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Field Mycology

Field Mycology is a quarterly magazine, published by the British Mycological Society. It provides articles about fungi of interest to the field mycologist, covering all aspects of identification, conservation, recording and collection, for all levels of expertise.

EDITORIAL PANEL

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Back cover: *Pluteus semibulbosus* photographed during the survey of Bushy Park in Sept. 2021. See the article by Andy Overall on p. 50. Photograph © Geoffrey Kibby.

EDITORIAL

Keeping up with the advances in science, whatever field particularly interests you, often seems almost impossble these days. So many new papers are being published daily in so many journals that it is impractical to read them all.

For mycologists social media are a great help as there are many specialists in different fields online and they frequently alert us to new and interesting topics and publications. Facebook, for example, despite some of its negative aspects, is a great place to talk to fellow mycologists and discover what is going on in the world of mycology. Many experts give details of their publications or research there as well as answer questions; invaluable for both beginners and more advanced mycologists alike.

With the advent of DNA sequencing the number of new species, new genera, or revisions of these, has multiplied greatly and they may also be published in journals not exclusively associated with mycology, making it even harder to discover them. Very often these days, as well as in journals, new taxa are published digitally on www.indexfungorum.org but this can easily be checked at regular intervals to see what is new.

Simply using one of the standard search engines on the internet and searching for something like "mycology news" can yield good results. One of my favourite websites is www.sciencedaily.com. Here you can discover new research in all fields of science including mycology. It includes a search window so you can search its archives to see past articles on your topic of choice.

As it has for the past 22 years Field Mycology will endeavour to keep you abreast of the ever changing world of mycology and now we are better value than ever! As always we welcome documented photographs of interesting finds for our regular Readers' Finds feature and of course submissions of articles to include in future issues.

Fungi talk to each other (or perhaps not…)

In a Royal Society Open Science study by Prof. Andrew Adamatzky involving analysing electrical activity in four species of fungi, species-specific spikes of electrical oscillations were revealed.

The electrical spikes grouped into clusters with up to 50 differentiated clusters recorded. When viewed as analogous to words the groups could be seen to form 'word lengths' and 'sentences' that matched those seen in human languages. The four species used were *Cordyceps militaris*, *Flammulina velutipes*, *Omphalotus nidiformis* and *Schizophyllum commune*.

Adamatsky postulates that the fungi may be communicating through their mycelium, perhaps identifying sources of food, warning of threats, etc. The most 'talkative' species with the largest 'vocabulary' proved to be *Schizophyllum commune*.

He says "We do not know if there is a direct relationship between spiking patterns in fungi and human speech. Possibly not," Adamatzky said. "On the other hand, there are many similarities in information processing in living substrates of different classes, families and species. I was just curious to compare."

Of course, not everyone agrees with this speculation, pointing out that other types of pulsing behaviour have previously been recorded in fungal networks, such as pulsing nutrient transport.

"This new paper detects rhythmic patterns in electric signals, of a similar frequency as the nutrient pulses we found," said Dan Bebber, an associate professor of biosciences at the University of Exeter, and a member of the British Mycological Society's fungal biology research committee.

"Though interesting, the interpretation as language seems somewhat over enthusiastic, and would require far more research and testing of critical hypotheses before we see 'Fungus' on Google Translate."

[Of course the fungi could be secretly plotting to take over the world…Ed.]

Adamatzky, A., (2022). Language of fungi derived from their electrical spiking activity *R. Soc. open sci.* 9211926211926 http://doi.org/10.1098/rsos.211926

Geoffrey Kibby

Fungal Portrait: 90

Inocybe lacunarum

Geoffrey Kibby & Mario Tortelli

Fig. 1. *Inocybe lacunarum* growing under a stand of *Carpinus*, Theydon Bois, Epping Forest, Essex. 5 July, 2021. Photograph © Geoffrey Kibby.

In July of 2021 we were looking for early *Cortinarius* collections at Theydon Bois in Epping Forest, Essex as part of a permitted study in the forest, when we came upon a large collection of an *Inocybe* species. There were two groups of what appeared to be the same species growing on opposite sides of a single hornbeam, *Carpinus betulus* in an open, grassy area (Figs 1 & 2). The bright tawny yellow caps contrasting with their white, bulbous stems were striking and after photographing both groups collections were made for further study.

On arriving home GK made a spore deposit and photographs were taken at x1000 revealing their strongly warted, almost star-like shape. The spores were 9.0 11.5 µm in length including the warts (Fig. 3). Both collections had identical spores suggesting that they were indeed conspecific. Pleuro- and cheilocystidia were both thick-walled metuloids with crystals at their apices (Fig. 4).

Using what literature we had available (Alessio, 1980, Stangl, 2001 and Outen & Cullington, 2015) we attempted to key them out to species. It soon became obvious that they were in a group of species centred around *I. mixtilis* which lack a cortina, have nodulose spores and a pruinose, marginately bulbous stem. This group includes *I. praetervisa* and *I. xanthomelas* as perhaps the nearest look-alikes. The spores of our collection however were larger and more nodulose than illustrated for those species, which prompted us to send them to Alvalab in Spain for sequencing to try and firm up our identification.

When the results came back we ran them through the GenBank database and were surprised to get a match with *Inocybe lacunarum*, a species described from Scandinavia by Jukka Vauras and Ellen Larsson (2015) and, at that point, with no published records from the UK. We then sent the sequence to Ellen Larsson who confirmed that it was indeed a 100% match with the sequence from their type collection.

Our collection extends the range of this species from boreal and hemiboreal regions of Fennoscandia down into the temperate areas of

Fig. 2. A second collection of more mature *I. lacunarum* collected close to the first collection on the same day. Photograph © Geoffrey Kibby.

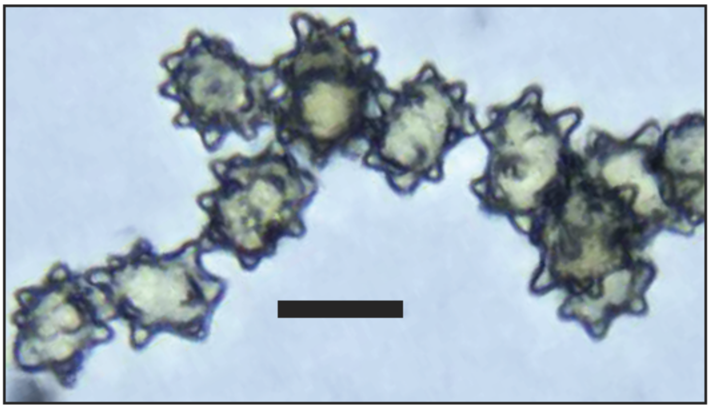

Fig. 3. Spores of *I. lacunarum* showing their very prominent, conical warts. Photo © Geoffrey Kibby. Bar = 10 µm.

Europe and also adds a new and unambiguous mycorrhizal associate *Carpinus betulus*, the type collection having been found close to *Betula pendula*, *Populus tremula* and *Quercus robur*.

Ours was not the first collection of this species in Britain however; a 2020 collection by Eric Janke from Stubbs Wood in South Hampshire, found under mixed broadleaved trees beat us to it. Eric's collection was also a match to the sequence from the holotype. It seems likely therefore that this species is widespread and perhaps even frequent in Britain but confused with similar species.

Fig. 4. Cheilo- and pleurocystidia of *I. lacunarum*. Photograph © Geoffrey Kibby.

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DNA barcoding reveals three *Rhodocybe* species new to Britain

Nick Aplin[1], Penny Cullington[2], Brian Douglas[3] & Eric Janke[4]

Introduction

As part of routine surveys during 2019 and 2020, several *Rhodocybe* species were collected from both Buckinghamshire and Sussex. Within *Rhodocybe*, the brown to pinkish colouration of three of our collections suggested a connection to section *Rufobrunnea*, a section for which only 2 species are currently recorded from the UK, neither of which appeared to be good matches to these collections. However, several new species in this section have recently been described from Turkey, Italy and Estonia (Vizzini *et al*., 2016, Sesli & Vizzini, 2017; Vizzini *et al*., 2018), which had some resemblance to our collections but had not yet been confirmed from the UK.

To investigate whether the three *Rhodocybe* collections did correspond to these newly described species, the collections were flagged up as candidates for DNA extraction, amplification, and sequencing by both the Sussex Fungus Group and the Hampshire Fungus Group. This DNA work was done as part of a field mycology DNA barcoding initiative set up in collaboration with the Lost and Found Fungi (LAFF) project (Royal Botanic Gardens, Kew).

Methods

Specimens were photographed in situ, microscopically examined and imaged in their fresh state, mounted in water, Congo red, Melzer's reagent and Cotton blue in lactophenol.

DNA extraction, amplification, visualisation, sequencing, and sequence analysis was conducted as described in Box 1 below.

Results

For one specimen, the newly generated ITS sequences produced a 99.5% full length match with the sequence derived from the holotype of

BOX 1
Molecular Methods

DNA extraction was performed using a slightly modified version of the dipstick protocol described by Zou *et al*. (2017). Briefly, an approximately 2 mm3 section of clean dried gill tissue was macerated in 200 ul of lysis buffer (20 mM Tris [pH 8.0], 25 mM NaCl, 2.5 mM EDTA, 0.05% SDS) using a plastic pestle, before diluting the crude extract with a further 300 µl of lysis buffer. A homemade filter-paper dipstick with wax handle was used to extract DNA from the crude extract; to wash the DNA in wash buffer (10 mM Tris [pH 8.0], 0.1% polysorbate 20); and to release the DNA into the PCR reaction mix – three dips of the dipstick were used at each step as recommended by Zou *et al*. (2017).

The internal transcribed spacer (ITS) region was amplified using the primer pair ITS1F and ITS4. Thermocycling was done with a Bento Lab (Bento Bioworks Ltd., London, United Kingdom), using the following protocol: 4 minutes at 95 ˚C, then 35 cycles of: 95 ˚C for 30 seconds, 52 ˚C for 30 seconds, 72 ˚C for two minutes followed by a final extension step for 10 min at 72°C and hold at 15 ˚C. 10 ul of PCR products were visualised on the Bento Lab electrophoresis unit on a 40 ml agarose gel stained with StainIN™ green (Client Life Science, Stourbridge, United Kingdom). Sequencing was done at the Institute of Biological, Environmental & Rural Sciences (IBERS) of the University of Aberystwyth.

Nucleotide traces were checked manually for quality and errors in FinchTV 1.4.0 (Yang *et al*., 2017). Approximate taxonomic affiliation was determined using a BLAST search in Genbank (httpscbi phylogeny was created based on the ITS phylogeny in Vizzini *et al*. (2018). All phylogenetic work was done in AliView (Larsson, 2014). Sequences were aligned using the MAFFT E-INS-I algorithm; the alignment was trimmed; and phylogenies were calculated using the FastTree algorithm and visualised in FigTree. A final phylogeny was produced using RAxML. *Clitopilus prunulus* AFTOL-ID_522 (DQ202272) was selected as an outgroup.

Rhodocybe asyae (KX834266), differing in only 1 single nucleotide polymorphism (SNP) and two gaps; for another, a 99.6% full length match with the sequence from the holotype of *R. asanii* (NR_154442) (2 SNPs); and for the third, a 99% match with the sequence from the holotype of *R. fumanellii* (NR_166243) (2 SNPs and 1 gap). Within our phylogeny these sequences clearly clustered with the holotype and paratype sequences of these species. In contrast, no other available sequences were more than 86% similar to the collections. All three collections were therefore considered conspecific with the type collections.

Our collection data are provided here in order to contribute to the knowledge of this poorly studied group, and to confirm the presence of these three species within the UK

Rhodocybe asyae Sesli & Vizzini

Collected 13/10/19, Tilgate Park, Crawley, East Sussex (VC 14). UK grid ref: TQ 2739 3425. Genbank accession number: MN840644. Herb: NA131019.

Pileus: To 35 mm, smooth, dry, minutely felty, reddish brown in centre, paler pinkish towards margin.

Lamellae: Narrowly adnate to subdecurrent, white or very pale buff, even at maturity; discolouring pinkish when handled, the number of lamellae reaching from cap margin to stipe 40-45.

Spore print: pinkish brown (surprising considering the pale gills!).

Stipe: to 30 x 5 mm, cylindrical, hollow, beige to reddish brown, covered with a white pruina (especially at apex) which disappears with age/handling.

Odour: Indistinct on collection, farinaceous on drying.

Basidiospores: 5.2 6.8 x 3.5 4.6 µm, subangular, hyaline, contents minutely guttulate/granular, inamyloid, acyanophilus.

Cystidia: Not observed, despite a deliberate search ("rare" and "versiform" in original description)

Basidia: (2-) 4-spored, simple-septate at base.

Cap cuticle: A cutis with light golden yellow pigment, hyphae with light incrustation.

Clamps: Not observed.

Habitat: In short grass under *Pinus* sp.

Figure 1: NA131019 *Rhodocybe asyae*. Photograph © N. Aplin.

Figure 2: HFRG_PC200928_1 *Rhodocybe fumanellii.* Photograph © P. Cullington

Rhodocybe fumanellii Vizzini & Fellin
Collected 28/9/2020, Rushbeds Wood, Buckinghamshire. UK Grid ref: SP 667 156. Genbank accession number: MW401761, Herb: HFRG_PC200928_1

Pileus: To 50 mm, smooth, dry, appearing +/- pruinose, covered with a fine tomentum, radially striate, reddish cocoa brown but in larger specimens beginning to dry out paler from centre outwards. Not umbonate, slightly rounded at first then +/- flat with downturned margin.
Lamellae: Crowded, subdecurrent, pale cream when young, gradually becoming more pinkish.
Spore print: Distinctly pink.
Stipe: To 60 mm x 10 mm, cylindrical, concolorous with gills, with fine white striate tomentum which where rubbed reveals a pinker surface beneath; base slightly broader where firmly attached to substrate with mycelial strands.
Odour: Pleasant on drying, fruity and sweet, aromatic, when cut strong with acidic component.
Basidiospores: 6-6.5 x 4-5 µm subangular, hyaline, contents minutely guttulate/granular.
Cheilocystidia: Sparse, cylindrical, slightly flexuose and septate. Basidia: 4-spored.
Cap cuticle: A cutis.
Clamps: Not observed.
Habitat: On fallen wood in a decomposing log pile (mainly composed of *Fraxinus excelsior*).

Rhodocybe asanii Sesli & Vizzini
Collected 13/10/20, Tilgate Park, Crawley, East Sussex (VC 14). UK grid ref: TQ 2734 3437. Genbank accession number: MW375030, Herb: NA13102020

Pileus: To 50 mm, cocoa brown in centre, beige elsewhere, margin almost white, smooth, dry, rounded at first and sometimes with an indistinct umbo, later becoming shallowly cup or funnel-shaped.
Lamellae: Moderately crowded, pale pink, adnate to subdecurrent. Spore print: Light pink.
Stipe: To 40 × 12 mm, cylindrical to bulbous at base, pruinose, discolouring grey- brown with handling.
Odour: fruity and sweet.
Basidiospores: 5-7.8 × 4.1-5.2 µm, subangular, hyaline, contents minutely guttulate/granular, inamyloid.
Cheilocystidia: Cylindrical to clavate, slightly flexuose and septate (absent in type material).
Basidia: 2 to 4-spored, simple septate at base.
Cap cuticle: A cutis, hyphae lightly incrusted.
Clamps: Not observed.
Habitat: On bare soil amongst needle litter under *Picea*.

Figure 3: NA13102020 *Rhodocybe asanii.* Photograph © N. Aplin.

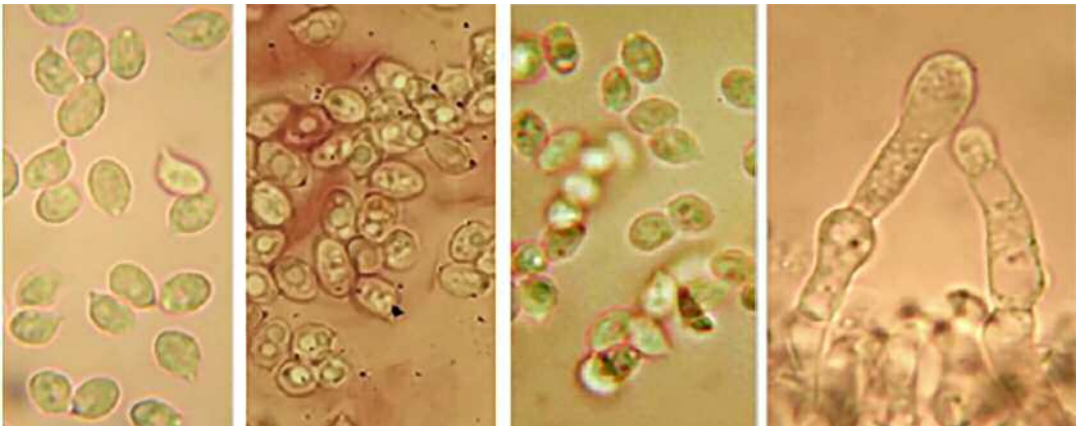

Figure 4: from left to right: Spores of *R. asyae**, *R. fumanellii***, *R. asanii** and cheilocystidia of *R. asanii**
*Mounted in water. Photographs © N.Aplin.
**Mounted in Congo red dye. Photograph © P. Cullington.

Discussion

Given that these three species were only described in 2017 and 2018 and are not yet present in any field guides or keys for this region, it is hardly surprising that there have been no previous UK reports. Until there is evidence of further collections it will be unclear whether they are in fact widely distributed in Great Britain and Ireland. Given the frequency of new species descriptions from other parts of Europe in the *Rhodocybe* group (Vizzini *et al.*, 2016, Sesli & Vizzini, 2017, Vizzini *et al.*, 2018) we suspect there is great potential to further expand and refine the British and Irish records. We follow Henrici (2020) in suggesting that unusual specimens not fitting to known species concepts be documented and retained for DNA sequencing in the future, as described in Harries (2017). We also apologetically refrain from offering a dichotomous key (for the same reasons offered in Henrici, 2020), and note that whilst some morphological characteristics seem to remain stable across collections, others do not.

Whilst these three species are superficially

Figure 5: *Rhodocybe* sp., HFRG_EJ171117_1 fruitbodies. Photograph © E. Janke.

similar, especially in microscopic anatomy, their habits and habitats may be enough to separate them. *R. asyae* and *R. asanii* seem to prefer soil under conifers (Sesli & Vizzini 2016) whereas *R. fumanellii* is most frequently described under broadleaf trees (Vizzini *et al.* 2018). Furthermore, whilst *R. asyae* has a smaller and slender collybioid/clitocyboid habit, *R. asanii* and *R. fumanellii* have a stockier lactarioid/trichalomatoid appearance. We note that in at least one of our collections the presence of cystidia is somewhat conflicting with the type descriptions, suggesting this characteristic may be an unreliable tool for identification.

A further unidentified collection

In addition to these 3 collections in the section *Rufobrunnea*, one of us (EJ) recalled an earlier collection made at Exbury Gardens in 2017, which was identified as *R. caelata* using the literature available at the time. In the light of the above discoveries he decided to sequence that collection and found that the ITS sequence (listed as HFRG_EJ171119_1 in Fig. 6) formed a basal clade outside Section *Rufobrunnea*, along with *R. pallidogrisea* and *R. tugrulii*, from which the collection is morphologically and genetically distinct.

Rhodocybe sp.

Collected 17/11/2017 Exbury Gardens, S. Hampshire (VC11) UK grid ref SU424002. Genbank accession numbers: ITS region - MW397197, LSU region - MW397521, Herb: HFRG_EJ171117_1

Pileus: Purple-brown 10 20 mm.

Stipe: Brown, fibrillose, 10 x 2 mm.

Spores: Ellipsoid 6 9 x 4 5.5 µm verrucose, cyanophylic.

Pseudocystidia with yellowish content in KOH.

Habitat: Near pathway in parkland, in disturbed, sandy soil near base of fallen *Pinus*.

The role of citizen science in mycology

This work adds to the growing body of evidence that field mycologists can undertake DNA-based

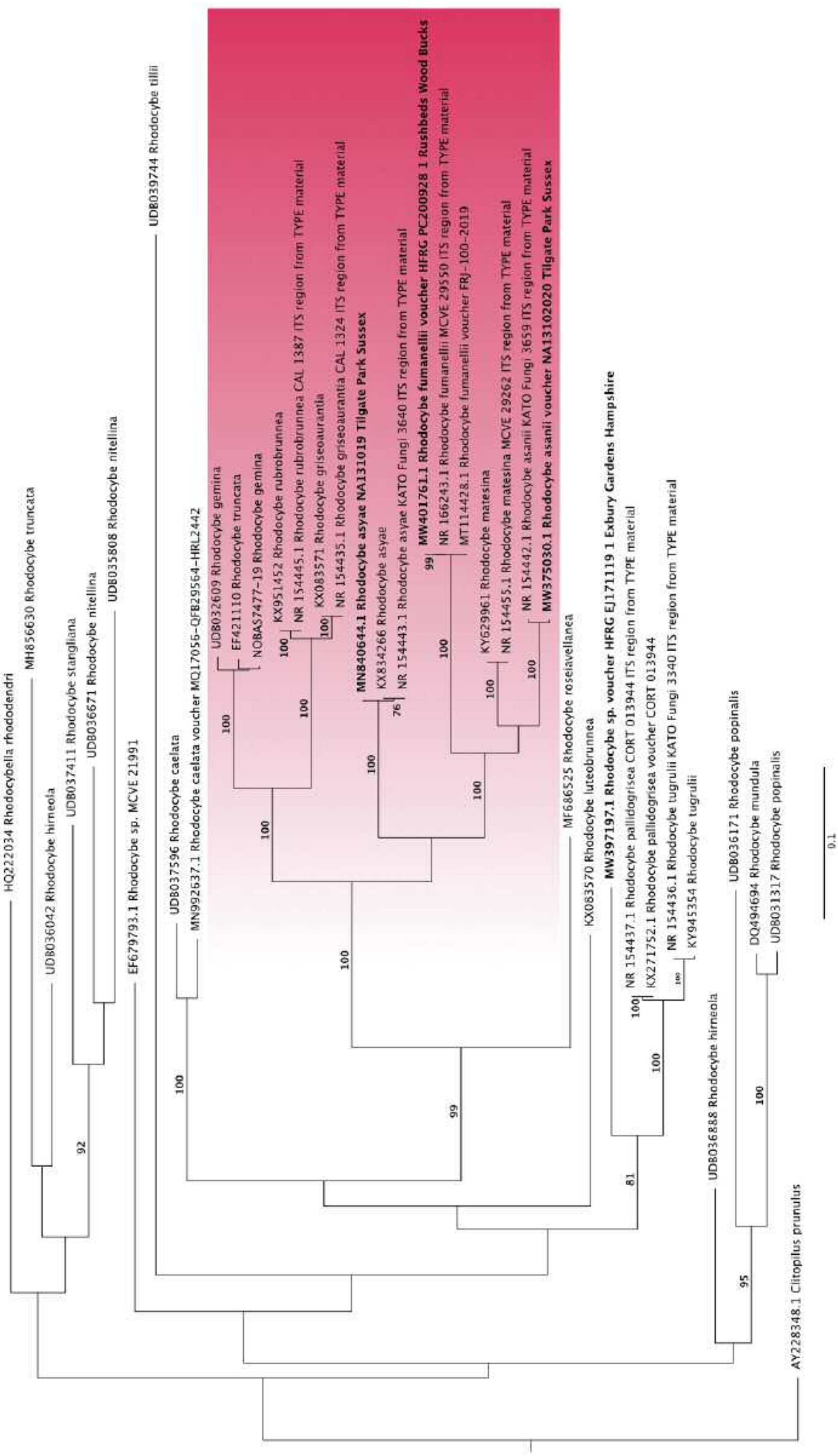

Figure 6: Maximum likelihood tree of *Rhodocybe*, with emphasis on sect. *Rufobrunnea* (shaded in red), rooted with *Clitopilus prunulus*. Our collections described in this article are displayed in bold.

identification of fungi themselves, and that this methodology can help make important contributions to the discovery and identification of fungal biodiversity, including that of novel species to Britain.

Acknowledgements

Thanks are due to the Esmée Fairbairn Foundation for funding the Lost and Found Fungi project, to Dr Brian Douglas both for his technical and financial support of the Sussex and Hampshire Fungus Groups when starting their DNA work and for his contribution to this study, and to the BMS for funding some of the sequencing work.

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Two collections of *Ramaria aurea* redetermined as *R. atractospora*

Graham Mattock[1], Geoffrey Kibby[2] & Antony Burnham[3]

Introduction

In the autumn of 2013, in September and October respectively, the authors independently made two collections of a beautiful *Ramaria* at different locations in the Forest of Dean and arrived at different conclusions as to their identity. Recent DNA sequencing reveals both identifications to be incorrect and showed instead that they were the same species: *R. atractospora.*

Collection 1, September 7, 2013 by Geoffrey Kibby and Antony Burnham

On a steep bank under *Fagus* in the Bromley Enclosure, Forest of Dean, SO 603079, a large group of a beautiful bright yellow-orange *Ramaria* was discovered (Fig. 1). The specimens were very striking with thick, white bases and rather blunt, branching, cauliflower-like yellow-orange tips, each fruitbody approximately 5 cm high and 5 7 cm across. The spores when measured from a deposit, were around 8.0 15.5 x 4.0 5.0 µm with faint helical ridges. Our attempts at keying it to species using the Petersen key (1999), available via the Internet, led, not very convincingly, to *R. fagetorum*, a species not known in Britain and somewhat smaller and paler than our specimens. The material was dried and sent on to Kew and was later pronounced to be *R. aurea*, based on the accepted knowledge at the time and placed in the fungarium as *R. aurea* K(M)196793.

Collection 2, October 13, 2013 by Graham Mattock

Whilst on a visit to Parkend in the Forest of Dean, the first author (GM) collected a large *Ramaria* sp. growing in leaf litter on a bank of broadleaved trees beside a disused railway line (now a cycle track). The specimen was photographed (Fig. 2) and dried for later examination under the microscope. Most *Ramaria* spores are ornamented with warts or helical stripes; these seemed to be smooth, averaging 13 x 4.5 µm.

Using the Petersen/Borgsjo key, the collection appeared to key to *Ramaria obtusissima var. incarnata* Corner. Their description read “branches cream, warm buff, pinkish buff to salmon, tops pale chrome, buff-yellow to orange-yellow. Spores 10.7-12.5-15.6 x 3.8-4.5-4.9 microns, smooth or with faint helical stripes. Fruit body size 20 x 20 cm” agreeing fairly well with my collection, its darker colours being considered at the time as due to age.

Fig. 1. *Ramaria atractospora*, Sept. 7, 2013, Bromley Enclosure, Forest of Dean, Gloucestershire. Photo © Geoffrey Kibby.

The only reservation with naming this collection *R. obtusissima* was that it did not appear in the British Checklist (Legon & Henrici, 2005 plus online updates), nor were there records on CATE or the FRDBI. Phillips (2006) suggests the genus *Ramaria* "is very little understood, so it's well worth recording all the details of appearance, conditions and habitat of any finds, then dry the specimens and send them to an established herbarium for further study", this remains good advice.

So, following up information about the start of some *Ramaria* DNA testing at Kew, the dried material was sent to their fungarium. Martyn Ainsworth looked at my specimen and discounted *R. obtusissima* because he could see some ornamentation on the spores and none of the clamps which *R. obtusissima* should have. The dried material was DNA sequenced by Laura M. Suz in 2014 where its closest match was found to be *R. aurea* and consequently it was placed in the Kew Herbarium as *R. aurea* K(M)190465.

Results of new sequence matching

Following the publication of Franchi & Marchetti (2021) Martyn Ainsworth emailed all of us saying that five collections of *R. aurea* from the Kew Herbarium, including our 2013 Forest of Dean collections, had been redetermined as *R. atractospora* (new to Britain) after comparison of their ITS sequences with that of the holotype described by Franchi & M. Marchetti 2020. The earliest of these collections was in 1983 from West Lancaster, Silverdale, Gait Barrows NNR, collected by L. A. Livermore. The other three are from Breconshire (Cwm Clydach), Mid-West Yorkshire (Fountains Abbey) and West Kent (Mereworth Woods). Martyn also says that all historical collections filed under *R. aurea* should be viewed with caution and re-examination/sequencing is now required to check their determinations.

Ramaria atractospora compared with *R. aurea*

Both species are part of a large complex of yellow to yellow-orange or orange species in subgenus *Ramaria* treated in Franchi & Marchetti (2021), although on their phylogenetic tree they do not appear to be very closely related. The original description of *R. atractospora* describes it in tones of light yellow-cream, light egg-yellow to ochre-yellow which would seem to agree fairly well with the first collection described here while the second collection extends the colour range to a more rust-brown. *R. aurea* on the other hand is both larger and more consistently bright golden yellow to yellow-orange. Their spores would seem to be the best distinguishing morphological character, being shorter and broader in *R. aurea* (9.4 12.6 x 3.9 5.6 µm) but it has to be said that with this very difficult group of often extremely similar species, molecular sequencing will almost certainly be required to be really sure which species you have.

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Fig. 2. *R. atractospora* showing a much darker, rust-brown hue. October 13, 2013, Parkend, Forest of Dean, Gloucestershire. Photo © Graham Mattock.

Fungi Royale at Bushy Park

Andy Overall[1]

In 2009 I was commissioned by the Royal Parks Charity to carry out a baseline fungi survey of Bushy Park. A follow up survey was commissioned to be carried out from September to December 2021.

The 2021 survey attempted to build upon and compare results with the baseline survey in 2009. In order to do this, the fungi 'hotspots' identified in 2009 are compared with how they were found during 2021 and an appraisal of the park as a whole and the habitats therein are also compared. This is with the understanding that large-scale environmental changes have taken place during the eleven years since the first survey.

Background, Habitat & Current Status

At 450 hectares (1099 acres) Bushy Park SSSI (designated for its large areas of acid grassland and dead wood invertebrate populations) is the second largest Royal Park within the Greater London Area. It lies in outer southwest London within the London Borough of Richmond and in the Vice County of Middlesex (21). The River Thames forms an enclosing loop around the park, which sits on flat, low-lying ground and therefore constitutes part of the Thames floodplain. It sits between 10 m and 15 m above sea level. Terrace gravels over London clay form thin, gravelly, free draining soils throughout most of the park. It is a habitat complex comprising areas of open woodland, within a matrix of grazed grassland/heathland, listed in the National Biodiversity Action Plan as lowland wood pastures and parkland.

At present Bushy Park contains some 4,000 free standing trees scattered throughout the mature parkland and in several woodland plantations, which constitute 47 ha across the site. Penduncate oak, *Quercus robur* is probably the dominant tree in the park, which is not surprising given that this tree has a close association with old deer-hunting grounds. There are also a fairly large number of Lime and Horse Chestnut trees that form the avenues, complemented by a small number of beech, hornbeam, Holm oak and Scots pine. In some areas a shrub layer of mycorrhizal partners such as Silver birch, willow and alder supports these canopy trees, most importantly in parts of the Woodland Gardens. The rather large fungal diversity within this area is a testament to this, whereas the lack of understorey in the unenclosed plantations has led to a relatively low fungal diversity in those areas. In particular areas, trees such as willow and alder that border the watercourses of the Longford River and the various ponds of the park, provided good habitat for associated fungi.

There are 128 hectares of unimproved acid grassland across the park, which potentially represents an invaluable habitat for fungi of all sorts.

The park was found to be in good condition, with the Chestnut Avenue, closed in part to cars, helping to minimize atmospheric pollution.

The survey proved to be a successful return to the park with a total of 277 species being identified from 572 records. Amongst these were 39 species new to the park, 18 of which are new to Middlesex and one new to Britain. The following are some of the standout species recorded:

Fuscoporia torulosa Figs 1 & 2

Historically recorded on *Quercus cerris, Q. robur*, *Castanea sativa*, *Prunus avium* and *Crataegus monogyna* with which it was recorded here. Initially recorded as new to Middlesex during the 2009 survey. It was subsequently recorded again by Jill Butler and confirmed by myself during 2018, from close to Hawthorn Lodge (TQ1606 6983). This was recorded again during the 2021 survey from the same site as in 2018 with 10 fruitbodies on the tree. With only 16 records in the FRDBI that originate from Berkshire, Surrey and West Kent, this is genuinely a rare species. It is believed to be at its northern limit in the British Isles, being very common in the Mediterranean area. These are only the 2nd and 3rd records for Middlesex.

Fig. 1. *Fuscoporia torulosa* growing on *Crataegus monogyna*, hawthorn. Bushy Park, Middlesex, 2021. Photograph © Andy Overall.

Fig. 2. One of the thick-walled, dark setae in the context of *F. torulosus*. Photograph © Andy Overall.

Details of illustrated collection

Fruitbody 9 10 cm across (it is recorded in the literature with a max width of 50 cm, 25 cm deep). Sessile, broadly attached, 10 cm at thickest point, margin rounded, 2 cm thick.

Upper Surface buff to rusty brown, velutinous, with concentric swollen belts, often with algal growth, becoming blackened and glabrous with age.

Context yellow brown, black with KOH. Tubes distinctly stratified.

Pore surface rust brown to cinnamon, pores fine, rounded, 5 7 per mm.

Spores 4.5 5.9 x 3.5 3.8 µm, ovoid to ellipsoid, smooth, negative in Melzer's reagent.

Setae ventricose to subulate, thick-walled.

Lentinellus ursinus Fig. 3.

This rare species was recorded from two distant, separate areas of the park, both on fallen, decorticated logs, making it difficult to identify the tree species. Deciduous and broadleaved will have to suffice.

Details of illustrated collection

Fruitbody pleurotoid, crepidotoid to conchate, sessile, broadly attached, 34 115 mm across. In small sub-imbricate groups.

Upper surface variable, pinkish buff, tan to light brown, rivulose, often covered with a superficial white tomentum, beneath which the ground colour can be noted. Margin inrolled throughout

Fig. 3. *Lentinellus ursinus* on a fallen log in Bushy Park. Photograph © Andy Overall.

Fig. 4. Another part of the same collection of *L. ursinus* as shown in Fig. 3, showing the dense white fibrillose covering that can appear on the cap surface. Photo © Andy Overall.

existence, appendiculate.

Gills adnate-adnexed, light buff to cinnamon pink, spotting, entire to serrated.

Flesh relatively thin, thickening toward the base of attachment, brownish, tough and fibrous.

Odour faintly fruity, taste distinctly bitter.

Spores an average from 20 measured spores = 3.7 x 3.1 µm, Q = 1.2, broadly ellipsoid to subglobose, barely verrucose using the x100 objective.

Pileus trama trimitic, with characteristic, flexuous, amyloid skeletal hyphae with distinctive nodules (bosselées).

Pluteus hongoi (see FM 21(1):25 for photo)
Described from Kyoto, Japan in 1984 by the well known German/American mycologist, Rolf Singer. There are only five collections of this species in the Kew Fungarium. On FRDBI it is recorded under its synonym *P. nothopellitus*. It may be confused with other large *Pluteus* on woodchip, such as *Pluteus cervinus* but once under the microscope these can easily be eliminated as the prongs at the apex of the pleurocystidia are mostly bifurcated. This record is the first for Middlesex and the park.

Details of the collection

Small clustered group on fresh woodchip

Cap 25 100 mm, convex, applanate, umbonate, fibrillose, almost smooth. Cream-white, umbo brown.

Gills fairly crowded, free, white to pinkish-brown, edge smooth.

Stem 35 110 x 3 15 mm, cylindric, base slightly swollen, white-cream, smooth with few fibrils.

Flesh white, thin. **Taste** raphanoid, earthy. **Smell** raphanoid.

Microscopic Details

Spores 5.5 8.5 x 4.5 6.5µm, broadly ellipsoid, smooth. Spore deposit pink-brown. Basidia 4 spored.

Cheilocystidia narrowly clavate.

Pleurocystidia fusiform with 2 4 hooks at the apex. Majority between 3 and 4 hooks.

A suite of alien species

During the first visit to the park on 12th September, we were informed by one of the staff that a number of fungi were fruiting on large woodchip piles within the woodland gardens area. The dominant species found was *Agrocybe rivulosa* in large numbers across all of the heaps. Also found was *Pluteus hongoi* described on p. 52. But amongst this large fruiting, were some much less common species.

Leucocoprinus meleagris Fig. 5

Considered a semi-naturalized alien species, there are only 16 records of this species on the old FRDBI, dating back to 1830, with just one previous record from Middlesex, which is one of mine

Fig. 5. *Leucocoprinus meleagris* showing the rapid bright red staining on cap and stem after scratching. On a deep pile of woodchips in Bushy Park. Photograph © Andy Overall.

Fig. 6. *Gymnopilus dilepis* showing the deep purple scaly cap surface contrasting with its golden yellow gills and flesh. Photograph © Andy Overall.

from Tower Hamlets Cemetery in 2008. This is a rarely encountered species that thrives on large woodchip piles where heat is generated from within.

Details of the illustrated collection

In large clusters.

Cap 20 45 mm, ovoid, umbonate conic-to-conic convex, white with dark, red-brown central squamules. Margin acute, bruising red-brown to claret.

Gills free, crowded, white to lemon-yellow, with pale floccose edge, readily bruising red.

Stem 55 110 x 4 7 mm, cylindrical, twisted, bent, cream, pinkish brown on handling, dark red-brown toward tapered, deep rooting base. **Annulus** fragile, ascending, white upper surface, brown beneath.

Flesh thin, white then yellowish, becoming reddish brown to claret in cap.

Chemical reaction becoming green with ammonia vapour (not solution)

Microscopic details

Spores 7.7 13.0 x 5.3 7.7 µm, broadly ellipsoid, smooth, thick-walled, with small germ pore, dextrinoid in Melzer's reagent. Spore deposit white.

Cheilocystidia narrowly clavate with long necks and apical encrustations.

Pleurocystidia absent

Gymnopilus dilepis Fig. 6

First recorded as new to Britain in 1995 from Brentmoor Heath, Surrey. Since then there have been around 30 records,but none until now from Middlesex.

It is a spectacular, colourful species, occurring on woodchip piles, quite often of conifer wood, in densely clustered groups.

Details of illustrated collection

Large clustered group on woodchip.

Cap 15 30 mm, convex, applanate, uneven, wavy, almost smooth with tiny, vinaceous scales over an orange buff ground. Becoming brown with age. Margin inrolled, often with velar remnants.

Gills fairly crowded, adnate-notched, yellow, spotting rusty, completely rust-brown in maturity, edge smooth, irregular.

Stem 20 50 x 3 10 mm, cylindrical, base slightly swollen, apex yellowish, otherwise streaked violaceous, becoming brown with age.

Flesh white, thin. Taste very bitter. Smell none.

Microscopic Details

Spores 5.5 8.5 x 4.5 5µm, ellipsoid, amygdaliform, warty, yellow brown. Spore deposit cinnamon-sienna. Basidia 4 spored.

Cheilocystidia cylindrical, lageniform, subcapitate. **Pleurocystidia** similar but scarce.

New to Britain

Cortinarius fuscogracilescens Fig. 7

Following DNA sequencing by Nick Aplin this collection was found to be a 100% match with the type specimen of *Cortinarius fuscogracilescens*. *Cortinarius* expert Kare Liimatainen at Kew further checked the sequence and agreed with the result.

A. Favre first described this species in 2009 from a collection made in 2008 from an area close to the Swiss border, in the Commune de Chens-sur-Leman, France. It was recorded as fruiting among grass on a rutted path, leading into a forest, on slightly acid soil near *Quercus*, *Carpinus* and *Corylus*.

At Bushy Park, it was found fruiting with *Quercus robur* in the Pheasantry area of the Woodland Gardens, among other species of *Cortinarius* from the same subgenus, *Telamonia*.

Details of the illustrated collection

Cap 20-50 mm, campanulate, convex, umbonate, deep reddish-brown, moderately hygrophanous then becoming tawny-brown, margin with scanty white velar remnants.

Gills adnate, moderately spaced, broad, cinnamon, edge cream, entire.

Stem 50 80 x 4 7 mm, cylindrical, base equal to slightly tapered, white, with pale brown streaks, shimmering somewhat, browning where handled and with age.

Flesh thin, cream, **Smell** non-distinctive

Spores 8 9.5 (11) x 4.7 5.5 (6) µm, Q av 1.7. Broadly ellipsoid, with dense, coarse warts. **Basidia** 4 spored.

Additional species recorded

Among other interesting species also seen on the day were some other *Pluteus* species including *P. cervinus*, *P. plautus* and *P. semibulbosus* (see back cover). *Tulosesus callinus* was present on the woodchip piles and *Lactarius serifluus* was recorded in the woodland areas.

Fig. 7. *Cortinarius fuscogracilescens*, newly recorded for Britain from Bushy Park. Collected under *Quercus robur*. Photograph © Andy Overall.

These and other species recorded during the survey highlight the importance of these ancient, surviving urban landscapes and the rich biodiversity they hold within.

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Hohenbuehelia tremula a rarely recorded species

A. Martyn Ainsworth[1]

This rarely recorded British species was collected on 29 November 2019 on soil in ancient chalk downland turf among ant hills (no trees or shrubs nearby) on Wolstonbury Hill, W. Sussex (VC 13). The photograph was not taken in situ (Fig. 1). Its ITS barcode sequence, generated by A.Yu. Biketova (RBG Kew), closely (99.5%) matched that obtained from the epitype (KU355358). There is only one other sequenced collection of this species in K (see Ainsworth *et al*. 2016). This was found by N.W. Legon in 2007 in a North Downs woodland (near East Horsley) and deposited in K with the associated note that it was found on fertile loamy soil (black soil) under a mixture of *Acer pseudoplatanus*, *Betula* sp., *Corylus avellana* and *Mercurialis perennis* and not under any conifers. These finds indicate that this species, as currently defined using ITS barcode analysis, should be searched for in a broader range of habitats than the coniferous woodland, sawdust and wood chips which are indicated in Consiglio & Setti's recent (2018) European monograph of *Hohenbuehelia*.

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Fig. 1. *Hohenbuehelia tremula* collected in West Sussex. Photograph © M. Ainsworth.

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Meruliporia (*Serpula*, *Leucogyrophana*) *pulverulenta*: an overlooked saprotroph of hollow oak trunks with a stronghold in Windsor Great Park

A. Martyn Ainsworth[1] & Kare Liimatainen[1]

This is a species for all oak polypore enthusiasts to bear in mind when hunting for *Buglossoporus quercinus* in July and August. It resembles the more familiar yellowish-brown and tripe-like resupinate *Serpula himantioides*, which is also found on well-rotted oak heartwood, but that species has larger basidiospores (Fig. 1). We would recommend microscopic examination and measurement of mature spores from any *S. himantioides*-like sporophores on oak that seem more yellow than usual and especially if found during the summer months.

The first finds in 2004

During an oak polypore survey on 18 July 2004, AMA collected a strikingly yellow meruloid sporophore (Fig. 2) at ground level on brown-rotted heartwood located just inside a hollow living *Quercus robur* trunk (tree 2289) in that part of Windsor Great Park known as Cranbourne Chase or Park. The area in question consists of a publicly accessible remnant of former pasture woodland, noted for its ancient and veteran open-grown oaks, and one in which grazing has been recently reinstated to manage the denser patches of understorey vegetation. Centuries ago, it was used as a royal hunting forest and then enclosed as a deer park. More recently, it was assessed as one of England's 23 most important oak sites by Farjon (2017). It is also an important hotspot site for oak polypore; there are at least 26 oaks in this small area which are known to harbour *B. quercinus* (Ainsworth, 2017).

The specimen was provisionally filed as *Leucogyrophana* sp., primarily based on the presence of a bright yellow (lemon chrome becoming luteous then brownish) merulioid hymenophore surrounded by a sterile white or pale yellow marginal zone with white or ochre mycelial cords permeating the wood. Older parts of the hymenophore were browner in colour due, at least in part, to the maturation of the rusty brown basidiospores. These failed to give a convincing reaction in Melzer's, although a few did seem to be very slightly dextrinoid. Deposited spores were examined in water and were within the range 5.4 6.4 × 3.5 4.5 µm; clearly falling short of the minimal length and width values, 9 × 5 µm, consistently quoted for the macroscopically similar *Serpula himantioides* in, for example, Hallenberg (1985), Hansen & Knudsen (1997), Bernicchia & Gorjón (2010) and Læssøe & Petersen (2019). On the other hand, the observed spore dimensions did accord with those of *L. pulverulenta* based on the literature sources available in 2004. At the time, however, AMA did not feel confident enough to refer the collection to this species because it departed in several respects from the published descriptions and there were very few photographs of verified *L. pulverulenta* available for comparison. Hallenberg's (1985) identification key distinguished *L. pulverulenta* and *L. pinastri*, both with hymenia "yellowish brown to brownish", from other members of the genus whose hymenia were "yellow to orange-red". Furthermore, he concluded that *L. pulverulenta* "seems to be restricted to domestic habitats … … in wooden constructions". Hansen & Knudsen's (1997) key adopted the same colour-based dichotomy in which the basidiomata of *L. pulverulenta* were described as "brown" and their habitat notes stated that it was found on "coniferous wood in buildings".

Based on morphological characters, the same species was found in the following month inside a hollow ancient *Q. robur* trunk (and probably the Ulvedals Oak, a famous 800+ years old tree) in Jægersborg Dyrehave near Copenhagen, an important Danish oak site with a similar history of usage as a royal forest and deer park. The spores of the Danish material were very similar but could reach 7.5 µm in length, thus raising the upper limit for the mystery merulioid. However, this still accords with published spore length data for *L. pulverulenta*. Although the length range is usually expressed as 5 7 µm in identification guides, there are a few outliers recorded in the primary literature within the range 4 9 µm (as *Merulius tignicola*, Harmsen, 1953; Ginns, 1978).

The Windsor stronghold and other sites in England

The mystery *Leucogyrophana* sp. was observed on the same living oak (tree 2289) at Cranbourne on 16 June 2005 and again on 19 Jun 2008. It was found inside a nearby dead oak (tree 2267) on 3 Aug 2008 and three days later it was recorded from inside three different living hollow oaks (trees 2106, 2223 and untagged) also in Cranbourne. Thus, five occupied oaks have been recorded within an area of 0.5 km^2 at this locality. This stronghold population on the Crown Estate at Windsor was increased to seven occupied oaks by a collection from inside a live trunk (tree 9953) made on 27 Jul 2007 from South Forest (see "Specimens examined" below) and a field record from inside a dead standing trunk (tree with broken tag 1?274) on 10 Aug 2008 from Bear's Rails (OS grid ref. SU9773).

Our *Leucogyrophana* sp. has been collected on oak pollards or maiden trees at single sites, all well-known for their ancient trees, in four other southern English counties: Buckinghamshire (Burnham Beeches), North Somerset (Bristol, Ashton Court Estate), Oxfordshire (Blenheim

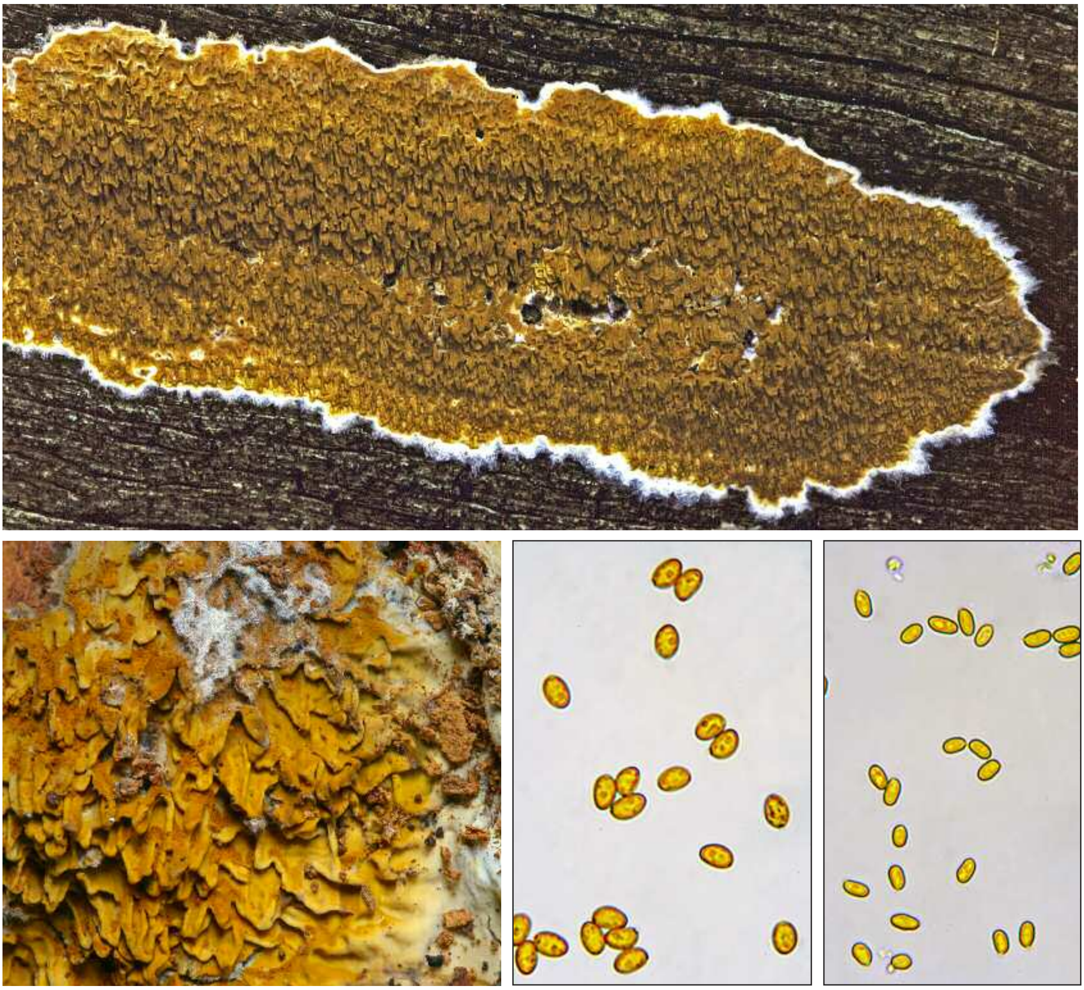

Fig. 1. *Serpula himantioides* sporulating on (top) fallen oak in Windsor Forest (scanned colour slide) and (lower left) inside live hollow oak in Blenheim High Park K(M)237678. Basidiospores from prints in water (to same scale) from (lower centre) *S. himantioides* from inside a fallen oak at Blenheim showing spores at lower end of range (8.4–9.6 µm long) and from (lower right) *Meruliporia pulverulenta* from sequenced basidiome K(M)264855 which is shown in Fig. 2. Photographs © Martyn Ainsworth.

Estate, High Park) (Fig. 2) and South Essex (Epping Forest, Lord's Bushes) (Fig. 2). See "Specimens examined" below for further collection details. All records and collections were made by AMA except for the material from Bristol which was collected by J.H. Smith. All specimens were found on brown-rotted heartwood of trees in parkland, pasture woodland or former pasture woodland.

DNA sequencing

The nuclear ribosomal internal transcribed spacer region (ITS) was successfully amplified and sequenced from one of the five Kew Fungarium collections of *Leucogyrophana* sp. that were sampled: K(M)248646 from Epping Forest (Fig. 2). A Blenheim collection of *S. himantioides*, K(M)237678, (Fig. 1) collected from inside a living hollow oak trunk, was also sequenced for comparison.

DNA was either extracted from dried hymenia using the DNeasy Plant Mini kit (Qiagen, USA) or amplified directly from this source using the Phire Plant Direct PCR kit (ThermoFisher Scientific) following the manufacturer's instructions. The ITS region was amplified and sequenced following previously published protocols (Liimatainen & Ainsworth, 2018). Sequences

Fig. 2. *Meruliporia pulverulenta* in July showing (top row) ground level basidiomes inside a live hollow oak (tree 2289) in Cranbourne Park K(M)257584 (scanned colour slides), (lower left) immature basidiome with its reflection in a rot pool formed within a fallen pollard oak trunk (tree 1108) in Lord's Bushes K(M)248646 and (lower right) very young basidiome inside a fallen oak trunk in High Park K(M)264855. Photographs © Martyn Ainsworth except for lower right photograph © Aljos Farjon.

were assembled and edited with Sequencher 4.1 (Gene Codes, USA). The newly generated sequences were deposited in GenBank with the codes OM523030 OM523031.

Identification of collections

The ITS sequence generated from *S. himantioides* K(M)237678 was over 99.8% similar to several European and North American sequences named as this species in GenBank. Furthermore, it was identical to a Belgian sequence obtained from a mycelial culture originally isolated from the brick wall of a house and which was used in the six-locus dataset used in the phylogenetic analysis of Binder *et al.* (2010). Basidiospores deposited by K(M)237678 were mounted in water and measured 9.6 12.2 × 5.1 5.8 µm, thus our oak-derived collection was confirmed as *S. himantioides*.

The corresponding sequence obtained from Epping collection K(M)248646, provisionally assigned to *Leucogyrophana* sp., showed 99% similarity to two GenBank sequences labelled *Serpula pulverulenta* sourced from sporophores on cellar timbers in two different German localities and published in Huckfeldt *et al.* (2011). The Epping-derived sequence showed the same degree of similarity when compared to a GenBank sequence labelled *Serpula tignicola* obtained from a Danish collection found on decayed wood of *Araucaria brasiliensis*. This collection had been made in 1952 by L. Harmsen, the author of the name *Merulius tignicola* (Harmsen, 1953), and the sequence was published in the analysis of Binder *et al.* (2010). This is in accordance with the currently accepted taxonomic view that *S. tignicola* is a later synonym of *S. pulverulenta*. Basidiospores deposited by the Epping collection measured 5.6 6.7 × 3.4 3.8 µm.

Further taxonomic and ecological considerations

The name *Meruliporia pulverulenta* is based on Sowerby's *Auricularia pulverulenta* which was recombined and sanctioned by Fries as *Merulius pulverulentus* though he later downgraded it to a variety of the dry rot fungus. In the protologue, Sowerby (1799) cited two collections (Norfolk and Yarmouth) from coniferous timber beams and he published an accompanying painting. However, when Ginns (1978) recombined the species in *Leucogyrophana*, he concluded that Sowerby and Fries had been considering two different fungi. Ginns had examined the Yarmouth collection preserved in K, cited in Sowerby's protologue, and found that it was a specimen of what is now known as *Coniophora puteana*. According to Ginns (1978), however, the contemporary usage of the name *L. pulverulenta* had followed the interpretation of Fries, not that of Sowerby. Ginns went on to stabilise this usage by typification of *Merulius pulverulentus* using a French specimen from Herb. Fries and cited in the sanctioning work. The outcome was that the otherwise pale-yellow spored genus *Leucogyrophana* now included a decidedly brown spored *L. pulverulenta*. That said, this genus accommodated such a degree of diversity that such an arrangement was unlikely to cause much controversy. Hallenberg (1985) continued to uphold this taxonomic arrangement but he also remarked that he could just as well have accepted this species within *Serpula* for which a combination had been available for use since 1959. The Ginns-Hallenberg generic placement was continued in Hansen & Knudsen (1997), Legon & Henrici (2005) and Bernicchia & Gorjón (2010). However, molecular evidence was accumulating that *L. pulverulenta* was more closely related to the type of *Serpula* than to that of the clearly heterogeneous *Leucogyrophana* (Jarosch & Besl, 2001; Binder *et al.*, 2010; Huckfeldt *et al.* 2011). This led to an acceptance of *Serpula pulverulenta* in CBIB UD4 (2009) and Læssøe & Petersen (2019). Based on the existing molecular evidence, the old (1942) *Serpula* segregate genus *Meruliporia* has recently been resurrected by Zmitrovich *et al.* (2019) who proposed the new combination *M. pulverulenta*. This is the name that has been applied in this article and is in accordance with the current taxonomic placement in Species Fungorum and MycoBank.

All the descriptions of *M. pulverulenta* in the previously cited publications refer to its habitat as coniferous wood and/or timber within buildings, including the very recent "only found in buildings" in Læssøe & Petersen (2019). Indeed, the compilers of the British & Irish checklist (CBIB UD4, 2009) changed the status of this species from "included" to "alien" based on an apparent absence of collections from woodland habitats. However, our evidence that this species is also found on oak is not entirely new.

Returning to Harmsen's (1953) paper, which included a distribution map of 200 Danish specimens, the summary includes the phrase "only once seen on oak" referring to a record on floor timber. Perhaps understandably, this outlying observation gradually lost significance before disappearing from concise habitat descriptions altogether. The principal aim of this article, therefore, is to present the case for *Quercus* to be restored to the officially recognised diet of *M. pulverulenta*, and furthermore to draw attention to the fact that it is a saprotrophic component, albeit rarely recorded thus far, of our most important ancient oak landscapes.

Specimens examined and GenBank accession numbers

Meruliporia pulverulenta

(currently filed at Kew under *Serpula*)

DENMARK. Sjælland. Copenhagen, Jægersborg Dyrehave, 8 Aug 2004, inside living hollow *Quercus robur* trunk, K(M)257585. UNITED KINGDOM. England. Berkshire (vice county 22): Windsor Great Park, Cranbourne Park SU949731, 18 Jul 2004, inside living hollow *Q. robur* trunk (tagged 2289) at ground level, K(M)257584. Ibid SU95127338, 6 Aug 2008, inside living hollow *Q. robur* trunk (tagged 2106) at ground level, K(M)248644. Ibid SU94797288, 6 Aug 2008, inside living hollow *Q. robur* trunk (tagged 2223), K(M)248645. Ibid South Forest SU94127165, 27 Jul 2007, inside living hollow *Q. robur* trunk (tagged 9953), K(M)257587. Buckinghamshire (vice county 24): Burnham Beeches SU946846, 8 Oct 2005, on living *Q. robur* pollard (tagged 1173) in knot hole, K(M)257586. North Somerset (vice county 6): Bristol, Ashton Court Estate, Clarken Coombe Wood ST548716, 4 Sep 2012, inside *Q. robur* trunk, K(M)249283. Oxfordshire (vice county 23): Blenheim Estate, High Park SP43391492, 20 Jul 2021, inside fallen hollow *Q. robur* trunk, K(M)264855. Ibid 8 Nov 2021. South Essex (vice county 18): Epping Forest, Buckhurst Hill, Lord's Bushes TQ41369328, 19 Jul 2007, inside fallen hollow pollard *Q. robur* trunk (tagged 1108), K(M)248646, GenBank No. OM523030. Ibid 17 Jul 2008, K(M)257588.

Serpula himantioides

Oxfordshire (vice county 23): Blenheim Estate, High Park SP43451543, leg. A. Henrici & A.M. Ainsworth, 29 Nov 2017, inside living hollow *Q. robur* trunk, K(M)237678, GenBank No. OM523031. Ibid leg. A. Henrici K(M)251035. Ibid SP43091521 leg. A.M. Ainsworth, 8 Nov 2021, inside fallen hollow *Q. robur* trunk.

Acknowledgements

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Xylobolus subpileatus, an alien new to Britain

Kerry Robinson[1]

I found this distinctive but unfamiliar species on 5 Dec. 2021 among the rotting remains of a beech stump at Mardley Heath Nature Reserve, Oaklands, near Welwyn, Herts (VC20). It looked a bit like a *Stereum* but coloured more like *Laxitextum bicolor*. I tried to key it in Bernicchia & Gorjón (2010) and arrived at *Xylobolus subpileatus*, but rejected it as 'not very likely'. The countries listed were all in southern Europe. I sent it to Alick Henrici in the hope of better ideas, but he could only agree, and now adds the following notes:

What was this very unlikely species doing here? Bernicchia & Gorjón mention one record from a railway sleeper. This reminded me of the alien *Hericium abietinum* found in Kent on a former sleeper, but otherwise unknown in Europe (see Henrici 2013). Luckily Kerry knew the exact site of her find and I urged her to go back for more. She duly found the substrate to be in fact a piece of very decayed worked wood, probably conifer, lying among the beech debris. So this was indeed a new British record, but merely an alien rather than a spectacular instance of the effects of global warming.

X. subpileatus is widespread and common throughout the subtropics and into southern Europe. It was described by Berkeley as a *Stereum*, firstly with the American M.A.Curtis, and again a few years later on his own as *Stereum illudens*. The Kew fungarium has a whole box full of collections made under this later name. Doubts have remained whether it should indeed be a *Stereum* rather than a *Xylobolus*.

[1] [redacted]

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Fig. 1. *Xylobolus subpileatus*, Mardley Heath Nature Reserve, Oaklands, Herts. Photo © Kerry Robinson.

Crustoderma fibuligerum - a notable corticioid new to Britain

Sue Rogerson[1] & Alick Henrici[2]

Crustoderma fibuligerum has several claims to be notable. It has had a chequered career, described in 1974 from the Himalayas in *Peniophora*, since then successively moved to *Sericeomyces*, to *Phlebia*, and only in 2010 to *Crustoderma*, now known to be its rightful home. The first European find was only in 2012. *Crustoderma* is one of very few corticioid genera giving a brown rot, but its affinities have only recently become known. DNA evidence shows it to be related to the many brown-rotting polypores in *Polyporales* (Justo *et al*., 2017). SR found it in Scotland, was puzzled by it, and initiated the research summarised below that led to its identification. AH here adds further notes on the genus as a whole thanks to the timely publication of a treatment in Larsson & Ryvarden (2021), *Corticioid fungi of Europe* Vol.1 (hereafter CFE). The promised volumes 2 and 3 are eagerly awaited.

Details of the Scottish collection

The following notes were made prior to identification:

- Fruitbody smooth, membranous, pale cream, fully adnate when found, somewhat peeling as it dried, margin fibrillose, white (Fig. 1)
- Hyphae slightly thick-walled, 4-5 µm wide, densely packed as in *Phlebia*, clamps in all tissues, some 'double' (as sometimes in *Phanerochaete*)
- Basidia clavate, 20-24 x 5 µm
- Spores 4-5 x 2-2.2 µm
- Cystidia c.100 x 5 µm, seemingly originating from the subiculum and protruding 35-50 µm beyond the basidia (Fig. 2).

Found 7.05.2018 during the BMS Spring foray, at The Hermitage, Dunkeld, VC88 (Mid Perths), a Scottish National Trust estate. Growing on the non-burnt part of a conifer log remaining from a bonfire, likely to have come

Fig. 1. *Crustoderma fibuligerum*, the Scottish collection. Photograph © Sue Rogerson.

from either Douglas fir (*Pseudotsuga menziesii*) or Sitka Spruce (*Picea sitchensis*). Material now in Kew, K(M)263339. Incidentally, the Douglas firs here have been claimed to include the tallest tree in Britain.

NB. This was evidently fairly young material, though sporulating freely. The CFE account states that with age the hymenium becomes tuberculate, ochraceous and finally reddish brown, though the distinctive white fibrillose margin is retained "which should make it possible to recognise the species in the field" (!).

The identification process

A search in Bernicchia & Gorjón (2012) found similar species in *Phlebia* and *Crustoderma* but no close match. SR therefore emailed Leif Ryvarden with some details and a request for help. He passed these on to Karl-Henrik Larsson, his co-author on the forthcoming CFE, who was immediately very interested. He suspected it was indeed a *Crustoderma*, a genus he was then actively researching, and requested photos. These reinforced his view that it was probably the very same species as had been found new to Europe in France three years earlier and identified by Gérard Trichies. It was also recently found new to the USA. Larsson sent SR some of the French material for comparison.

Much further correspondence followed, also involving Karen Nakasone who had described several fairly similar N. American species. SR contacted her seeking a better match, being unhappy about the discrepancy between the narrow spores of the Scottish collection and the stated broader ones in the type description of *C. fibuligerum* (2 3 µm wide). It turned out that all examined collections, including a paratype, have these narrower spores, the type description being somewhat misleading. Trichies agreed that the Scottish and French material were conspecific, only asking that publication be deferred until his own detailed but much delayed account had been published. This finally took place in 2020, despite a cover date of 2017 on the journal concerned, see Trichies *et al*. (2020). DNA from the Scottish collection, kindly extracted by Eric Janke, has since shown perfect ITS agreement with that of four French collections now on GenBank.

Current known distribution

This is summarised in CFE as "Described from Indian Himalaya and recently discovered in Europe, eastern Siberia and eastern USA". In more detail this becomes:

- India, Himachal Pradesh, Oct. 1967 on *Cedrus deodara*
- Near Vladivostok, 1990, coll. K-H Larsson, then as *Phlebia* sp. indet., recently reassessed
- Bhutan, published 2005 as another new species *Phlebia singularisa*, now synonymised

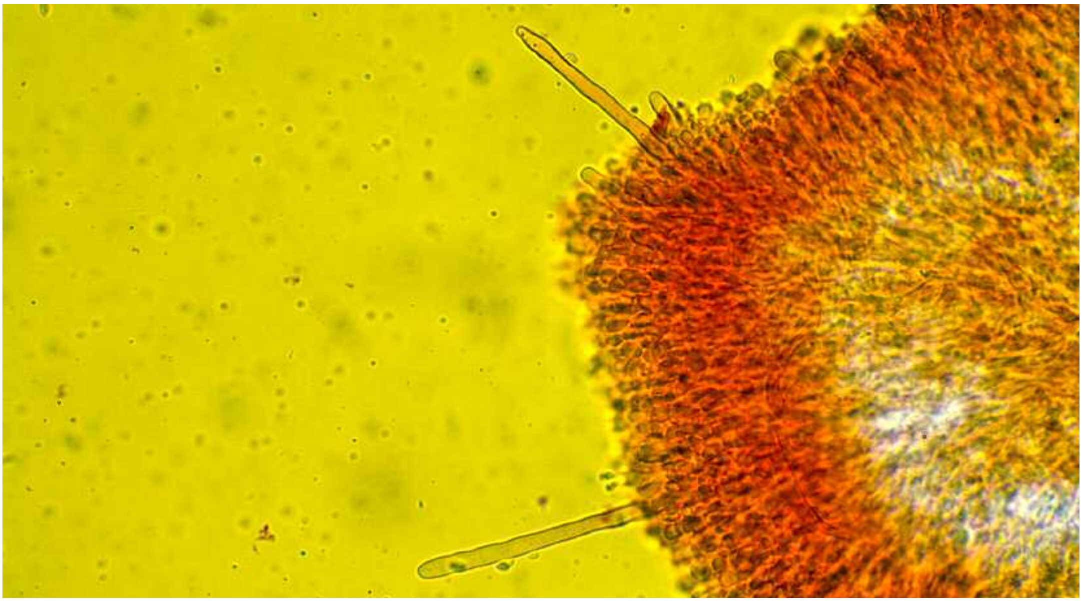

Fig. 2. The characteristic protruding cylindric cystidia of *Crustoderma fibuligerum*. Photograph© Sue Rogerson.

- France 2012-2016, at c.550 m in the Massif Central on *Pseudotsuga menziesii*
- Eastern USA, 2016 (details not seen).

The French material amounted to ten collections, spread over two nearby sites, nine of these all between December and March, the exception being one on 4 May, strongly suggesting a preference for fruiting in winter.

Some further notes on *Crustoderma*

The genus was erected by Parmasto in 1968 for the single species *Corticium dryinum* that had been described from Alabama (on oak as its name suggests) by Berkeley and his American colleague M.A.Curtis in 1873, published among other American novelties in the first issue of M.C.Cooke's new journal *Grevillea*. It has since been found to be fairly widespread in Europe though nowhere common, very largely on conifers. Curiously in CFE no hardwood hosts at all are mentioned for this species or indeed for the genus as a whole.

Crustoderma dryinum has been known in Britain since 1987 when found by Joyce Pitt on an exotic conifer (?*Cedrus*) in Bedgebury Pinetum in Kent and identified by Derek Reid. There is a record on a hardwood host (?*Acer*, verified by Kew plant anatomists) from Herts, and another from W.Gloucestershire on *Fagus*. Hugill & Lucas (2017) report three New Forest records on pine. They and CFE both include fine photos.

Many more species have since been described, particularly by Nakasone from N. America, sharing the common chacteristics of cyanophilic spores, long protruding cylindric cystidia and a brown rot. By 2012 Bernicchia and Gorjón listed five in Europe but with the phylogenetic position of the genus 'still unclear'. These five have been extended to seven in CFE, including two previously treated in other genera, one as *Phlebia tristis* (known e.g. in France), the other as *Hyphoderma cryptocallimon* (British records may need reappraisal). Trichies *et al.* (2020) provide a world key to 17 species, all the others having larger spores than *C. fibuligerum*. Phylogeny has been at least partially clarified by Justo *et al.* (2017) as noted above. They show that *Crustoderma* sits somewhere in the large /antrodia clade of *Polyporales*.

Crustoderma should give some comfort to all who collect corticioids they can't even assign to a genus. With the hindsight of DNA, it is clear that even acknowledged experts have this problem and can end up in print with the wrong answer. The dense context suggests *Phlebia*; the spores and cystidia suggest *Hyphoderma*.

Finally a word on brown rot

Though seldom obvious when making collections, DNA-based phylogeny has shown ever more clearly that the type of rot is a far more significant guide to relationships than for instance the corticioid versus poroid distinction. Brown-rotting species seem never to share a genus with similar looking white-rotters. Around 20% of *Polyporales* are brown-rotting but rather few species in other orders. Most occur in northern latitudes and exclusively on conifer hosts.

Brown-rotting corticioids are very unusual except in the *Boletales* where all are brown-rotting (*Coniophora*, *Serpula* etc.). The only other brown-rotting British corticioids we are aware of are the two species of *Dacryobolus*, belonging in the same *Antrodia* clade as *Crustoderma*, and the two uncommon species of *Jaapia*, in the small totally brown-rotting order *Gloeophyllales*.

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Notes and Records

Alick Henrici[1]

I discuss just two topics in this issue, one at the cutting edge of modern taxonomy, followed by one going back more than 150 years to the world of Berkeley & Broome, thus well before the foundation of the BMS. It was merely the BMS 125th anniversary that was celebrated this year at its Spring meeting. One talk given there was a very thoroughly researched account by John Edmondson of the life of Mrs Lloyd Wynne, a name surviving in *Marasmius wynneae* and several other species named in her honour. I add here some notes on the species named after her and their subsequent fate, a topic covered by Edmondson in less detail than his meticulous account of what little is known of the life of this remarkable woman.

Carving up *Cortinarius*

It had to happen one day. It is starting to happen now: a carve-up of the largest genus in the agarics into a set of smaller monophyletic genera. The first steps have been taken in Liimatainen *et al.* (2022), entitled *Taming the beast: a revised classification of Cortinariaceae based on genomic data*. This proposes the treatment of *Cortinarius* as currently understood in ten genera, seven of them new, which reads like something important, so I discuss it here at some length.

In the last 25 years or so dramatic falls in the cost of sequencing have allowed the use of multiple genes to unravel phylogeny. ITS helps to sort out closely related species, but ever larger combinations of genes are now used to clarify the deeper nodes in phylogenetic trees. The abstract at the head of this paper summarises its methodology in terms that unfortunately mean nothing to me: “Targeted capture sequencing is used for the first time in fungal taxonomy in Basidiomycetes. It provides a cost-efficient way to produce -omics data in species-rich groups”. Be that as it may, the results are significant. The earliest branches in the tree of *Cortinarius* have now emerged with sufficient clarity for some of these to be safely hived off into separate monophyletic genera.

It needs stressing that this paper takes only the first steps. It is only these early-diverging parts of the genus, broadly corresponding to sg. *Phlegmacium* as currently understood, that are now split into nine of the ten genera advocated. The tenth is of course *Cortinarius* itself, still split only into subgenera, and awaiting further clarification. However the British species are now assigned to ten subgenera, rather than just the three other than *Phlegmacium* now in use. *Dermocybe* for instance becomes a subgenus in this treatment, rather than a section of sg. *Cortinarius* (as in *Funga Nordica*) or a genus (as at times in the past, and possibly again in the future). *Telamonia* remains huge, losing only two small groups to other subgenera.

Nearly all the changes here at generic level, and thus triggering name changes, stem from splitting sg. *Phlegmacium* into three genera, all quite large, these being *Phlegmacium*, a new genus *Calonarius*, and (surprisingly?, see below) the existing genus *Thaxterogaster*. Sadly, morphology fails in general to reflect the clear DNA differences that underlie these genera, though for instance all the large group of ‘Calochroi’ are now placed in *Calonarius*. Only five other British species receive name changes:

* The only two cystidiate members of sg. *Phlegmacium* (*C. crassus* and *C. rubicundulus*) move to a new small genus *Cystinarius*.

* Three yellow-orange species, all with distinctive odours, *C. limoneus*, *C. callisteus*, and *C. tofaceus*, currently in sg. *Cortinarius*, move to another new small genus *Aureonarius*, sister to *Calonarius*.

The other four new genera are all small, two confined to the southern hemisphere, the other two also unknown in Britain. All the new genera have been given names ending in …narius, as a reminder of their origins and thus also retaining the masculine gender of *Cortinarius*. *Phlegmacium* unfortunately is neuter, so species such as *Cortinarius argutus* and *C. vulpinus* become *P. argutum* and *P. vulpinum*. *C. glaucopus* however doesn’t follow suit. Its name is a noun (pus = foot), and not being an adjective it does not follow the gender of its genus. Tricky!

Thaxterogaster is a genus described by Singer in 1951 for a group of American and Australian species, gasteroid and largely hypogeous, and thus for Singer entirely outside the *Agaricales*.

However, it has long been known to be closely related to *Cortinarius*. It here includes around 20 British species, none gasteroid, the majority phlegmacioid (notably the *C. purpurascens* complex), but also the sg. *Myxacium* species with a bitter cap cuticle (sect. *Vibratiles*).

Should we be following these changes?

What follows is a personal view. Whoever 'we' may be, I think we should wait. The relationships described are real enough. They follow comparable recent splits in other large genera such as *Psathyrella* and *Inocybe*. But acceptance now has for me a strong flavour of 'changing horses in mid-stream'. A wave of further changes to the rest of *Cortinarius* are sure to follow in the next few years, inevitably imposing further name changes. Then will be time enough to change.

I am reminded of a comparable earlier dilemma at family level, less crucial in that it didn't affect species names. *Cortinarius* in the 1960 checklist was one of 15 genera in the family *Cortinariaceae*. Today (e.g. in *Funga Nordica*) it is the only one left. In the 2005 checklist (Legon & Henrici) we still assigned 12 genera to this family, following the treatment in the *Dictionary of the Fungi*, 8th Edn. 1995. By then the 9th Edn. 2001 was already available, which had already moved some of these 12 elsewhere. It wasn't followed on the stated grounds that "the molecular position is as yet too fluid with too many gaps to form a satisfactory basis for a detailed classification". The reorganisation of *Cortinarius* is now similarly still fluid.

This paper has received some adverse comments on the grounds that the major new genera described appear to be indistinguishable short of sequencing, and thus a step in the wrong direction. The counter argument is that there are two quite distinct goals to be aimed at when classifying fungi (or indeed any life forms): Goal A: helping species identification, Goal B: understanding the evolutionary tree. Linnaean binomials were designed with Goal A much in mind; this paper reports an important step towards Goal B. Workers towards this goal have to use an uneasy mix of the Linnaean hierarchy plus the rank-independent concept of clades to express their results. Workers towards Goal A have also to compromise at times and offer keys to groups of species that merely look similar but in fact belong in several genera. This is already essential in some areas of the boletes, but is likely to spread as ever more genera get split up into more truly homogeneous units.

Summary

The following details are only likely to be of interest to true *Cortinarius* aficionados. The keys and sections referred to are those of *Funga Nordica*. This order of treatment is also closely followed in Kibby (2021). All the proposed changes relevant to British species are summarised. The further subgenera listed here as destinations are all retained within the genus *Cortinarius*.

sg. ***Cortinarius***
Key A sect. *Cortinarius* to sg. *Cortinarius*
Key B sect. *Veneti* to sg. *Leprocybe*
Key C sect. *Orellani* to sg. *Orellani*
Key C sect. *Limonii* + sect. *Callistei* to the new genus *Aureonarius*
Key D sect. *Dermocybe* to sg. *Dermocybe*.

The three subgenera listed here other than sg. *Cortinarius* could well end up in a future reorganisation as components of a single genus reinstating the name *Dermocybe*.

sg. ***Myxacium***
Key A sect. *Myxacium* retained
Key B sect. *Defibulati* retained
Key C sect. *Delibuti* to sg. *Camphorati*
Key D sect. *Vibratiles* to *Thaxterogaster* p.p.

sg. ***Phlegmacium***

As well as the main 3-way split outlined above, three species move elsewhere:

- *C. caperatus* (the former *Rozites caperatus*) to sg. *Paramyxacium* (a largely southern hemisphere subgenus)
- *C. infractus* to type of a new sg. *Infracti*
- *C. subtortus* to sg. *Camphorati*.

sg. ***Telamonia***

All species in 16 of the 18 keys A to R are retained. The two exceptions are:

- Key C sect. *Anomali* to sg. *Camphorati*, now forming its major part, joined there by other species with broadly globose spores: sect. *Delibuti* from *Myxacium* and *C. subtortus* from *Phlegmacium*.
- Key K sections *Acuti*, *Obtusi*, *Fragrantiores*, all with an iodoform smell, to the new sg. *Iodolentes*.

The species named for Mrs Lloyd Wynne

Around 20 years ago I made some unpublished notes on the five species named after Mrs Lloyd Wynne by Berkeley & Broome, all described in their long-running series 'Notices of British Fungi', four from the area around her husband's estate at Coed Coch in N.Wales (Denbighshire), and one from a hothouse in Kew. Only one of these is no longer in use (found to have an earlier name). I had assumed, in a markedly sexist way, that she had caught the foraying bug from Berkeley on his many visits to this mycologically productive area. Not so! She was a self-starter in mycology and respected as an equal in the man's world of the Woolhope Club that met in Hereford and preceded the founding of the BMS. Berkeley visited because she was already organising forays there. He listed Coed Coch as a site for some 30 of the 'above a thousand' species of macrofungi treated in his 1860 Outlines of British Fungology. More significantly he dedicated that whole work to her "as a small tribute to the zeal with which she has studied the numerous fungi of her beautiful country".

As something of a pedant, what I had noticed was Berkeley's spelling inconsistencies, having named her first three species 'wynnei' and only the later two with a feminine ending 'wynniae', while some of my books were now spelling some of these as 'wynneae'. It turns out that only the last of these should now be used, there being rules laid down in the code for the formation of commemorative names, any deviations being classed as 'orthographic errors to be corrected'.

I have since investigated two other such commemorations. Derek Reid described *Lepiota marriagei* collected in Somerset by a Mrs Marriage (now a *Leucoagaricus*). This looked wrong until I found that Reid specifically but ungallantly states that he had named it for her husband. I also found that *Mycena belliae* had been named for the plural 'Misses Bell', and should thus have a genitive plural ending and become *M. belliarum* (I'm old enough to have been schooled in Latin grammar). On the strength of this the name got changed in Index Fungorum. However, Aronsen & Læssøe (2016) in their *Mycena* book beg to differ, writing "We prefer to accept that Johnston and Berkeley were aware of Latin rules and preferred to name the fungus after one of the sisters". I'm quite sure there were no formalised rules for multiple dedicatees at the time. But enough of this nit-picking!

Details follow of the subsequent history of the five species described in 'Notices of British Fungi'.

Marasmius wynnei No. 802, 1859
Now a well-known species *M. wynneae*, though in the interim some authors (eg. Carleton Rea, Kühner & Romagnesi) wrongly reduced it to a synonym of the later *M. globularis* Fr. .

Polyporus wynnei No. 807, 1859
Now *Loweomyces wynneae*, well illustrated in B&K Vol.2 and FTE. This has also been combined in *Polystictus*, *Leptoporus*, *Fibuloporia* and *Tyromyces*, this last still used in the deliberately 'conservative' treatment by Ryvarden & Melo (2014).

Agaricus* (*Entoloma*) *wynnei No. 1342, 1873
Now *Entoloma wynneae*, as far as I am aware still known only from the Coed Coch type collection and three others by Alan Outen in 1995, 1996 and 2005, these all from Peter Orton's favourite sawdust heap near the school where he taught at Rannoch, Perthshire. This is ironic since Orton had omitted it from the 1960 checklist as 'doubtful'. Outen's photo of his 1995 collection appears in Noordeloos (2004) attributed to Derek Reid. See Outen (2009) for an explanation of this mishap together with a description and a copy of his photo.

Hiatula wynniae No. 1772, 1879
Now *Leucocoprinus wynneae*. Described from a hothouse in Kew. Not seen there since, but now known in the wild from Queensland and Sri Lanka fide Pegler (1966) in his revision of the list of agarics known from Kew Gardens. *Hiatula* Fr. was a genus for ringless lepiotoid species, now abandoned since no material survives to clarify the identification of its type species.

Hygrophorus wynniae No. 1781, 1879
Now *Chrysomphalina grossula* as in CBIB, illustrated in Kibby Vol.2 and FTE. Also placed in recent literature by Bon in *Cuphophyllus*, by Clemençon in *Camarophyllus*, and earlier by Singer first in *Omphalina* and later in *Gerronema*. Berkeley overlooked that he had himself described it already in 1875, though only as a variety *abiegna* of *Agaricus* (*Omphalina*) *umbelliferus*, now a *Lichenomphalia*. He was evidently unaware that Persoon had already described it in 1828 as *Agaricus grossulus*.

In addition to these five species of agarics, Berkeley and his American co-author Curtis named a new asco genus *Wynnea* (*Sarcosomataceae*) still in current use, which has since spawned a further related genus *Wynnella*. So the name of Mary Lloyd Wynne lives on around the world.

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Urocystis on *Ranunculaceae* in Britain

Bruce Ing[1]

At one time all leaf blister smuts on *Ranunculaceae* were considered to be *Urocystis anemones*. However, it is now known that the smuts in this genus are highly host specific. Studies by Ainsworth & Sampson (1950) (A&S) and Mordue & Ainsworth (1984) (M&A) indicate that many other host genera, native and cultivated, have been infected in these islands, and thus many further *Urocystis* species are British. Most of these are listed in CBIB (Legon & Henrici, 2005). The list below includes one more added since (see under *Pulsatilla*) and two more added here (see under *Aconitum* and *Aquilegia*). The species are listed under host, in alphabetical order. In addition, British plants that are infected in Europe are listed so that they may be checked, if and when found. The object of this article is to encourage colleagues to search for these smuts and increase our knowledge of their frequency and distribution. Most appear to be rare but may be simply under-recorded.

Aconitum napellus (Monkshood) is infected by *Urocystis irregularis* (G. Winter) Săvul. Although not previously recorded as a British species I have recently collected material from two gardens in Wester Ross. The smut is widespread in Europe.

Anemone coronaria (Garden Anemone) is suggested as a host by A&S, and implicitly by M&A, on cultivated Anemones. In Europe it is infected by *Urocystis antipolitana* Magnus. No material has been confirmed, so it is not listed in CBIB, but the host is commonly grown in our gardens so it is worth looking out for it.

Anemone nemorosa (Wood Anemone) is commonly found carrying *Urocystis anemones* (Pers.) G. Winter *sensu stricto*.

Anemone ranunculoides (Yellow Anemone) is naturalised in southern England and is frequently found with *U. anemones sensu stricto*.

Aquilegia species (Columbines) are host to *Urocystis aquilegiae* (Cif.) Schwarzman. The host is cited by M&A and CBIB as carrying

U. sorosporioides (see below, now confined to *Thalictrum*). There is a single record from London. In Europe the fungus is often on *Aquilegia caerulea*, which is widely grown in British gardens.

Eranthis hiemalis (Winter Aconite) is infected by *Urocystis eranthidis* (Pass.) Ainsw. & Sampson and this occurs on both cultivated and naturalised plants. The smut is not rare and has been found as far north as Easter Ross.

Ficaria verna (Lesser Celandine), although a very common plant, is rarely found with its smut, *Urocystis ficariae* (Liro) Moesz. There are a few records from England and Wales but the most recent record, in 2018, was from Kindrogan (sadly now closed) in Perthshire.

Helleborus viridis (Green Hellebore) is listed by M&A and CBIB as carrying *Urocystis floccosa* (Wallr.) D.M. Hend., which also occurs on *H. foetidus* and *H. niger* in Europe. It is rare in Britain.

Hepatica species (Liverleaves) in cultivation are included in A&S and M&A. The smut is *Urocystis syncocca* (L.A. Kirchn.) B. Lindeb. (syn. *U. hepaticae-trilobae* (DC.) Ainsw. & Sampson). In Europe it infects *Hepatica triloba*. It was recorded from Kew in 1890, and listed as an alien in CBIB.

Pulsatilla vulgaris (Pasque Flower) is listed by A&S and M&A as infected by *U. anemones*. The species involved is *Urocystis pulsatillae* (Bubák) Moesz, and was found in Hertfordshire in 2012 (CBIB, Update 6). The smut occurs on several *Pulsatilla* species in Europe, especially *P. alpina* (Alpine Pasque Flower), which is widely grown in British rock gardens.

Ranunculus species (Buttercups) are regularly attacked by *Urocystis ranunculi* (Lib.) Moesz, most frequently *R. repens* (Creeping Buttercup) but *R. acris*, *R. bulbosus* and *R. sardous* are also hosts. The smut is common everywhere.

Thalictrum species (Meadow Rues) are listed by A&S, M&A and CBIB as infected by *Urocystis sorosporioides* Körn. ex A.A. Fisch. Waldh. Native *T. alpinum* and *T. minus* and cultivated *T. aquilegifolium* are the host species. The smut is rare in Britain.

Trollius europaeus (Globe Flower) is rarely infected by *Urocystis trollii* Nannf., both in the wild and as a garden plant. The smut also occurs on cultivated *Trollius* species, more commonly than on our native species. It is rare but has been found recently in Perthshire and Easter Ross.

The following plants cultivated or native in Britain have never been recorded as infected here, but are in Europe.
Actaea spicata (Baneberry) is infected by *Urocystis carcinodes* (Berk. & M.A. Curtis) A.A. Fisch. Waldh.
Adonis annua (Pheasant's Eye) is infected by *Urocystis leimbachii* Oertel
Clematis alpina (Alpine Clematis) and *C. vitalba* (Travellers' Joy) are infected by *Urocystis mustaphae* Maire

Details of these, and all other species, may be found in Klenke & Scholler (2015).
Some of the accepted British species are also covered in Woods *et al*. (2018).

Acknowledgements
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Book reviews

The Lives of Fungi
A Natural History of our Planet's Decomposers

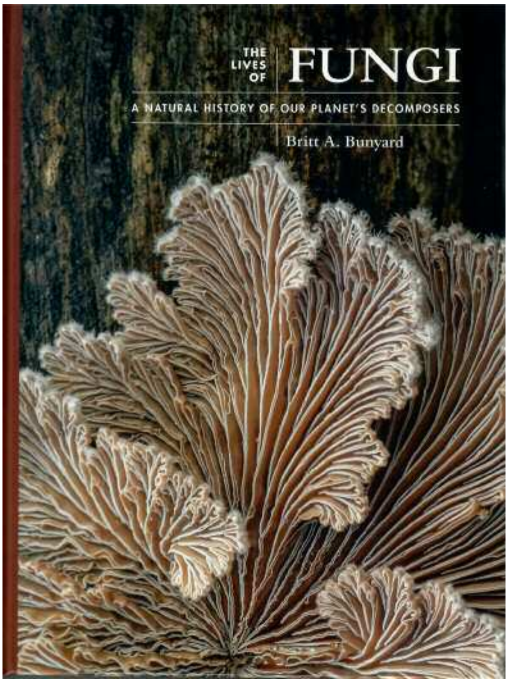
Britt A. Bunyard

Princeton University Press 2022
B5 size, 228 Pages
ISBN 978-0-691-22984-3
Ebook ISBN 978-0-691-23035-1
£19.99 NHBS.com & other online book sellers

This fascinating account of the natural history of fungi could not have come at a more appropriate time with fungi being a hot topic among the world's chief climate scientists, moving centre stage and into the environmental limelight. Not least for their ability to help store carbon in the soil, a big worry during these climate-warming decades.

I love this book's simple introductory, opening statement, "Everything depends on everything else" which then goes on to state that all living things have a reliance on fungi.

The book strives and largely succeeds in unveiling the mysterious, often hidden world of fungi, how they live and what they do, bringing the reader a wide range of fascinating examples and enlightening facts.



Each chapter has a number of sub-chapters that then describe particular fungi associated with the area/subject being discussed.

The introduction, What are Fungi? is an overview of what the book later goes on to cover in more depth, with topics such as biology, reproduction, diversity of form, survival modes, fungi and the future. The book is interspersed with wonderful, clear photographs, illustrating the various topics. One such picture in the introduction is a full page showing stages of a Red Palm Weevil being slowly engulfed by the insect killing fungi, *Beauveria bassiana* and *Metarhizium anisopliae*.

Fungal reproduction describes the myriad of strategies fungi have evolved to release their spores into the environment, from simply dropping them, to actively firing them or by producing the odour of rotting meat to attract flies to help disperse them. Zoochory, a word I'd not come across before, included in this chapter, is animal-mediated spore dispersal, our current knowledge of which is scant. The book asserts that as we learn more about this association, we may reveal that some of these associations are underpinning whole ecosystems.

Chemistry and Physiology draws the readers' attention to various, fascinating examples whose chemistry/physiology has brought the fungus notoriety, be it fungi that glow in the dark, fungi that resemble fruit, supposed aphrodisiac fungi, *Cordyceps* which fruits from caterpillar larvae in the ground, or the disturbing, historic trail of *Claviceps purpurea*, Ergot, an ascomycete fungus that grows on various cereal grains and which made its way into bread and caused absolute mayhem during the 1600's in America. Ergot poisoning causes strong hallucinations, madness and loss of limbs. It is now strongly believed that the witches of Salem were a result in part of Ergotism; where some 200 people were accused and 19 were executed for witchery.

The strange Corn Smut, *Ustilago maydis* and Beech Orange Fungus, *Cyttaria gunnii* are just two of the fungi covered in **Saprobes and Parasites**: **Parasites of Animals** and **Parasites of Plants**. The former fungus is now considered a prized, edible pathogen of maize, especially in Mexico, where it is commonly known as Huite le Coche. The latter, first found by Charles Darwin in 1839 during a stop over in Tierra del Fuego, is restricted to the Southern Hemisphere and to its host tree *Nothofagus*.

Pathogens, Pandemics and Scourges: **World Changing Fungi**, **Fungi through history** and **Human impact**, could not be a more apt chapter in these times of COVID 19 and the take-away message here is, despite scientific advances that have kept humans ahead of the race, just like with COVID, it's only a matter of time before the next microbe or human pathogen strikes, perhaps wiping out important sources of food, much like the potato blight did two centuries ago. An import statistic here is that food enough to feed 600 million people is destroyed every year just by the combination of Rice Blast, Wheat Stem Rust, Soybean Rust and Corn Smut.

Mutualistic Symbionts, fungus animal mutualisms, fungus plant mutualisms.
This chapter discusses the all important, mutually beneficial fungus-plant and fungus-animal relationships. Termites cultivating a fungus to feed young grubs or *Cerrena unicolor* and its close relationship with a 7.5 inch wasp (female) *Megarhyssa atrata*, Giant Ichneumonid Wasp (most of this length is from the extremely long ovipositor). Thankfully we don't have such wasps in Britain, these are in North America but we do have the fungus. Mycorrhizal fungi are discussed, both ecto- and endomycorrhizal and their importance for healthy trees, plants and forests.

The final two chapters, **Fungi & Humans** and **Fungi & The Future**, really bring to the fore the importance of fungi in our changing world, with particular emphasis on the carbon crisis and the potentially crucial role of arbuscular mycorrhizal fungi (AM).

AM are soil fungi which partner with most plants across the planet, including important crop species. Scientists are now looking at producing crops based around AM fungi, as the nutrient uptake via AM fungi is unsurpassed. More crucially the ability of AM fungi to pull carbon dioxide out of the environment and into the soil. Glomalin is a sticky protein produced by AM and their associated soil microorganisms, it's like an organic glue, it binds and helps structure soil. 30-40% of a glomalin molecule is carbon and could account for as much as one third of the worlds soil carbon. This is more than plants and environment combined. Scientists are now revisiting their climate change model as a consequence of this finding.

This is a book for those that are interested in the role of fungi, what they actually do in the natural world, how they have evolved and co-evolved, our dependent relationship with fungi and how fungi could be our saviour.

All this is brought to the reader with a clear, easily understandable approach, supported by excellent photography.

Given that the book covers so much ground, imparting both common knowledge (to the already initiated) and more cutting edge information, the price is more than reasonable.

Although the focus of this book is fungi, it reflects on all living things and how we all depend on each other for our survival. Everything depends on everything else.

Andy Overall

The genus Cortinarius in Britain

Geoffrey Kibby & Mario Tortelli
Self Published April 2022
A4 size, 150 Pages, hardback
ISBN 9 780957 209480
£44.99 Summerfield Books, NHBS & other online book sellers

Historically, the genus *Cortinarius* would have brought dismissive shrugs and lots of head shaking among field mycologists, especially species belonging to subgenus *Telemonia*. These are the most often encountered *Cortinarius* that give away very little in their subtle differences from one another, being often small and some shade of brown.

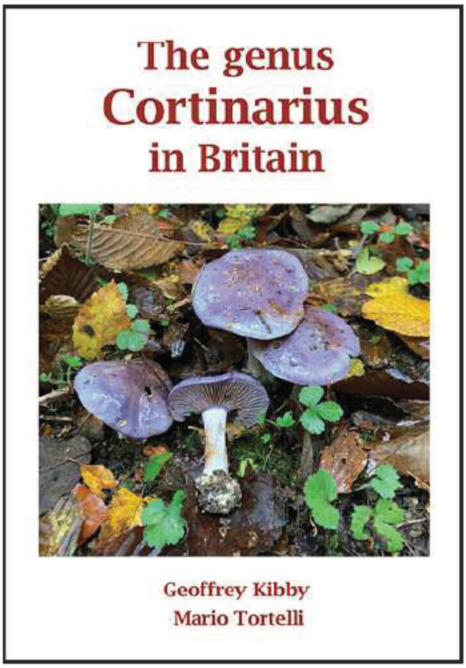
This book begins with a look at the history of the study of *Cortinarius* with special mention of the works of Peter Orton, a brilliant British Mycologist who produced in 1955 & 1958 *The genus Cortinarius* parts I & II. In the intervening years, very little has happened with the genus in Britain until now, this, the first major work on *Cortinarius* in Britain for over 60 years.

Compared to Kibby's other publications the layout of this book is closer to his recent volume guides, *Mushrooms and Toadstools of Britain & Europe*, rather than his keys to certain British genera, although that is essentially what this book is. The guide layout with good keys before each subgenus, with three species described and pictured per page, helps make this more ordered, concise and clearer to the user.

One notable difference with this publication is that Kibby is not alone; he is joined by the very knowledgeable and experienced field mycologist of 40 years, Mario Tortelli, who has a special interest in *Cortinarius* having studied them in Britain and across Europe. Three very important works are cited as the basis for past British identifications: *Cortinarius Flora Photographica* (5 volumes), *Atlas des Cortinaires* (24 Vols) and *Il Genere Cortinarius in Italia* (5 vols). These works were mostly produced pre-DNA sequencing, which makes this current work, in which 43% of collections illustrated were confirmed via DNA sequencing particularly valuable. Those species confirmed as British by molecular sequencing are indicated by a large red dot.

Mention is made of the crucially important work currently being carried out on the genus by Liimatainen *et al* and others, which the authors acknowledge helped give them the confidence to approach such a difficult topic. Following this molecular revolution, interest in *Cortinarius* is now at an all time high, making this volume a timely publication.

With use of quality photographs, chief characteristics are then covered, highlighting stem shape, veil types, cap surfaces, gill colour or any colour changes due to bruising or when KOH is applied. The various spore shapes and ornamentation are nicely portrayed with the use of clear micrographs.



The genus
Cortinarius
in Britain

Geoffrey Kibby
Mario Tortelli

A thorough glossary helps the user navigate any unfamiliar terms and the 'bibliography with further reading', points the user towards important works and papers on *Cortinarius.*

Importantly, the authors explain that they have not attempted to over complicate and confuse by using numerous sections and subsections and go for a more practical approach utilizing the various characters of the subgenera. A key to the four subgenera, *Myxacium*, *Phlegmacium*, *Cortinarius* and *Telemonia* follows with an overview and key to each of these subgenera as they appear. Over 330 species are covered, some of which are illustrated for the first time. And as well as presenting us with a wonderful pictorial account of these species the authors state that the book was conceived or can be viewed as a visual baseline checklist of all presently known British species, bar a very few omissions.

There are three species per page, illustrated in most cases by both a photograph and a Kibby illustration and a spore drawing. Most books will not have both photographs and illustrations of species. The meaning of each Latin or Greek species name is interpreted e.g. venetus = sea blue. All photographs are taken by the authors unless otherwise listed in acknowledgments.

Descriptions include general info on size, colour, taste & smell, any chemical reaction, spore size and ornamentation. Notes give you info on habitat, distribution and anything important attributable to the given species. Species with two stars are not authentically British but are considered likely to be here.

To say that this book is eagerly awaited among British mycologists, especially those with a special interest in *Cortinarius*, would be a massive understatement. Compared to other recent and not so recent works on Cortinarius, this book represent excellent value for money.

This will undoubtedly be the go-to book on British *Cortinarius* for many years to come. A super achievement and crucial piece of work from two of our foremost British Field Mycologists. Let's hope its not another 60 years before we see the likes of such work again.

Andy Overall

Field Mycology

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