

Hydropus inopinatus - a new species described from the UK

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Background

In August 2021 a mysterious small mycenoid mushroom was found by Barry Webb in Buckinghamshire. It appeared on a piece of damp well-rotted *Pinus* which he'd collected from Burnham Beeches. For about a year its identity remained a mystery — even after amplification and sequencing by Eric Janke and Aberystwyth University respectively — until further collections were made from two different Hampshire sites, by Mike Harrison and Eric Janke. All three collections turned out to have matching sequences, placing the species clearly in the genus *Hydropus* s.s. although they did not cluster with any other currently available sequence. This was reported in FM 24(1) - *Hunting for the identity of a Hydropus species found in Buckinghamshire and Hampshire*, Cullington *et al.* (2023) - comprising the full story, species description and photos, phylogenetic tree with GenBank accession nos.

The delay before publishing

Though we were already of the opinion that the species was likely to be genuinely new, there were two obstacles preventing formal publication. Firstly, alongside our natural instinct to err on the side of caution, there was a basic practical issue. Any newly described species must have a designated type collection to be kept in a fungarium as voucher for future reference and study. This we did not have! All existing material from our first three collections had been used up for sequencing or microscopic study. This is a tiny mushroom with cap only a few mm across when mature. Furthermore when each collection was made the possible significance of its identity was not realised therefore minimal material had been collected.

Secondly, further research was needed to ensure that the species had not already been described in some paper unbeknownst to us. We'd already received advice from *Hydropus* expert Jerry Cooper in New Zealand supporting Eric's placement of the species within the genus, now considerably reduced (see our previous article for

further explanation). Cooper's feelings were that our species was likely to have a northern European distribution rather than worldwide, that as such it was one of very few European species within *Hydropus* s.s., all of which are rare, and he encouraged us to publish. As belt and braces, Eric now contacted Vladimír Antonín, working on the genus in Europe and best placed to advise us if we had a genuinely undescribed species. Back came the news that he had no knowledge of anything matching having been reported, thus in effect giving us the go ahead. What we lacked now were further collections to provide a designated type and to broaden our experience of the species in order to fill out the description.

More recent collections

In October 2022 — a few months after our two Hampshire collections but in fact prior to our FM article—unbeknownst to us Mario Tortelli found what turned out to be this same species in Mereworth Woods, Kent (Fig. 1). Struggling to determine it even to genus, he sent a sample to Alvalab (in Spain) for sequencing, receiving the result that it matched nothing known. Realising how similar in appearance Mario's collection was to our recently published photos in FM, a check was then made by Geoffrey Kibby comparing Mario's Alvalab sequence to ours now in GenBank. Bingo! It proved to be a 99.74% match. Interestingly, however, this find was not from conifer wood but from a well rotted *Castanea* stump. No material or notes from this collection survive, just Mario's convincing photo and the sequence remain.

In 2023, in January, August and October, Mike Harrison made four further sightings, all from well-rotted conifer wood but at different locations within Morgaston Wood, The Vyne, the Hampshire site where he'd made his original collection the previous year. One of his August collections was then successfully sequenced by Eric, providing a further exact match (this now the fourth entered into GenBank as *Hydropus* sp.) but unfortunately we had just the record and

the sequence - no remaining material, notes or photo.

In July 2023 Barry Webb noticed the species appearing once again, fruiting quite prolifically in Burnham Beeches on two different rotting *Pinus* stumps, one being the stump from which the wood for his original collection came, the other from a totally different area. He made a further collection from Penn Wood several miles away, though this time on well-rotted *Picea*. Barry took me to both sites and together we endeavoured to make viable collections as best we could though mature perfect specimens were hard to come by.

These tiny insignificant mushrooms are clearly irresistible to the local slug population!

Several times Barry deliberately camouflaged miniscule immature clusters with litter in the hope that they'd be further developed in a day or so, only to find no sign of them on his return - just the telltale trail of slime with some rather satiated gastropods nearby! Though we could detect no smell from the species it was clearly emanating some alluring signal. Finding perfect collectable specimens proved a challenge: besides being tiny, when large enough to pick they tend to have a coating of adhering woody debris (possibly due to the slug slime?), also when dried they shrivel to such an extent that there's virtually nothing usable left to work with. We did eventually manage to make a reasonable collection from the original Burnham Beeches spot, providing us with a sporeprint and morphological notes in the hope that this would be our designated type collection (Fig. 2).

A snag!

Though we were confident that this latest Burnham Beeches collection was a perfect match for our species, we needed a matching DNA barcode to prove it beyond doubt. Frustratingly over the ensuing months Eric, despite his best efforts, made numerous unsuccessful attempts to obtain a useable amplification, trying every method he could think of. Whether this was due to slug / fungal / other contamination or inefficient drying technique we have no idea - these things happen! In desperation I decided to deplete our valuable collection further by sending him another cap, and failing that we had the spore print as a last resort though I was reluctant to lose that. However, in June this year I received the



Fig. 1. *Hydropus inopinatus*, Mereworth Woods, Kent, 12 October 2022. Photograph © Mario Tortelli.



Fig. 2. *Hydropus inopinatus*, holotype K-M001442993, Burnham Beeches, Buckinghamshire, 5 July 2023. Photograph © Penny Cullington.

encouraging news that he'd succeeded with the latest sample and that the results were back from Aberystwyth University with a 100% match to Barry's original collection. Thus we were now in a position to go ahead with publication.

Taxonomy

Hydropus inopinatus P. Cullington, M. Harrison, E. Janke, & B. Webb, sp. nov.

Registration Identifier IF901514

Fig. 2

Etymology: *inopinatus* means unexpected and reflects the authors' surprise when sequencing revealed the species as belonging to *Hydropus* s.s.

Holotype: UNITED KINGDOM, England. S. Buckinghamshire: Burnham Beeches, in mixed woodland on a very rotten soggy *Pinus* stump near a stream. Alt. ca. 54 m.; 51°33'26.61"N, 0°37'14.34"W; 05 July 2023, B. Webb & P. Cullington HFRG_PC230705_1; Holotype accessioned in K as K-M001442993, GenBank accessions PP982811 & PP992745.

Diagnosis: A small mycenoid greyish white mushroom with a smooth partly translucent pileus, decurrent lamellae, a finely pruinose stipe, 2-spored basidia, spores amyloid, smooth, amygdaliform, 8–9 x 5–6 µm, cheilocystidia clavate to subutriform, pleurocystidia not seen, caulocystidia as cheilocystidia. Substrate damp very rotten stumps, both coniferous and deciduous.

Description

Habit mycenoid. **Pileus** 1–5(6) mm diam, at first inrolled convex, as it expands margin deflexed and undate, eventually ± applanate with sunken centre and margin ± reflexed in places, thin-fleshed, outer half translucently striate, inner half smooth, surface at first finely pruinose, this less apparent with age, dull greyish white at first, becoming white in outer half, retaining grey tinge in inner half. **Lamellae** (sub)decurrent, at first arcuate then horizontal, medium to widely spaced with blunt uneven edges, L = 14–18 interspersed with lamellulae variable in length, white. **Stipe** central, to 8(10) x 1–2 mm, ± cylindrical with slightly swollen clavate base at first, either straight or curved dependent on the angle of emergence from the substrate, white, entirely finely pruinose, base strigose with fine mycelial

strands attaching to substrate; stipe when cut exuding colourless fluid. **Odour** and **taste** not observed.

Basidiospores 8–9(10) x 5–6 µm, smooth, amyloid, ellipsoid to subphaseoliform. **Basidia** 78–110 x 18 µm, mainly 2-spored, some 1-spored, some 4-spored, with oil droplets within, sterigmata 15–18 µm long. **Cheilocystidia** 26–40 x 10–12 µm, clavate to flexuose cylindrical or utriform, some with pedicel, forming a palisade, finger-like protuberances seen in some specimens. **Pleurocystidia** not seen. **Pileipellis** a cutis of short cylindrical cells with rounded ends. **Caulocystidia** similar to cheilocystidia, clustered in bundles throughout the stem length. **Clamps** not observed.

Substrate and habitat

Growing gregariously, loosely clustered on damp very well rotted stumps or wood having fallen from stumps having partly disintegrated and in contact with damp soil. Collections known so far mainly on *Pinus*, one on *Picea*, one on *Castanea*, from Buckinghamshire, Hampshire and Kent.

UNITE Species Hypothesis (1.5% threshold)
SH0972688.10FU

Additional specimens examined

Buckinghamshire: Burnham Beeches, 31 Aug. 2021, B. Webb HFRG_BW210831_1, GenBank accession (ITS + LSU) OQ133570, no material remains (Fig. 1 in Cullington *et al.*, 2023). *Ibid.*, 2 Jul. 2023, B. Webb & P. Cullington K-M001443237. *Ibid.*, 7 Jul. 2023, B. Webb & P. Cullington K-M001443238. *Ibid.*, 21 Jul. 2023, B. Webb & P. Cullington K-M001443236. *Ibid.*: Penn Wood 15 Jul. 2023, B. Webb & P. Cullington K-M001443239.

Hampshire: The Vyne, Morgaston Wood, 22 Sept. 2022, M. Harrison HFRG_MH220922_1 (in GenBank as HFRG_MK220922), GenBank accession OQ133585, no material remains. *Ibid.*, 12 Aug. 2023, M. Harrison Hampshire Fungus Recording Group Fungarium HFRG_MH230812_1, GenBank accession OR896139. *Ibid.*: Waggoners Wells, 18 Sept. 2022, E. Janke HFRG_EJ220918_2, GenBank accession OQ133584, no material remains (microcharacters shown in Figs. 3–5 in Cullington *et al.*, 2023).

Kent: Mereworth Woods, 12 Oct. 2022, M.

Tortelli SFSG_MT221012_1, GenBank accession PP982809, no material remains (Fig. 1).

General comments

It seems remarkable that this small yet quite distinctive species should not have been described until now. Bearing in mind that one of its notable characteristics appears to be its habit of fruiting in troops (as is evident from our photos), another that – at the Burnham Beeches location at least – it has fruited repeatedly in the same spot over several years [see also postscript below] it seems unlikely that it is genuinely rare. A third characteristic of particular note – one which we should possibly have picked up on earlier to point us to genus – is the watery translucent fluid contained within the stem, this after all the feature to which the genus name refers. However, *Hydropus* is by no means unique amongst mycenoid genera in having this feature though it may also have been a contributory factor in the placing of some species – now moved elsewhere – within this genus prior to the DNA era (See FM 24(1) for further discussion re this). The genus is large, though of the 179 species listed to date in Species Fungorum the vast majority are tropical, very few are European, and the four accepted as British are amongst those now placed in different but closely related genera, leaving our new species as the sole UK representative within *Hydropus* s.s. – its barcode placing it near to the generic type, *H. fuliginarius*, an American species. (See phylogenetic tree Fig. 4).

It is hoped that following this publication more collections will materialise to give us further information about range and host substrate. All records so far are from southern England, collected mostly in August but also in October with one surprisingly in January. It would appear that as long as the wood substrate is damp, really well rotted and disintegrating this species is not that choosy about the host tree, having been recorded on both conifer and deciduous woods. It remains to be seen if this is borne out in future.

A final general observation regarding records of new species

One problem we as field mycologists are experiencing more and more is that in the last few years the growing number of new species both to science and to the UK are not yet covered in any available generalist keys. Keeping abreast of new developments and discoveries has become no easy task. If not prepared to spend considerable time searching through the numerous papers (not necessarily in English) in which such species are described, one has little or no chance of taking them into account as part of ones identification process. Not everyone has the facility or finance to have collections sequenced, consequently it is likely that many interesting and potentially valuable collections go either mis- or unidentified.

In an ideal world the routine practice of keeping photos, micrographs, notes, dried samples of all such collections is the way to go in the hope that the day of easily available cheap



Fig. 3. *H. inopinatus*, Burnham Beeches, Buckinghamshire, July 2024. Photograph © Barry Webb FRPS.

barcoding is not that far away. How many of us have the time and dedication to do this? Life's too short...

Acknowledgements

Thanks are due to many people who've made this publication possible: to the co-authors of our new species, Barry Webb, Mike Harrison and Eric Janke, also to Mario Tortelli, for finding and making collections; to the British Mycological Society and City of London Corporation (owners of Burnham Beeches) for providing some funding for sequencing; to Aberystwyth University and Alvalab for sequencing; to Lee Davies for curation at RBG Kew; to Paul Kirk for registering the species in Index Fungorum; to Geoffrey Kibby (who suggested the epithet) and Martyn Ainsworth for valuable help and advice. Finally I'd like to add particular thanks to Eric Janke for his dedication, skill and persistence in preparing

the extraction and amplification of the samples ready for sequencing, to say nothing of the analysis, collation and subsequent taxonomic and phylogenetic interpretation of the results.

Postscript

Having finalised this article (in early July) I received the news from Barry Webb that the recent persistent rains have triggered the reappearance of this enigmatic little mushroom. At Burnham Beeches it's coming up not only on the original *Pinus* stump but also on its neighbour not far away, still only 3–4mm tall and as yet undamaged by slugs (Fig. 3).

Reference

Cullington, P., Harrison, M., Janke, E., (2023). Hunting for the identity of a *Hydropus* species found in Buckinghamshire and Hampshire. *Field Mycol.* 24(1): 5-9.

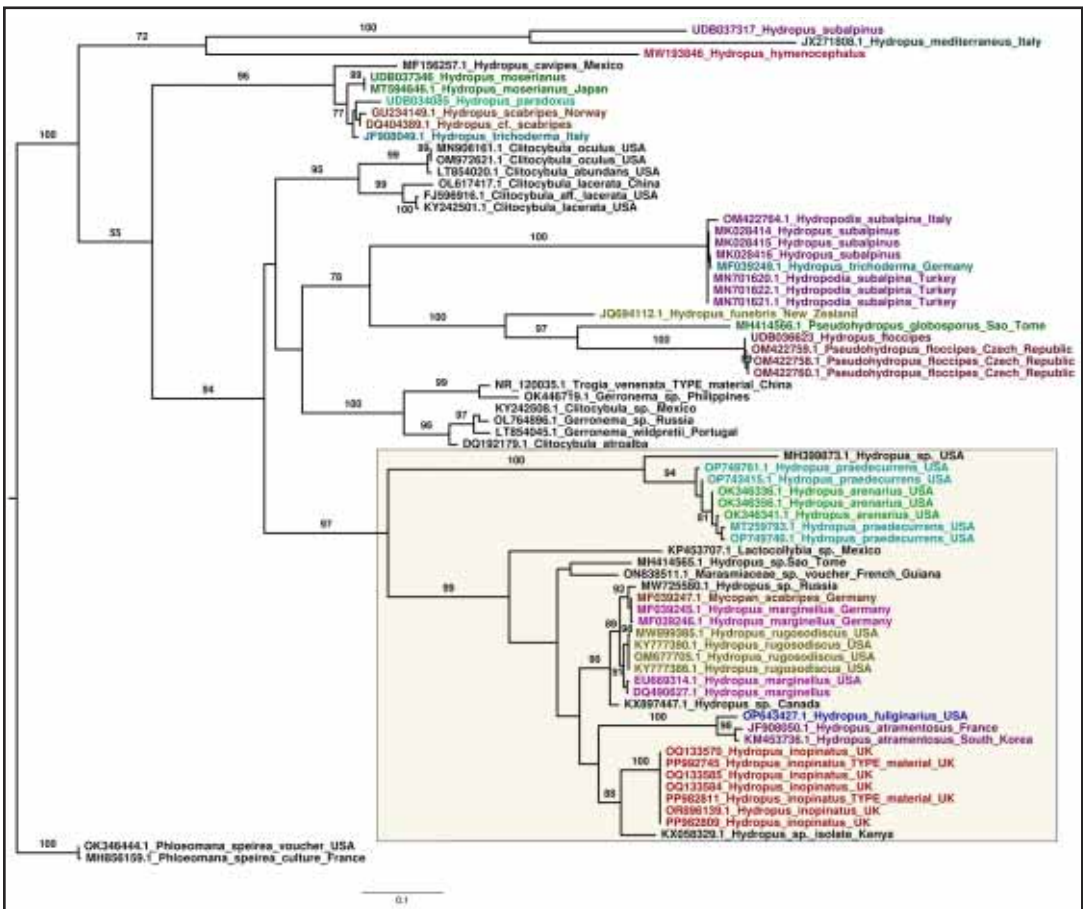


Fig. 4. Phylogenetic tree of the ITS region showing position of the seven UK collections of *H. inopinatus* alongside *H. fuliginarius* within the *Hydropus* sensu stricto clade (shown in the coloured box) together with other *Hydropus* sensu lato species listed in GenBank and UNITE, which are highlighted.