SOME PROBLEMS IN THE GENUS *PLUTEUS*

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The genus *Pluteus* is easily recognised by the combination of smooth pink ellipsoid spores, free gills, lack of any veil and habitat usually, but not always, on dead wood. But there are several places within the genus where distinctions between individual species are not yet fully resolved, and mycologists with broad and narrow species concepts have provided very different treatments. We discuss a number of issues within these problem areas.

Treatments available

The standard account of *Pluteus* in Britain is by Orton (1986) in *British Fungus Flora* Vol.4 (BFF4). In the introduction he writes "This work summarizes some thirty-five years work by me on this group but must not be regarded as complete, for I am sure a few more species yet remain to be discovered and there are quite a few species as yet imperfectly known". He recognised 43 British species including two described by Pearson (1952) and seven out of eight earlier described by Orton himself (Orton, 1960).

Orton's account was soon followed by a second detailed treatment, that of Vellinga (1990) in *Flora Agaricina Neerlandica* Vol.2 (FAN2), incorporating studies by Vellinga & Schreurs (1985). She adopted a much broader species concept and treated only 29 species (four of these unknown in the Netherlands). Nine of the ten Pearson/Orton novelties were considered to be synonyms of previously described species, the only one she allowed to survive being *P. pallescens* P.D. Orton 1960. Ironically, this is the very one that Orton discarded in 1986; he recognised, after comparison of type material, that it was identical to *P. satur* Kühner & Romagn. 1955.

Citérin & Eyssartier (1998) compared these two approaches and provided a key of their own, but added little of substance. The recent treatments in CBIB (Legon & Henrici, 2005) and by Heilmann-Clausen (2008) in *Funga Nordica* both follow FAN2 in most respects. The broad species approach of FAN2 was adopted in CBIB on the grounds that most collections can be identified down to this level with some certainty, whereas some of Orton's finer distinctions are less firmly established. It is a fairly safe bet that, when eventually DNA studies of *Pluteus* take place, some of Orton's species will be restored to favour and others rejected as merely reflecting intra-specific variation.

Most of the differences between BFF4 and FAN2 relate to three broadly defined species in FAN2 each corresponding to several species in BFF4.

1. *P. chrysophaeus* of FAN2 is there considered an earlier name for three yellow to golden species in BFF4: *P. luteovirens*, *P. galeroides* and *P. xanthophaeus*.
2. *P. plautus* of FAN2 includes the conifer-associated *P. plautus* of BFF4, but also no less than six further hardwood species of BFF4.
3. *P. ephebeus* of FAN2 is there considered an earlier name for a complex of three medium-sized, grey, cracking species admitted in BFF4 to be 'clearly related', *P. murinus*, *P. pearsonii* and *P. villosus*. In BFF4 *P. ephebeus* Fr. is dismissed as 'doubtful'. In FAN2 it also includes two further little-known species, *P. robertii* Fr. and *P. lepiotoides* Pearson, the latter known only from its type collection. [*P. robertii* is kept distinct in CBIB as the British concept, based on Reid (1967), is certainly different.]

In this article we comment on the first two of these complexes and then on two other problem areas: the species around *P. cervinus* and conflicting concepts of *P. pellitus*.

Discussions of species complexes

1. *P. chrysophaeus*

Pluteus chrysophaeus as described in FAN2 includes as synonyms two of Orton's species: *P. xanthophaeus* and *P. galeroides* plus *P. luteovirens* described by Carleton Rea. Of these, *P. xanthophaeus* seems to us to have the weakest claim to autonomous status, differing

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doi:10.1016/j.fldmyc.2010.07.006

Fig. 1. *Pluteus luteovirens* described by Carleton Rea has been synonymised with *P. chrysophaeus* but there are problems with the latter name as outlined in this article. Collection from rotted woodchips, West Dean Arboretum, near Chichester, August, 2008. Photo © G. Kibby.

Fig. 2. *Pluteus* species agreeing with *P. galeroides* of Peter Orton, usually synonymised with *P. chrysophaeus*. Collection from rotted elm log, Flatford Mill Field Studies Centre, Suffolk, November 2009. Photograph © G. Kibby.

from *P. luteovirens* only in its yellower stipe, and greener pigment in the subcuticular cells. Considering *P. galeroides* and *P. luteovirens,* although it is possible that there is only one variable taxon involved here, it is also possible that the differences observed by Orton, Rea and others are real and that with more field work (and eventually molecular studies) the taxa involved might be more accurately defined. We feel that there may be two species involved: *P. luteovirens*, with greenish-yellow pigments, locally common on fallen deciduous timber (Fig. 1) and a rarer *P. galeroides* with more golden-yellow to tawny yellow colours, noticeably hygrophanous, changing to cinnamon-brown as it dries (Fig. 2 & back cover). Whether either of these would match *P. chrysophaeus* of Schaeffer is debatable. Orton thought Schaeffer's species was actually *P. phlebophorus*. Having examined Schaeffer's description and plate (Fig.3) there is certainly a problem to resolve. Schaeffer's description is that of a golden yellow species but his coloured plate quite clearly shows a taxon with a brown cap which could easily be *P. phlebophorus* as Orton suggests. Other authors, including Quélet and Carleton Rea, have also considered *P. chrysophaeus* to be a brown-capped species (*chrysophaeus* means dusky gold). Kühner & Romagnesi cite Schaeffer's concept of

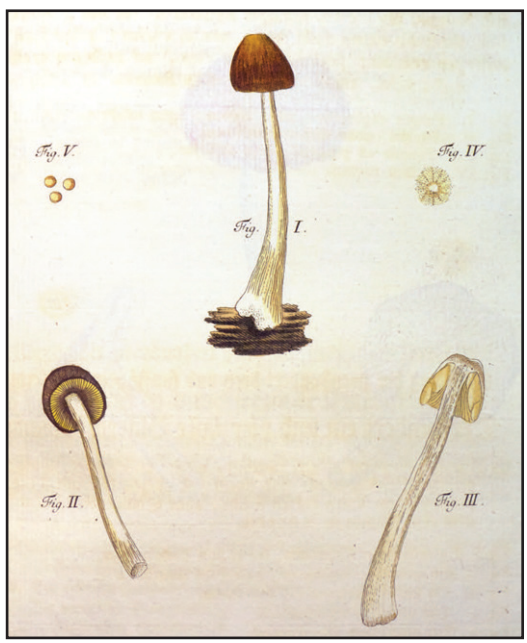

Fig. 3. The original plate of *Pluteus chrysophaeus* by Schaeffer, published in 1762. It could easily be what is now called *P. phlebophorus*.

P. chrysophaeus for *P. lutescens* (i.e. *P. romellii*) and use the name *P. chrysophaeus* in Fries's sense as an earlier name for *P. phlebophorus*.

Given the contradiction between the description and the coloured plate in Schaeffer, quite a strong case can be made for reject ing *P. chrysophaeus* as a *nomen confusum* and reverting to Rea's name *P. luteovirens*.

Adding to the problems in this group, the cystidia are quite variable in shape and size so Orton's use of these as a differentiating character is unconvincing. DNA work is needed to help resolve these unanswered questions.

2. The *P. plautus* complex

We are unhappy with all existing treatments of this group: as seven species in BFF4 (surely too many); as six species in Courtecuisse & Duhem (still too many?); as one species in FAN2 (surely too few); and as two species in FN, one of these named as *P. semibulbosus* (a name we would prefer to see abolished, see below). By way of compromise, we offer here a four species treatment, though in the absence of DNA support this must remain as doubtful as all the others:

1. Darker, typically ± cinnamon, on deciduous or conifer wood 2
1. White to clay-buff or olive-grey forms, on deciduous wood. Margin striate when moist. With a tendency to somewhat larger spores and shorter cap cuticle elements *fide* Vellinga & Schreurs, but with much overlap. 3

2. On conifer wood eg. on *Pinus* in Scotland ....***P. plautus*** *s. str.*
2. On deciduous wood .....***P. granulatus*** [Orton restricts this name to apply to an uncommon form with the cap rather conspicuously scaly at the disc only and the margin striate. It predates his *P. punctipes*, which he considered a much commoner species with entirely scaly cap].

3. Fasciculate, very delicate, more or less *Coprinus*-like in build, strongly pellucid-striate. [Not well understood *fide* Vellinga & Schreurs].....(Fig. 4) ***P. hiatulus***
3. Somewhat larger, often with more or less hemispherical basal bulb and a smell of *Scleroderma*. Rather common, the most

Fig. 4. A collection of what appears to be *P. hiatulus* with delicate, very striate cap margin and *Coprinus*-like build. Gobions wood, Hertfordshire, 21 Sep 1995. Photograph © Alan Outen.

Fig. 5. *Pluteus depauperatus* with distinctly bulbous stem base and olive-grey cap fading to pale whitish-buff. Found on rotten branch, Colemere, Shropshire, October 2009, Mike and Di Hall. Photograph © G. Kibby.

frequent member of the complex in Britain. ....(Fig. 5) ***P. depauperatus***
Syn. *P. boudieri* Orton
Syn. *P. semibulbosus ss.* Boudier, Kühner & Romagnesi, Moser, FN (*non sensu* Lange, Orton with cellular cuticle which is *P. inquilinus ss.* FAN).
?Syn. *P. gracilis*
?Syn. *P. dryophiloides* described by Orton from a single collection with stronger (*Collybia dryophila*) colours.

See Orton in BFF4 for his detailed arguments for recognising more species than in this key. Note that *P. hiatulus* Romagn. is not one of Orton's seven. He suspects it to be a good species (BFF4 p.36) and reports finding several possible British collections all of which he eventually assigned to his *P. boudieri*. [Minority opinion: I am unconvinced by the views of my co-authors that *P. hiatulus* as conceived here is worth separating from *P. depauperatus* as conceived here, A.H.]

The problem of *P. semibulbosus*

This Friesian epithet has been widely used for two different very pale species with a bulbous base. In one tradition (that of Kühner & Romagnesi, Moser, FAN2, & FN) it has a filamentous cuticle and belongs somewhere in the *P. plautus* complex. In the other (that of Lange, BFF4) it is an unrelated species with a cellular cuticle. The collection so named in Phillips is of the first of these (material examined by Schreurs, see Vellinga & Schreurs (1985), but the accompanying description is of the second. In view of all this confusion *P. semibulbosus* was rejected in CBIB as a *nomen dubium*; CBIB thus agrees with FAN2 and FN in using the name *P. inquilinus* for the *P. semibulbosus* of BFF4. We find it unhelpful that FN continues to use the confused name *P. semibulbosus* for a poorly defined pale subset of the *P. plautus* complex.

When *P. plautus* comes to be further disentangled we suggest that the correct name for this paler taxon should be *P. depauperatus* Romagn. with *P. boudieri* P.D. Orton as a probable synonym.

3. Relatives of *Pluteus cervinus*

P. cervinus is certainly our commonest *Pluteus* and most mycologists would consider themselves very familiar with it, but there is one historical taxon and a number of recently described species which must be considered in any future assessment.

Pluteus cervinus var. *bullii* was described by Berkeley, illustrated by Cooke (1884: pl 304(357)) and raised to species by Rea (1927) and is usually regarded as just a large, luxuriant form of *P. cervinus*, found mostly on sawdust heaps. Recent collections examined by us and by Henrici (2004) showed that the cystidia covering the gill face and margins were predominantly single-pointed rather than with the usual 3-4 points (noted by Rea also), which to us indicates, along with the larger size and restricted habitat, that a distinct, 'good' but rare taxon may be involved.

Penny Cullington, as reported in FM 5(1): 30, also examined a large *Pluteus* found on woodchips in Scotland and found that the largest specimens had a majority of single-pointed cystidia while the more immature specimens had more conventional 3–4-pronged cystidia. See also FM 5(3): 103 for a photograph of the single-pointed cystidium from a collection from Sheffield.

The alternative suggestion, given by Henrici (2004) that the characters distinguishing it from *P. cervinus s.s.* could be a result of the unnatural habitat is feasible, but there is a danger in dismissing any rare species from an extreme habitat as an aberrant form of a commoner species. Without genetic confirmation of this hypothesis we can only look for more distinguishing morphological characters. A photograph of a recent collection from West Dean College, Sussex is shown in Fig. 6. The caps of this collection reached 14 cm in diameter. Once again the cystidia were predominantly single-pointed.

Another extremely large and even less well known taxon is the remarkable *P. cervinus* var. *eximius* Saunders & Smith, also found on sawdust (Fig. 7). This reached up to 20 cm and is shown with a blackish-brown pileus with reddish tones at the margin and an extremely stout, blackish, fibrous stipe. It might well be an extreme form of *P. bullii* or *P. cervinus* or another poorly known species altogether. The illustration in Cooke (1886: 304(357)) is a direct copy of the Smith plate but exaggerates the red tones at the margin to a bright scarlet.

P. cervinus lacks clamp connections in all of its tissues but other very similar species have recently been described which possess clamp

Fig. 6. A collection that matches *Pluteus bullii* (Cooke) Rea, with very large fruitbodies and a high proportion of one-pointed thick-walled cystidia on the gills. On rotting sawdust, West Dean Arboretum, near Chichester, August 2008. Photograph © G. Kibby.

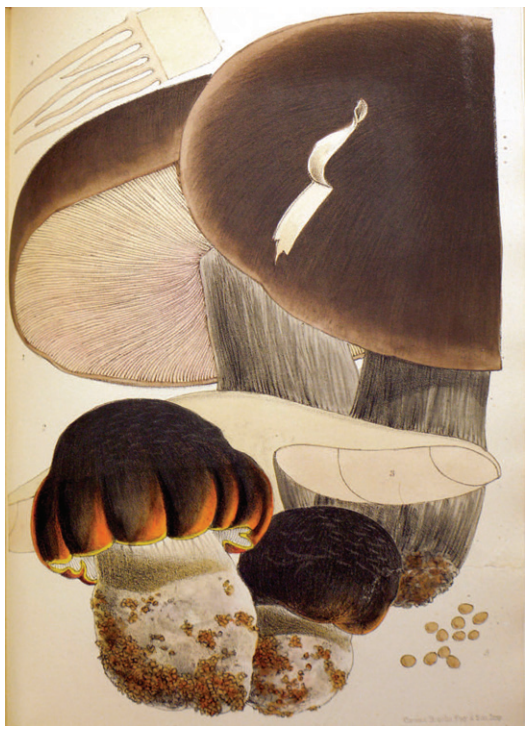

Fig. 7. *Pluteus cervinus* var. *eximius*, the original plate from Saunders & Smith, 1870, showing the massive fruitbodies with very dark colours. Photograph © Royal Botanic Gardens, Kew.

connections, at least in some portion of their tissues. Perhaps the best known, following a number of good British collections from 1996 onwards, is *P. pouzarianus* (Fig. 8), discussed in FM 5(1):30-33 (2004) and in B&K4:121, which has clamps on a high proportion of the hyphae in the pileipellis. It may also be distinguished by its greyer, more fibrillose cap cuticle and a distinct preference for conifer wood.

P. primus (not yet British) appears macroscopically almost identical to *P. cervinus* but is associated with conifers and described as having clamps on all septa of the pileipellis. It is also similar to *P. pouzarianus* but with longer cheilocystidia and longer, larger spores. It is said to be vernal and is illustrated in B&K4:122 but it is worth noting that they did not find any significant difference in the spore size. Less well known is *P. brunneoradiatus* (not yet British) with similar features to *P. pouzarianus*: lacking clamps in the pileipellis but with clamps on the young basidia. It is associated with hardwoods and is illustrated in B&K 4: 103. It would be interesting to see if molecular analysis of these extremely similar taxa supported their separation.

Fig. 8. *Pluteus pouzarianus* growing on conifer litter close to conifer stumps. The cap and stem are greyer than in the much commoner *P. cervinus* and it has numerous clamp connections in the cuticle. Photograph © G. Kibby

4. *Pluteus pellitus* and *P. nothopellitus*

Unlike the three previous problem areas this one is a problem with a solution! *Pluteus pellitus* is a white species close to *P. cervinus* and sharing the characteristic harpoon-like crested cystidia of the latter. It has an entirely white, more or less smooth pileus and is described in both BFF4 and FAN2; however, the descriptions do not agree, as noted by Citérin & Eyssartier (1998). One interpretation is of a species with clamps and small spores 5.5–7.5 (8.0) x 3.8–5.3 (5.5) µm: this is the view of Kühner & Romagnesi (1956), Moser (1983) and probably Orton (although he does not discuss clamp connections and we were unable to trace his specimens). Bonnard (1995) neotypified *P. pellitus* based on this interpretation. Vellinga in FAN2 has an alternative interpretation: a species without clamps and with larger spores (6.0) 6.5–9 (9.5) x 4.5–6.5 (7.0) µm. Recently, the Spanish mycologists Justo & Castro (2007) resolved this discrepancy by describing a new species, *P. nothopellitus*, to replace *P. pellitus sensu* Vellinga. Specimens of *P. nothopellitus* were determined from Spain, Germany and the Netherlands in Europe and from Michigan in the U.S.A. After examining numerous British collections at Kew and with the assistance of Nev Kilkenny looking at collections in the Royal Botanic Garden, Edinburgh, we have discovered that both taxa are present in Great Britain, but the large-spored form, *P. nothopellitus*, predominates in herbarium collections. There were also, surprisingly, several collections of *Volvariella gloiocephala* filed at Kew as *P. pellitus*; this differs in having a volva at the stipe base (as do all species of *Volvariella*) and in having enormous spores (13-18 x 8-10 µm).

To complicate matters, there are white forms recorded of most of the other *Pluteus* species with the '*cervinus*-type' cystidia so it is important to examine thoroughly any such collection. A key to these white species with harpoon-like cystidia (including non-European species) is given in the Justo & Castro paper. We present a modified version of this key covering those species most likely to be present in the UK.

[* = not yet British]

1. Clamp connections present 2
1. Clamp connections absent.....5

2. Growing on coniferous wood 3
2. Growing on hardwoods.....4

3. Cheilocystidia up to 200 µm long .....
.....***P. primus* var. *purus****
3. Cheilocystidia up to 60 µm long .....
.....***P. pouzarianus* var. *albus*** *
4. Clamp connections common in all tissues;
spores 5.5–7.5 (8.0) x 3.8–5.3 (5.5) µm .....
.....***P. pellitus***
4. Clamp connections scarce (< 10% of septa);
spores 5–8.6 x 4–5.8 µm .....
.....***P. brunneoradiatus* var. *albus****

5. Smell raphanoid. Cap radially fibrillose but not scaly ..... ***P. cervinus* var. *albus***
5. Smell sweet-nauseating or indistinct. Cap either silky-glabrous or with some recurved scales, at least at the centre 6

6. Cap usually more or less scaly at centre to coarsely so; smell sweet-nauseating, cheilocystidia scarce or absent, lamellae very deep, obtuse at the cap margin (sp. 5.5–8(-9.5) x 3.5–5(-5.5)) .....***P. petasatus***
6. Cap usually entirely smooth; smell indistinct; cheilocystidia abundant, gills not deep and obtuse at cap margin (sp. (6-)6.5–9 (-9.5) x 4.5–6.5 µm) .....***P. nothopellitus***

[Note: *P. brunneoradiatus* var. *albus* and *P. primus* var. *purus* have not yet been formally published by Bonnard who proposed them].

***Pluteus violarius* Massee**

Orton (1986) was forced to exclude this species from his treatment of the genus, as there is no dried material in existence and hence no microscopic details are known. However, he referred to the painting by Cooke (Fig. 9) as distinctive and worth looking out for. In appearance it is unlike any known British species because of its remarkable Tyrian purple cap colour, and although it is possible it represents a chance introduction of some foreign species it could equally be a genuinely rare native. We reproduce it here in the hope that it might stimulate its rediscovery.

Acknowledgements

Our thanks to the Royal Botanic Gardens, Kew for their permission to reproduce the colour plate by Saunders and Smith and for all their assistance in this study.

Fig. 9. *Pluteus violarius* was described by Massee and illustrated by Cooke but has never been found since. It is unlike any other British species. Photograph © British Mycological Society.

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