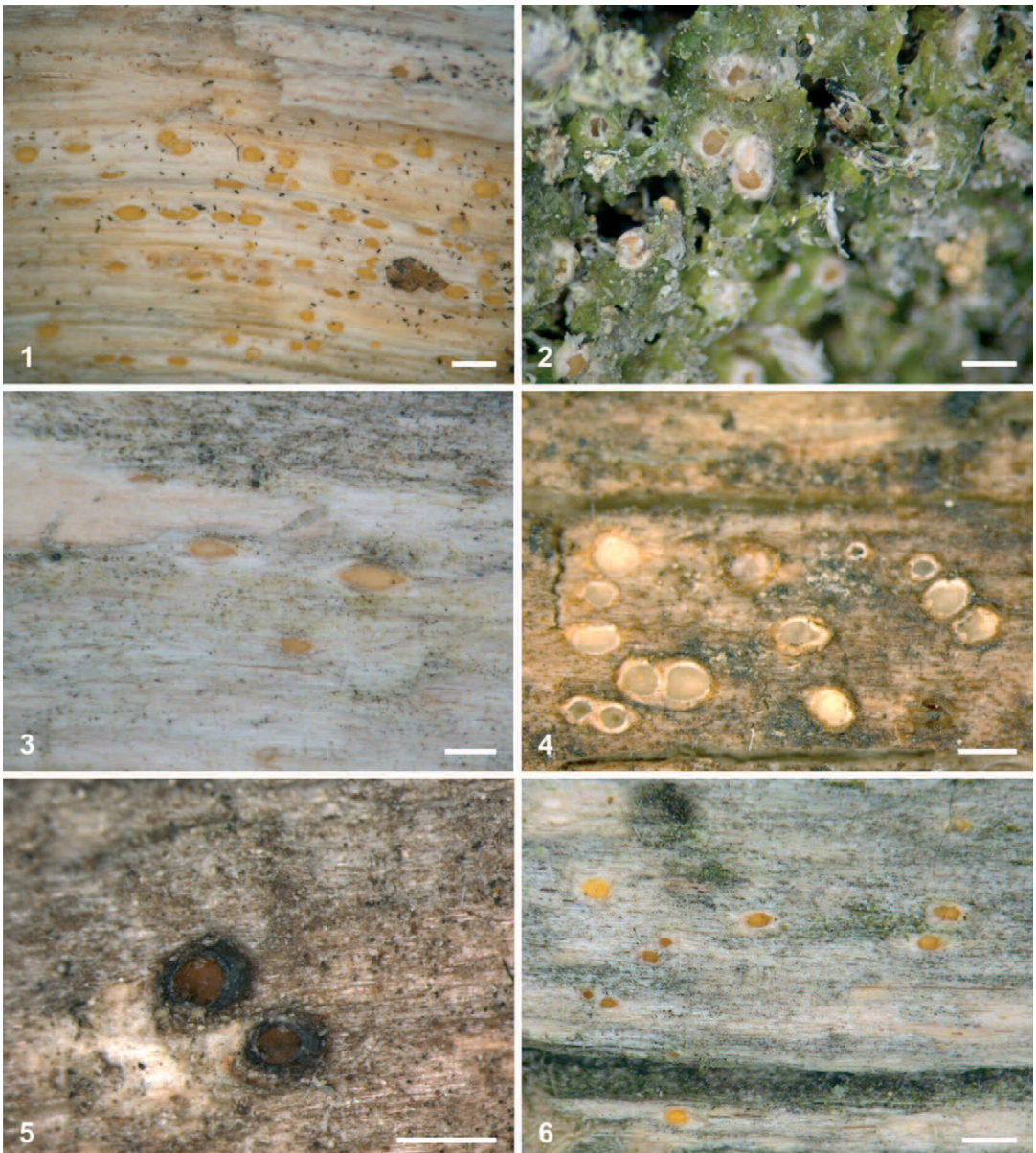
At least 50 taxa have been referred to *Cryptodiscus* worldwide, some now redispersed elsewhere, others awaiting modern study. In this article we revise *Cryptodiscus* for Great Britain and give a short overview and description of the genus with a key to its British species. We hope that this publication will encourage people to look out for these fungi in Great Britain and so learn more about their distribution and their ecological preferences.

Cryptodiscus was described by Corda (1838) with *Stictis pallida* Pers. (*C. pallidus* (Pers.) Corda) as the type species. It is assigned to the family *Stictidaceae* (*Ostropales*) (Sherwood 1977), which is typified by the genus *Stictis* Pers. *Cryptodiscus* species have roundish to ellipsoid ascomata, which are usually persistently immersed in the substrate, although *C. pini* can become somewhat erumpent (Figs 1-6). The ascomata open with a pore that

widens with maturation. The colour of the disc differs from pale ochraceous to light brown or pale orange depending on the taxon. The size of the ascomata is in the range 0.2-0.8 mm in diameter. In most species, the ascoma wall is hyaline to pale ochraceous, but in one, *C. pini*, it is dark brown. In contrast to *Stictis*, the margin of *Cryptodiscus* species is not differentiated into layers and no distinct periphysoid layer is developed. It also lacks crystals, which are often abundant in other *Stictidaceae*. A cross-section of the ascoma wall of *Cryptodiscus pallidus* is shown in Fig. 7, representative for most of the species in the genus. The hymenium of the species studied stains reddish brown with Lugol's solution and bluish after pre-treatment with 10% KOH. The asci are cylindrical with a thickening in the upper part (tholus) and an often visible pore. The eight ascospores are hyaline, cylindrical-oblong and transversely 1-7 (-9) septate. The paraphyses are filiform and abundant, sometimes forked at the end and often with a swollen apex.

During an investigation of Swedish ostropalean fungi the genus *Cryptodiscus* was revised with the help of molecular and microscopic tools (Baloch *et al.* 2009). The results showed that most of the species previously referred to the genus are not closely related to the type, whereas various other species previously assigned to different genera turned out to be more appropriately referable to *Cryptodiscus*. Field studies revealed that several *Cryptodiscus* species are more common in Sweden than expected based on herbarium records. In the British Isles, all species seem to be rather uncommon, although *C. foveolaris* and *C. gloecapsa* are widespread. Presumably, here too, most of the species will prove to be more frequent, at least in certain areas, when more field work is undertaken.

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Figures 1-6. *Cryptodiscus* species that occur in Great Britain.

1. *C. foveolaris*, the most widespread and probably most common species (Wedin & Baloch SW072 S)
 2. *C. gloeocapsa*, a lichenized species, note the greenish colour due to the symbiotic algae (Tibell 23543 UPS)
 3. *C. pallidus* in the typical appearance with ellipsoid ascomata that seem to split the substrate length wise (Gilenstam 2475 UPS)
 4. *C. pallidus*, the untypical British specimen with roundish ascomata (Coppins 8173 E)
 5. *C. pini*, with dark more or less erumpent apothecia (Coppins K(M)42282);
 6. *C. tabularum*, with roundish rather orange ascomata immersed in pine wood (Westberg SW185 S).
- Scale bars = 0.5 mm.

Results of this reinvestigation

Six species referred to *Cryptodiscus* have been reported from the British Isles based on material in Herbs K & E, as well as the literature (Sherwood 1977, Dennis 1981a, b) and the FRDBI (Fungal Records Database of Britain and Ireland, 2006, managed by the British Mycological Society and hosted by CABI; <http://www.fieldmycology.net/GBCHKLST/gbc hklst.asp>), viz.: *Cryptodiscus angulosus* (P. Karst.) P. Karst., *C. foveolaris* (Rehm) Rehm, *C. libertianus* var. *rosarum* Velen., *C. microstomus* (Carmichael ex Berk.) Sacc., *C. pallidus* (Pers.) Corda, and *C. rhopaloides* Sacc. Four of these taxa prove not to belong to *Cryptodiscus*, and should be redispersed. However, three additional species are reported here, one new to Britain and two recently referred to the genus, so that the following five can now be recognised in Britain of which the last three are so far known only from Scotland:

- Cryptodiscus gloeocapsa* (Arnold) Baloch, Gilenstam & Wedin
C. foveolaris (Rehm) Rehm
C. pallidus (Pers.) Corda
C. pini (Romell) Baloch, Gilenstam & Wedin
C. tabularum Kirschst.

Species not referable to *Cryptodiscus*:

- C. angulosus* P. Karst.
 (possibly *Rhytismatales*)
C. microstomus (Carmichael ex Berk.) Sacc.
 (*Ostropomycetidae incertae sedis*, see Baloch *et al.* 2009)
C. rhopaloides Sacc. (*Ostropales incertae sedis*, see Baloch *et al.* 2009)
C. libertianus var. *rosarum* Velen. (Collections referred here represent an undescribed species of *Ostropales*, to be described).

Amongst the five British species, *C. tabularum* is new to the British Isles, whereas *C. gloeocapsa* (basionym: *Bryophagus gloeocapsa*) and *C. pini* (basionym: *Odontotrema pini*), both recently transferred to *Cryptodiscus* (Baloch *et al.* 2009), are already listed as British in Cannon *et al.* (1985) under *Bryophagus* and *Paschelkiella* respectively. In the same study, *C. angulosus*, *C. microstomus* and *C. rhopaloides* were excluded from *Cryptodiscus*

based on morphological and molecular phylogenetic evidence, although their true position is not yet resolved. *C. angulosus* differs from *Cryptodiscus* in having large ascomata, up to 1.5 mm diam and a flat disc, which is dark, blue-green to grey in colour. The ascoma margin adheres to the ruptured host tissue, which splits into irregular lobes. The wall structure also differs from *Cryptodiscus* and a periphysoidal layer is developed. The systematic affiliations of this species need further investigation; in our opinion it is a leotiomyceete and possibly belongs to *Rhytismatales*.

C. microstomus belongs to the same subclass as *Cryptodiscus*, *Ostropomycetidae*, but represents another lineage. It very much resembles typical *Cryptodiscus* in early developmental stages, when the ascoma is still hyaline and the small ochraceous disc is exposed. With maturation the ascoma broadens, but the round pore stays small. The wall becomes dark-brown to black and covers most of the hymenium. Microscopical characters resemble those of *Cryptodiscus* and spores are similar to those of *C. pallidus*.

Cryptodiscus rhopaloides is included in *Ostropales*, but not within *Stictidaceae*. It differs from *Cryptodiscus* in having a pruinose disc and a distinctly pseudoparenchymatous ascoma wall structure. A fringe of elongated cells forms short periphysoids. The ascoma margin adheres to the substrate, which is ruptured in irregular lobes upon maturation of the fungal fruiting body. It appears to be commoner in Britain than any of the true *Cryptodiscus* species, and has larger spores 30–40 x 4–5 µm, known on various hardwoods in England and Scotland.

Finally, a fungus on *Rubus* stems tentatively identified as *Cryptodiscus libertianus* var. *rosarum* is known from several collections in Britain, though to the best of our knowledge is unknown elsewhere. It proves to differ from the type of that name from the Czech Republic and is evidently an undescribed species. Though referable to *Stictidaceae*, it does not belong in *Cryptodiscus*. The Czech fungus is also out of place in that genus, and both species require further study.

Descriptions of the British *Cryptodiscus* species

Cryptodiscus foveolaris (Rehm) Rehm

Figs 1, 8a

C. foveolaris is widespread in Europe and can be found on weathered wood on a wide range of hosts, including conifers (*Picea abies*, *Pinus sylvestris*) and broad-leaved trees (*Betula* sp., *Corylus avellana*, *Fagus sylvatica*, *Populus tremula*, *Quercus* & *Salix* spp.). It is usually found on moist wood of dead, attached branches or on decorticated logs and depends on near-natural forests with dead wood. Usually, the individuals are very scattered even in suitable forests. Due to the small inconspicuous apothecia it can be easily overlooked. The ochraceous to pale orange apothecia stay immersed in the substrate. They are 0.2–0.3 mm in diameter and grow scattered or crowded. *C. foveolaris* can be readily identified by its oblong, 1-septate spores (6–9 x 2.5–3 µm). In the British Isles, *C. foveolaris* is apparently uncommon but widespread, having been reported from England and Scotland. The species is known from Europe and North America.

Examined records from Great Britain: ENGLAND: Surrey VC17: Esher Common, on dead twig of *Salix* sp., 5 Feb 1995, Spooner, K(M)28654; Middlesex VC21: London, Buckingham Palace Garden, on fallen deciduous twig, 9 Feb 1998, Henrici, K(M)56267; East Suffolk VC25: Wenhaston, east of Bickers Heath, 14 Oct 2001, Francis, K(M)156507; Herefordshire VC36: Ross-on-Wye, Kerne Bridge, on stump of *Betula* sp., 4 Dec 1982, Graddon 4055, K(M)42286; Shropshire VC40: Ellesmere, on decorticated branch of *Fagus*, as *Stictis pallida* (could be part of the type of *Stictis fagicola* Phill. (Phillips, 1887)); SCOTLAND: North Ebuades VC104: Isle of Skye, Sleat, on cut surface of branch of *Betula*, 1 Mar 1989, Dennis, K(M)159107.

Cryptodiscus gloeocapsa (Arnold) Baloch, Gilenstam & Wedin 2009

Figs 2, 8b

This is actually a lichenised species which has been hitherto known as *Bryophagus gloeo-*

capsa Arnold. The apothecia are very much like those of any typical *Cryptodiscus* species, although lifestyle and substrate are quite peculiar. *C. gloeocapsa* grows on bryophytes and on soil, e.g. on shaded road-cuttings and on acid soils associated with mines (Fletcher *et al.* 2009). The lichen thallus forms a yellowish-green coating over the substrate and becomes gelatinous when wet due to its symbiotic algae (*Gloeocystis*-like). The fruiting bodies, as in most *Cryptodiscus* species, are light ochraceous to pale orange and small (0.2–0.5 mm diam.). The apothecia are roundish, become eventually partly erumpent and are deeply urceolate. The hymenium gel reacts Iodine negative and KOH/Iodine positive. The ascospores are cylindrical-fusiform, tapering at one end, 3–4 septate and 20–30 x 1.5–2 µm. *C. gloeocapsa* has a north-western distribution in the British Isles. It is known from Northern to Central Europe, and has been reported from Macaronesia, North America, Asia and Africa (Fletcher *et al.* 2009).

Records from Great Britain: ENGLAND: Durham VC66, Shropshire VC40; SCOTLAND: East Sutherland VC107, WALES: Anglesey VC52; IRELAND: North Kerry VC-H2; all VC citations based on specimens at the Natural History Museum London (BM).

Cryptodiscus pallidus (Pers.) Corda

Figs 3, 4, 7, 8c

This is the type species of *Cryptodiscus*. In Great Britain it seems to be very rare and we have only two records, both of specimens collected in Scotland. Studies in Sweden revealed that this species occurs in similar habitats to *C. foveolaris* and, like that species, forms only very scattered apothecia and is easily overlooked (Baloch *et al.* 2009). *C. pallidus* has a strong preference for decorticated moist wood of broad-leaved trees (*Alnus glutinosa*, *Fagus sylvatica*, *Populus tremula*, *Rosa* sp., *Salix cinerea*) and usually cannot be found on coniferous wood. The exception is a collection on *Juniperus* from Norway. Morphologically, this species can be very similar to *C. foveolaris*, but the spores are 3-septate, usually with constrictions at the septa

and larger, 12–16 x 3.5–5 μm . The apothecia of *C. pallidus* are pale ochraceous and 0.3–0.8 x 0.2–0.4 mm in diameter. Ascomata are typically ellipsoid and seem to split the substrate lengthwise (Fig. 3). This had been observed in all collections from Sweden and in the type specimen. However, both Scottish specimens have round rather than ellipsoid apothecia and there is no sign of the typical splitting of the wood fibres (Fig. 4). This might just be part of the natural variation of *C. pallidus*, but the morphological differences between species in this genus are often subtle and this variation is worth further investigation. The pale and ellipsoid apothecia and preference for broad-leaved wood distinguish *C. pallidus* from *C. tabularum*. The latter has smaller and roundish apothecia, which are also somewhat stronger in colour and grow on pine wood. *C. pallidus* is known from Europe, North America and the Canary Islands.

Examined records from Great Britain:
SCOTLAND: Argyll VC98: Glen Nant, south of Taynult, on decorticated branch of *Quercus*, 2 Aug 1980, Coppins 8173 (E); Wester Ross VC105: Kishorn, Rassal Ashwood NNR, on standing *Fraxinus* trunk, 1 Jun 1999, Coppins 18463 (E).

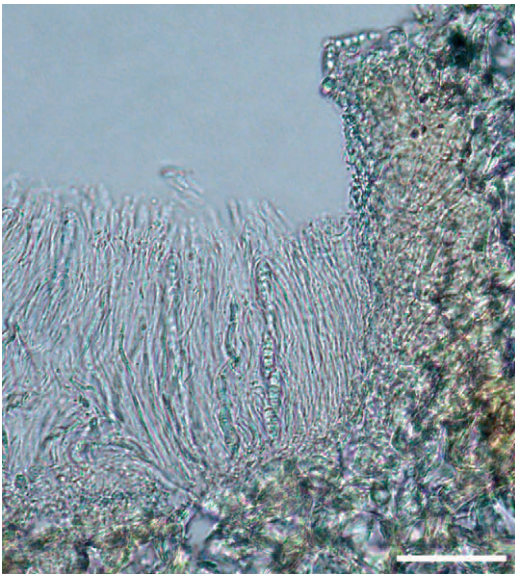


Figure 7. *Cryptodiscus pallidus* (Baloch SW128b, S) Cross-section through ascoma wall and part of the hymenium. Scale bar = 30 μm .

Cryptodiscus pini (Romell) Baloch, Gilenstam & Wedin

Figs 5, 8d

C. pini is a rather outstanding species, the only known member of the genus having dark apothecial walls and fruiting bodies which eventually become erumpent. These characters give it a quite different appearance from that of other *Cryptodiscus* species, and it is not surprising that the species was until recently treated in another genus, the monotypic *Paschelkiella*, referred to the *Odontotremataceae*. The apothecia are roundish, 0.3–0.6 mm in diameter and dark brown with a red-brownish disc. The mature \pm erumpent apothecia are deeply urceolate. In cross-sections the margin is reddish brown and not carbonized, the lateral wall is hardly thicker than the basal wall. The ascospores are narrowly oblong, 1-septate and 9–13 (–15) x 1.5–2 μm . As for *C. pallidus*, the only reports from the British Isles are from Scotland. The species depends on suitable pine trees as substrate and therefore is restricted to regions with mature pine forests and plantations. In Sweden, *C. pini* has been frequently found in forests of *Pinus sylvestris* on decorticated branches still attached to the tree or lying on the ground. The species is known from Northern Europe (Scandinavia, Scotland) and western North America. In North America *C. pini* has been collected on the cultivated conifer *Libocedrus*.

Examined records from Great Britain:
SCOTLAND: Mid Perthshire VC88: Rannoch, on wood of *Pinus sylvestris*, Mar 1976, Coppins, K(M)42282; Easternness VC96: Cairngorms National Park, Rothiemurchus Forest, on decorticated wood of *Pinus sylvestris*, 1 May 1980, Sherwood & Coppins, K(M)156612; Wester Ross VC105: Torridon, on decorticated wood of *Pinus* sp., Jun 1983, Clark, K(M)45760; between Torridon and Allegin, on decorticated branches of *Pinus* sp., 14 Jun 1983, Clark, K(M)48177; Torridon, on decorticated branches still attached on the tree, on *Pinus*, Jun 1983, Clark, K(M)159126; Coire Mhic Nobuil, *Pinus*, 21 Jun 1983, Clark, K(M)159127.

Cryptodiscus tabularum Kirschst.

Figs 6, 8e

C. tabularum was described from a wooden plank of a hut in Bavaria/Germany (Kirschstein 1936), but had never been recorded since. In the survey in Sweden mentioned above it was rediscovered as an inhabitant of pine forests. During our revision of the British *Cryptodiscus* we found three specimens of this species from Easternness and Wester Ross in herb. Edinburgh (E) even labelled with a herbarium name: *C. caledonicus* Sherwood sp. nov. (ined.). The apothecia are circular, about 0.2–0.4 (–0.5) mm in diameter and are permanently immersed in the substrate. The disc is ochraceous to orange coloured. Mature spores of

C. tabularum are 18–25 x 3.2–4.4 µm in size and have 5–7 septa with constrictions. Most of the specimens collected, however, have 3-septate spores (12–18 x 2.4–4 µm) without constrictions at the septa, hence it could be confused with *C. pallidus*. To date *C. tabularum* has been reported only from weathered wood of *Pinus sylvestris*, whereas *C. pallidus* usually grows on wood of broad-leaved trees. The species has been reported from Germany, Sweden and Scotland.

Examined records from Great Britain:
SCOTLAND: Easternness VC96:
Rothiemurchus Forest, on old decorticated
Pinus sylvestris branches, 1 May 1980,
Sherwood & Coppins (E); Wester Ross VC105:

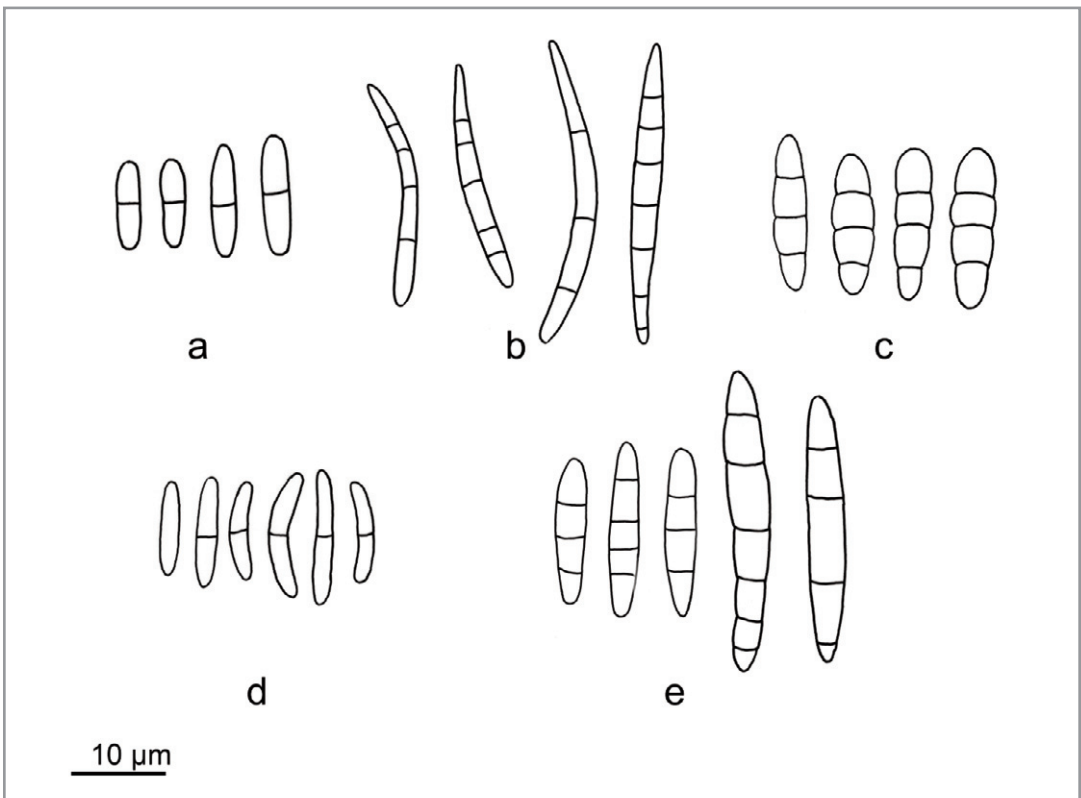


Figure 8. Ascospores of *Cryptodiscus* species.

a. *C. foveolaris* (Baloch SW128a, S); **b.** *C. gloeocapsa* (Vězda exs. 1086 and Vězda 403 both S); **c.** *C. pallidus* (Gilenstam 2694, UPS); **d.** *C. pini* (Baloch SW172, S); **e.** *C. tabularum* (Wedin 8271 and Westberg SW132 both S), note the variation in size between the short 3-septate spores commonly observed in specimens and the rarely collected mature state with 5–8-septate spores with constrictions at the septa.

Spore drawings taken from Baloch *et al.* 2009.

Kinlochewe, Coille na Glas-leitire, on decorticated log of *Pinus sylvestris*, 20 Aug 1963, Dennis, K(M)159144; Kinlochewe, Beinn Eighe NNR, Coille na Glas-leitire, on decorticate branch of large fallen *Pinus*, 12 Apr 2001, Coppins 19716 (E).

Key to the British species:

- 1. Lichenized; growing on bryophytes or soil
 ***C. gloeocapsa***
 – Saprotrophic; growing on decorticated wood. 2
- 2 Ascospores 1-septate 3
 – Ascospores with 3 or more septa 4
- 3 Ascomata light-coloured and deeply immersed, disc ochraceous to yellowish-orange, on wood of either coniferous or broad-leaved trees; spores 6–9 µm long . .
 ***C. foveolaris***
 – Ascomata dark brown, becoming +/- erumpent when mature, disc pale brownish, on weathered pine wood; spores 9–13 µm long ***C. pini***
- 4 Ascomata ellipsoid, seem to split the substrate lengthwise, disc pale ochraceous, mature spores 3-septate with constrictions at septa, 12–16 x 3.5–5 µm; usually on wood of broad-leaved trees . . . ***C. pallidus***
 – Ascomata roundish, not splitting the substrate, disc yellowish-orange, spores 3–7 septate, constrictions at septa only if spores have more than 3 septa, 12–18 (–25) x 2.4–4 µm; on weathered pine wood
 ***C. tabularum***

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