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

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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 merulioid 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

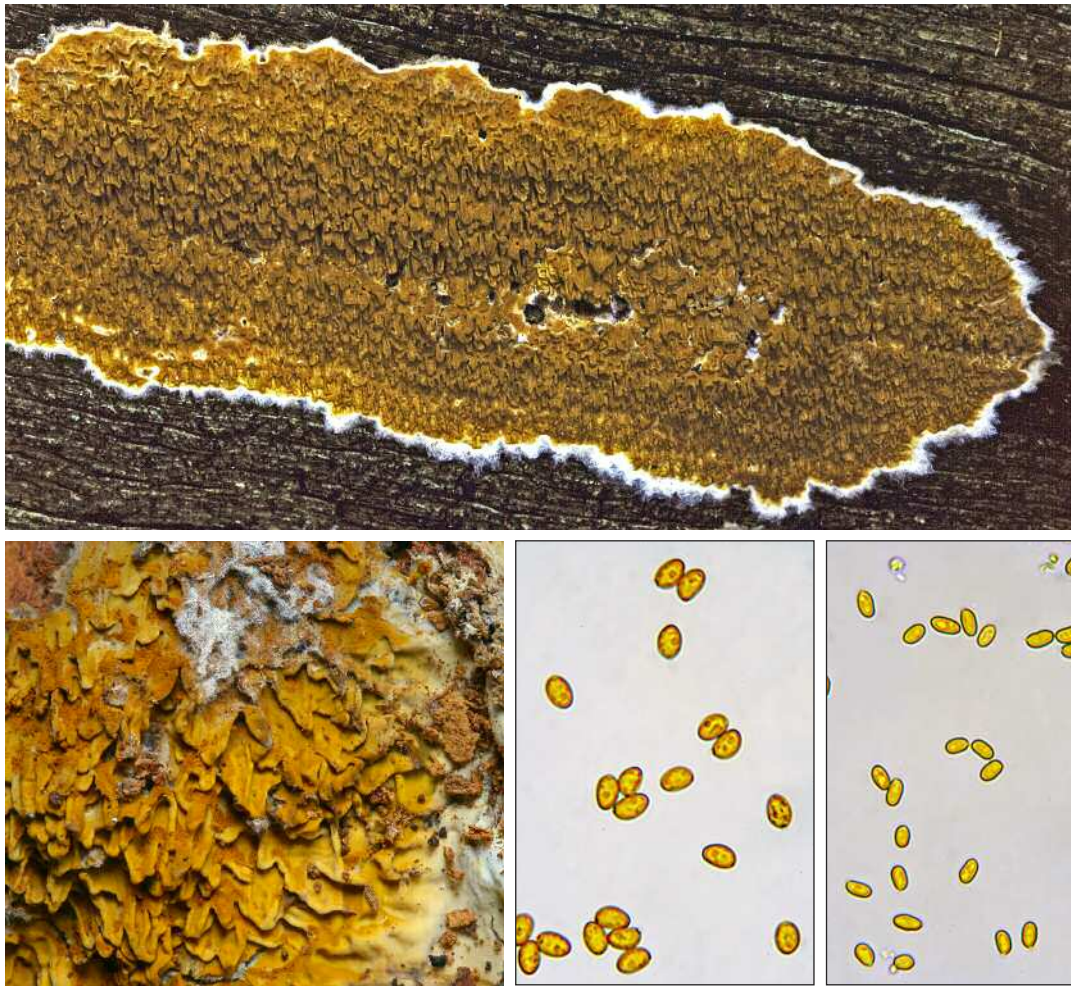

Fig. 1. *Serpula himantioides* sporulating on (top) fallen oak in Windsor Forest (scanned colour slide) and (lower left) inside live hollow oak in Blenheim High Park K(M)237678. Basidiospores from prints in water (to same scale) from (lower centre) *S. himantioides* from inside a fallen oak at Blenheim 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.

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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.