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Stipitate Hydnoid Fungi in England

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Stipitate hydnoid (tooth fungi) research project

Stipitate Hydnoid Fungi in England

A desk survey
by Peter Marren

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Contents

1. Summary

Some 10, possibly 13, species of stipitate hydnoid fungi occur in England, out of a British mycota of 18 species. All were listed on the original provisional Red List of British fungi, and all but one are listed for Biodiversity Action, with their own joint Species Action Plan. This desk-based survey attempts to find out more of their status in England, and on what action, if any, is needed to conserve them. The survey is based on database, herbarium and foray records, and on available literature. It suggests that stipitate hydnoids are in fact fairly widely distributed, at least in southern England, but are rare outside their core areas, notably the New Forest and the woods of east Berks, west Surrey and west Kent. They seem to be genuinely absent from large areas of England.

English and British evidence supports findings from the Netherlands and elsewhere that stipitate hydnoids need woodland soils naturally low in nitrogen and phosphorus. As a group they are found on soils of widely varying pH from acidic sands to marl-clay and limestone, but the majority of British records are from sand and gravel deposits. Preferred habitats in England are mossy banks, both artificial (eg woodbanks, railway cuttings, marl pits) and natural (eg streambanks), within large areas of open semi-natural woodland where there is low competition from vascular plants. As mycorrhizal fungi, stipitate hydnoids are associated with trees, the most frequent hosts being oak, sweet chestnut, Scots pine and beech. They have been found under coppice or maturing trees of about forty or more years, but there is no particular association with mature or veteran trees. While there is little record evidence for a decline in Britain, it can be inferred that soil eutrophication, from emissions and farm fertiliser, has reduced the available habitat for these fungi. Declines from this cause have been well documented from the Netherlands and Germany. Outside a few sites, there is insufficient evidence to propose local management solutions, and in general these fungi do not seem threatened by inappropriate land-use practices. They occur in managed woodland, including plantations, as well as undisturbed semi-natural woodland. Priority should be given to local surveys, including past records, in the known English sites listed here.

2. Background and method

The Biodiversity Action Plan currently lists 40 species of non-lichenised fungi, and of these no fewer than 14 are 'stipitate hydnoids' or tooth fungi. These include all but one of the British species of *Bankera*, *Hydnellum*, *Phellodon* and *Sarcodon*. The exception, *Phellodon niger*, was left out presumably by mistake, since there are fewer records for it than for several other species. It is included in this report as is the apparently extinct *Sarcodon regalis*. There are recent records of the following species in England:

Hydnellum concrescens
H. scrobiculatum
H. spongiosipes
Phellodon confluens
P. melaleucus
P. niger
P. tomentosus
Sarcodon imbricatus
S. regalis
S. scabrosus

Records of *Hydnellum ferrugineum* from England need confirmation, as it has been much confused with other species. There are also old English records of *Bankera fuligineoalba* and *Hydnellum aurantiacum*, and the former, at least, probably still occurs here. Those of *Hydnellum compactum*, *H. mirabile*, and *Sarcodon leucopus* are presumably misapplied names or mistakes, since these species are not known in Britain. Scotland is more diverse in stipitate hydnoids, and all but one of the British species occurs there. Those not so far found in England are *Hydnellum caeruleum*, *H. peckii*, *H. auratile*, *Bankera violascens* and *Sarcodon glaucopus*.

The aim of the Species Action Plan for stipitate hydnoid fungi is to 'maintain populations at all extant sites' and in addition, 'experimentally establish two new populations of one species in expanding native pine woods'. The latter objective is likely to apply to Scotland rather than England. However, English Nature's project objectives include the possibility of 'actively promoting colonisation of the fungi at new sites in England by creating suitable conditions for colonisation by the fungi'.

The aim of this project is to determine where stipitate hydnoid fungi occur in England using existing records rather than by field survey. It should also summarise what is known about the ecology of these species, their relationship with other species, any threats to their survival, and their management needs. It should also include recommendations for their protection and for further research, survey and monitoring. The data in this report is the property of its funding body, namely English Nature, and will be stored in National Biodiversity Network (NBN) format and made available through an NBM mode. The project manager is Carl Borges, based at English Nature's Colchester office.

Note on names

I have followed the nomenclature of Pegler *et al.* (1997). British material of *Sarcodon imbricatus* is now believed to belong to an overlooked taxon, *Sarcodon squamosus* (Johannesson *et al.* 1999) - an unfortunate name since it invites confusion with *Sarcodon*

scabrosus. Since there is still some doubt about which species we have, I have retained the older, well-known name. I have not followed the English names used in Pegler *et al.* since these have not yet found much acceptance.

* An asterisk against a record indicates that it was trawled as a result of this survey and is not at this time entered on the database.

3. Stipitate hydnoid fungi and their ecology

3.1 A short portrait of stipitate hydnoid fungi

Hydnoid fungi, that is fungi which bear their spores on short spines, belong to the Order Aphyllophorales, which also includes bracket, club and resupinate fungi. They form a morphologically similar, but probably not a natural group. I will not attempt to describe each species in this report, since details on identification is readily available in the monograph by Pegler *et al.* (1997). However, since this report will be available to and read (I hope!) by conservationists as well as mycologists, I will touch on their general characteristics here. The term 'stipitate hydnoids' was devised for 'tooth fungi' with a definite 'stalk' or stipe as it is more correctly known. Thus tooth-fungi lacking this structure, such as *Mucronella* or *Hericium*, are excluded. 'Stipitate' is the adjective of 'stipe', and means 'possessing a stipe'. 'Hydnoid' means 'like a Hydnum', and so presumably excludes our two species of *Hydnum*, the Wood Hedgehog or Wood Urchin *Hydnum repandum*, and its orange-capped relative *H. rufescens*. For the purposes of this report, 'stipitate hydnoid' refers to species of *Bankera*, *Phellodon*, *Sarcodon* and *Hydnellum*, all of which are relatively rare species of conservation interest. The Earpick Fungus *Auricalpium vulgare* also meets these criteria but is not a species of conservation concern.

All these fungi have fruit-bodies with tiny 'teeth' on their underside, lined with spore-bearing structures. In *Hydnellum* or *Sarcodon* the spores are brown; in *Phellodon* and *Bankera* they are white. There are also two contrasting textures: soft and mushroomy in the case of *Bankera* and *Sarcodon*, tough and leathery (corky when dry) with *Hydnellum* and *Phellodon*. These different textures reflect the micro-structure of these fungi, for which I must refer you to Pegler or the article I wrote with Gordon Dickson (Marren & Dickson, 2000), which also has some nice pictures. The differences in fundamental structure mean that stipitate hydnoids are probably not closely related. However they do seem to have much in common when it comes to their ecology, behaviour and habitat preferences.

Stipitate hydnoids are variable in shape. Some become top-shaped, others are more like fans or brackets, and others become irregular and lumpy. *Sarcodon* and *Bankera* resemble *Hydnum* species in being roughly mushroom-shaped with a distinctive cap (pileus), with a smooth surface in the case of *Bankera* or scaly as in *Sarcodon*. *Hydnellum* and *Phellodon* species are more plastic, and grow from the edge, often engulfing vegetation and fusing with their neighbours. It is common to find *Hydnellum* and *Phellodon* species with fused caps. On a slope, the caps can also overlap one another, producing tiers of partially fused fruit-bodies.

Fortunately for the surveyor, stipitate hydnoid fruit-bodies can last several weeks, or sometimes even months. The softer *Bankera* and *Sarcodon* can rot quickly like mushrooms, but in dry conditions *Sarcodon* species can darken and persist much longer. The tougher *Hydnellum* and *Phellodon* normally last several weeks, changing in texture, colour and shape as they grow. They can start to fruit as early as August, especially in Scotland where early September is regarded as the peak time to look for them. In England, late September is normally the best time, but in the absence of ground frosts the fruit-bodies may persist into December. Their appearance is irregular, and some seasons are better than others. Probably moist, humid conditions suit them best.

Stipitate hydnoids are mycorrhizal fungi (for evidence see following section) which help trees obtain nutrients on poor, mineral soils. Hence they are seldom if ever seen away from

trees. *Hydnellum* and *Phellodon* species normally seem remarkably free from invertebrate damage. Possibly they contain inhibitory chemicals (*H. peckii*, for example, has a burning-hot taste) that also puts off mammalian grazers. On the continent, one species, *Sarcodon imbricatus* used to be of economic importance as a foodstuff and the source of a blue pigment for wool-dyeing.

The majority of records of stipitate hydnoids are based on herbarium specimens. These species dry well and retain much of their natural appearance, though not their natural colours. However identification is easiest with fresh, young fruit-bodies, since some distinguishing characters rest on colours and colour changes, exuding droplets, and even taste, which tend to be lost with age. Nowadays a good colour photograph might be regarded as a substitute, though it may not be sufficient to separate some critical species. The best published illustrations are in Pegler *et al.* (1997) and Breitenbach & Kranzlin (1986), although those in Philips (1981) are still useful.

See Appendix B for photographic illustrations of stipitate hydnoid fungi known to occur in England.

3.2 What do we know about their ecology?

Until recently, the answer, from Britain at least, was very little. Most of what we know about them is in the literature of northern Europe and North America, and their behaviour there may not be the same as here. However, a useful picture does emerge from comparing Arnolds (1989) and Guilden & Hanssen (1992) with the 1997 monograph, and evidence gathered from recent surveys in connection with the British BAP.

Firstly, all stipitate hydnoids, except the tiny Earpick Fungus *Auriscalpium vulgare*, are ectomycorrhizal fungi associated with trees. The evidence for this comes from laboratory-based studies in Japan, Germany and Canada. In Germany, the hyphae of *Hydnellum concrescens* have been traced to the rootlets of spruce, whilst in Canada, Danielson (1984) managed to synthesise ectomycorrhizas between *Bankera fuligineoalba* and jack pine *Pinus banksiana*. In the Netherlands, Arnolds deduced the mycorrhizal connection from the following field observations:

- the fungi were always associated with trees, either in woodland or on heaths with scattered trees
- many species were host-specific, that is associated with a particular kind of tree or related group of trees
- there was never any bleaching of leaf litter that one finds with purely saprophytic fungi
- stipitate hydnoids usually occurred on poor, oligotrophic mineral soil without much humus or leaf litter, where a saprophytic way of life would be difficult (more on this later).

In the Netherlands (but not necessarily Britain), all the BAP species were restricted to trees over 40 years old, and so are presumably late-stage fruiters. At what stage they actually colonise the tree is unknown. They occurred in three main habitats:

- Oak woods on poor, acid sand
- Pine woods on poor, acid sand
- Roadsides with old oak or beech.

They were typically associated with stands of moss and lichen (especially *Cladonia*) with a restricted growth of vascular plants, such as heather, bilberry and wavy hair-grass. *Phellodon* species strongly preferred poor soils, whilst *Hydnellum* species exhibited a wider ecological range and occurred on mineralogically richer soils. These ecological preferences are evidently shared by neighbouring parts of Germany, such as the Saarland, where they have also been well recorded. In general, 'oligotrophic' pine forests are considered the optimum habitat of stipitate hydnoids across the north European plain from Holland to Poland. Mixed deciduous forests of oak and beech on acid soil are the next best habitat, with spruce becoming important at higher altitudes eg in Switzerland, where several species are exclusive to sub alpine spruce forests.

In the Scandinavian countries, however, many stipitate hydnoid fungi exhibit a somewhat broader ecological range. For example, *Bankera fuligineoalba*, normally regarded as a species of dry, sandy pinewoods also occurs in spruce forests and plantations in Norway. *Sarcodon imbricatus*, another pinewood species, is common over a range of soils, from acid to calcareous, and under spruce as well as pine. Unlike the countries of the European plain, the status of stipitate hydnoids in Scandinavia seems to be comparatively healthy, possibly because of this greater ecological amplitude. However it is notable that most species are absent from the west oceanic coast of Norway, and are commonest in the continental south-east.

Compared with Europe, Britain has a somewhat impoverished mycota of stipitate hydnoids, though it is possible that more species may yet turn up here:

Stipitate hydnoid mycota compared

England	Scotland	Netherlands	Switzerland	Norway	Sweden
13	18	21	26	28	32

Within Britain, there is a marked difference between the stipitate hydnoids of deciduous woods, commons and parks in southern England, and of the pinewoods of Highland Scotland, as the following table shows:

Commonest species in England (in order)	**Commonest species in Scotland** (Newton pers. comm.)
Hydnellum concrescens	*Sarcodon imbricatus*
Phellodon melaleucus	*Hydnellum peckii*
Hydnellum spongiosipes	*Phellodon tomentosus*
Phellodon niger	*Bankera fuligineoalba*

The Scottish figures may be skewed because of the focus on native pinewoods, but plainly the fungal flora of a Scottish pinewood compared with, say, an English beechwood, offers a complete contrast. Scotland's pre-eminence in stipitate hydnoid fungi is presumably due to its monopoly of the optimum habitat, native pinewood on acid, sandy soil. By contrast,

species of deciduous woodland, like *Hydnellum concrescens* and *H. spongiosipes*, are commoner in England. What the Scottish experience is also showing is that the species with restricted distribution are not necessarily the rarest. The example, the dramatic-looking *Hydnellum peckii* is confined to Scotland, but there it is the second commonest species (in terms of individual records, it is the commonest), and occurs in plantations as well as natural woods. Even the supposedly endangered *Hydnellum aurantiacum* and *Sarcodon glaucopus* put on a good show within their more restricted range during the favourable season of September 2000.

In England, stipitate hydnoid fungi seem to be thinly distributed outside their main centres in the New Forest and the sandy commons, parks and woods of E. Berks, Surrey and W. Kent. For example, from foray data kindly sent to me by Dr Derek Schafer, there were 33 records representing 14 species of stipitate hydnoids from 114 forays (29%) in Scotland compared with only 5 records of 2 species from 31 forays in the New Forest (16%), and none at all in 173 forays in Herts, Beds and Bucks (0%).

The English records of stipitate hydnoids throw up two remarkable facts which shed light on their ecology. Firstly, one is struck by how often they have been found on banks within woodland, either natural ones like streambanks, or, more often, man-made ones like woodbanks, earthworks, cuttings and road verges. Secondly, in strong sites at least, several species commonly share the same habitat, sometimes indeed, occur together on the same small section of bank, in so strong an association that it seems their hyphae must intermingle, and that they may even share a single mycorrhizal partner. For example, in Mark Ash Wood in the New Forest, a 20m length of mossy bank contained *Phellodon niger*, *P. melaleucus*, *Hydnellum concrescens* and *H. spongiosipes*, while the old railway cutting in Setthorns Inclosure has all these, plus *Sarcodon scabrosus*. The natural slopes of Buttersteep Hill near Ascot, Berks, may be the richest site in England, with six species in close proximity.

Naomi Ewald's (2000) analysis of results from the first season's 'hydnum hunt' in the New Forest shows that raised banks were the preferred habitat of all six species found, followed by 'moss dominated vegetation' and the edges and slopes of marl pits. Other habitats included 'bare ground' and 'heather'. Only *Hydnellum concrescens* was recorded from 'grass'. She also observed that a striking number of records were close to watersides, either of a stream or a pond (which in the New Forest are mostly flooded marl-pits). In Scotland, where there are fewer woodbanks, stipitate hydnoids are found most often on disturbed ground within woodland, such as track edges, road verges, streambanks and overgrown sand-pits. They avoid tall, dense vegetation, such as dense stands of heather, and the association with paths seems to be real. Sandy soils are preferred, including afforested dunes at Culbin Forest. The track leading from Coylumbridge Hotel to the Lairig Ghru pass is known in mycological circles as 'Hydnellum Avenue'; all the pinewood species have been found there.

What is so special about banks? Probably, first, freedom from competition. Though 'stipitate', these fungi have short stipes and release their spores close to the ground. They avoid dense vegetation and competition from grasses, preferring to associate with mosses, such as *Dicranum* and *Polytrichum*, and lichens, like *Cladonia*. Banks also tend to lack a thick humic layer or leaf litter, typical of forest soils. Stipitate hydnoids prefer oligotrophic soils with only a thin skin of soil over bare clay or sand, capable of supporting only wisps of grass, heather or bilberry. This agrees with Arnolds' observations in the Netherlands. As mycorrhizal species, these fungi derive their nutrients from the tree partner, and have no need for fertile soils. Martyn Ainsworth has made the interesting suggestion that stipitate

hydnoids exploit dry, heat-stressed environments where the tree roots are close to the surface.

Secondly, banks may offer freer drainage than the woodland floor, and also, perhaps, enhanced light and solar heat. Though they prefer light, well-drained soils, stipitate hydnoids evidently need a high humidity to shed their spores. Unlike gill fungi, you need damp paper to obtain a spore-print from a hydnoid. Perhaps the dominance of spongy moss cushions on woodland banks helps to maintain a constant circulation of humid air. The rarity of stipitate hydnoids on the western fringe of Britain and Norway suggests, however, that oceanic conditions and high rainfall are not favourable. In England, most species seem to congregate in places with warm local climates (Windsor Great Park and the New Forest are notably warm), with the commonest two, *Hydnellum concrescens* and *Phellodon melaleucus*, more tolerant of higher rainfall and calcareous soils.

If these observations are correct, they go some way to explain why stipitate hydnoids are so local in England. Many of the best sites are on naturally acid woodland soils, but the majority of natural woods in eastern England are on ill-drained clay, where competition may be too high. They also prefer large areas of semi-natural habitat, like the New Forest or the inter-connected woods and heaths of the Thames Basin (or the pinewoods of Abernethy and Rothiemurchus). Why this is so one can only speculate, but given the apparent sensitivity of these fungi to chemical pollutants, and nitrogen deposition in particular, perhaps large sites offer a much greater degree of environmental buffering than small ones. This is certainly the impression one gets in the New Forest, which has largely escaped the advance of the stinging nettle (and its attendant docks and thistles), increasingly smothering the wet valleys of southern England.

3.3 What is the evidence that they are declining?

The now outdated provisional red-list of British fungi lists all these species as 'rare', 'vulnerable' or 'endangered' (in one case 'critically endangered'). An 'endangered, species has declined to the point that it could die out altogether unless action is taken. The Species Action Plan takes this as read and speculates on the causes of the decline. The possibilities are habitat loss, changing forest practices such as coniferisation, enrichment of soils from atmospheric deposition or the drift or run-off of agricultural chemicals, or all of them. This may very well be true, but the evidence does not come from Britain!

The two main published works comparing present and past records of stipitate hydnoid fungi are Arnolds (1989) in the Netherlands and Gulden & Hanssen (1992) in Norway, which also refer to related work in other European countries. They come to very different conclusions. In the Netherlands, stipitate fungi have suffered a massive decline, resulting in the apparent extinction of 8 uncommon species, a 90% decline of 6 more, while the remaining 7 species have suffered declines of between 58-87%. Only *Auriscalpium*, reliant on pine cones, not tree roots, remains relatively unaffected. Arnolds quotes evidence to show that some species were formerly quite common on poor, sandy woods and heaths, especially in central Holland and on coastal dunes. Their decline dates from about 1950 and coincides with widespread chemical farming. According to Arnolds, declines on this scale could not be explained by habitat loss, nor more intensive management involving planting and drainage (if anything, potential stipitate hydnoid habitat has *increased*, as pines and oaks invade formerly open dunes and heath). The decline of stipitate hydnoids has been shared to some extent by other woodland ectomycorrhizal fungi, notably the Chantarelle

Cantharellus cibarius (Jensen & Dobben 1987), and also lichens and mosses. Pinewoods previously with a field layer dominated by moss and lichen are now typically more eutrophic and grassy, and less suitable for stipitate hydnoids.

In Norway the situation seems to be much healthier. A statistical analysis of available records indicates no strong evidence for a general decline, and only three species have suffered a statistically significant decrease, namely *Hydnellum aurantiacum*, *H. peckii* and *H. suaveolens*. Stipitate hydnoids are most diverse and common in the south-east of the country, and least so on the west coast, which, significantly or not, is the area most affected by acid precipitation. As noted before, most species exhibit a broader ecological amplitude in Norway than in Holland, occurring over a greater range of soils and biomes. The upbeat situation in Norway seems to be shared by Sweden and Finland. Hence there is an interesting contrast between the Scandinavian countries and those of the north European plain, the former showing little sign of serious decline, the latter displaying wholesale declines resulting in multiple extinctions.

What could be causing the decline? In Arnolds' view, the only factor to fit the facts is chemical pollution, specifically the deposition of active nitrogen from the atmosphere and from agriculture. In the Netherlands about 48 kg per hectare of nitrogen is deposited from the air every year. Nitrogen input in forests can be even higher, with one estimate of 60 kg per ha per year for ammonium compounds alone. The pattern of nitrogen fall-out is irregular, being highest in the south-east of the country and lowest along the coast. This agrees with the pattern of decline of stipitate hydnoids. Another possible factor is acidification, which has reduced top soil pH in some areas. However stipitate hydnoids thrive in coniferous forests with very acid, granitic soils (pH 3.5-4), and they are still frequent in places like Norway and Sweden, whose forests have suffered severely from 'acid rain'. The Netherlands has the best long-term records for mycorrhizal fungi in Europe, possibly in the world, and stipitate fungi have been particularly well studied here by authorities like Donk and Maas Geesteranus, as well as Eef Arnolds himself. He is in no doubt that eutrophication, that is increased fertility, is the fundamental cause. Although Dutch farming methods may be particularly liable to pollute the soils, the increase in soil fertility and the loss of mycorrhizal fungi is shared by countries like Denmark, Germany, Poland and Czechoslovakia. It is also shared by Great Britain, as the recent ECOFACT publications make clear. Major sources of chemical pollution are motor vehicles, agricultural fertiliser and the 'suburbanisation' of the countryside (Firbank *et al.* 2000). Indeed, any observant botanist will have seen some of the effects for himself.

Arnolds concludes that in these circumstances it is 'neither sufficient to create nature reserves, nor meaningful to give the threatened species legal protection. Placing them on red data lists is valuable as a signal of the gradual deterioration of the environment, but not more than that. Only a dramatic decrease of air pollution, in particular the emission of nitrogen compounds, will be effective in the long run'.

Have stipitate hydnoid fungi declined in Britain? While I doubt whether the available records would be sufficient for a statistical analysis, it seems that we lie somewhere between the extremes of the Netherlands and Norway. There is no sign of decrease in the Scottish pinewoods on the Spey and the Dee, nor in the New Forest. A comparison of pre-1960 and post-1960 records suggest some contraction in the distribution of the more widespread species like *Hydnellum concrescens* and *Sarcodon imbricatus*, but old records are unreliable until they have been redetermined by an expert. For example, *Hydnellum ferrugineum* might

seem to have declined, but most old records under that name probably refer to what are now different species. In terms of individual records, most species will seem to have *increased*, but this is an artifact of recent surveys for conservation purposes.

Evidence from Scotland, still in preparation, will show that some species are able to colonise new habitats, such as plantations. This is evident in England too, where the exclusively pinewood species, *Sarcodon imbricatus* and *Hydnellum scrobiculatum* must presumably have colonised their sites, either by spores or in the roots of planted trees. Their occurrence in formerly open places like marl pits and railway cuttings also indicates mobility. However, outside their core sites, stipitate hydnoid fungi seem to be much rarer than their available habitat. Undoubtedly they are being overlooked - these fungi tend to be extremely local and rather inconspicuous - but their apparent absence in well-recorded areas like Hertfordshire and Wiltshire must be significant. They are also apparently absent from places where, from continental parallels, you might expect them, such as sandy forests in Norfolk and Suffolk, or ancient forests with sandy soils like Sherwood or Needwood in the Midlands, or Savernake in Wiltshire. Since soil eutrophication has been severe in parts of Britain, it is possible that stipitate hydnoid fungi have suffered unobserved declines, for example in East Anglia. However, field mycologists have been active in Britain for 150 years, and the obvious conclusion is that they were never common here outside their core areas.

I conclude that there is no documented evidence for a decline in Britain. That a decline nonetheless might have occurred could be inferred from environmental changes, notably the observed increase in soil fertility in woodland and, locally, from habitat loss. But to assert that it *must* have happened, without direct evidence that it did, is unscientific. On current evidence, it seems that no British species are endangered and about to disappear, while all of them could be regarded as vulnerable to atmospheric pollution (but that is equally true of many other fungi and lichens). All species are currently scarce or rare in terms of distribution, though whether they are so naturally or because of recent changes to their environment is uncertain. We are right to focus attention on them, not only for their own sake or for the pan-European concern for stipitate hydnoids, but because what is happening to them is also happening to hundreds of other fungi, and has ominous implications for the whole forest ecosystem.

3.4 Existing work on stipitate hydnoid fungi

There are two projects running concurrently with this one. In Scotland, a three-year survey funded by SNH, concluding in 2001 is underway to map the distribution of stipitate hydnoid fungi, and to 'establish a baseline of information against which future population changes can be assessed'. This project includes field survey of native pinewoods, carried out mainly by Adrian Newton and Liz Holden, together with a redetermination of existing records, with the assistance of Professor Roy Watling. This survey will undoubtedly bring about a reassessment of the status of the Scottish species, and uncover much about their ecology.

These fungi are also being surveyed in the New Forest by a team of volunteers, organised by the Hampshire Wildlife Trust with the assistance of Gordon Dickson, the British authority on these species. Surveys in autumn 1999 and 2000 added much to our knowledge and understanding of the stipitate hydnoids and the places they grow. The group have also surveyed our three *Hericium* species in the Forest. The author is a member of this group, and has also seen the reports of the first two seasons in Scotland.

The other important event affecting our knowledge of these fungi was the publication of an illustrated monograph, *British Chanterelles and Tooth Fungi* by Pegler, Roberts and Spooner in 1997. This work has greatly assisted identification and made these fungi more accessible. A field key by Gordon Dickson, published in *Field Mycology* in July 2000, will make them even more so.

The conservation of stipitate hydnoids in Britain has focussed mainly on acquiring an adequate database, the fundamental pre-requisite for species survey. The national database contains some 2,700 records of *Bankera*, *Hydnellum*, *Phellodon* and *Sarcodon* species, mainly from BMS forays and herbarium material. It still lacks some important county-based records (eg of Herefordshire), and also notebook records by individual mycologists. Scottish Natural Heritage, in collaboration with the Royal Botanic Gardens, Edinburgh, has established a separate database of fungus records from the Cairngorms area.

Many sites where these fungi occur are SSSIs or nature reserves, although this fact is largely incidental. Active management to preserve them has been limited in England to Buttersteep Hill near Ascot, where invasive *Rhododendron* has been cleared by conservation volunteers under the direction of Ted Green. The Species Action Plan stresses the need for appropriate or remedial management and the designation of some sites as SSSIs. However, it also states that the requirements of hydnoid fungi are at present insufficiently understood. There is, in fact, a great deal of published information about these fungi, but, with the exception of the ongoing Scottish survey, almost all of it is buried in the technical literature of European journals, often in foreign languages. Fortunately much of it has been summarised in key papers, such as Arnolds (1989) and Gulden & Hanssen (1992), and I draw on this in the present report.

3.5 **Trawling for records**

The major source of records is the BMS (British Mycological Society) database, held by the International Mycological Institute at CABI Bioscience, Egham, Surrey. This incorporates the following information: species name, 'association' (ie main component(s) of associated vegetation), 'ecosystem' (variously interpreted as habitat type or physical description eg 'pine woods' or 'sandy river bank'), altitude (usually left blank), date, locality, grid ref, vice-county number and county. For example:

Phellodon confluens *Quercus* Deciduous woodland 30[m] 12/09/1982
New Forest: Stubbs Wood SU 3703 V.c 11 Hampshire

In many cases, the entries are not as full as this. The reason is that the compiler was working from herbarium labels or foray lists which usually provide only a minimal amount of detail. Some old herbarium labels provide only the county and the recorder's name. It is a pity that the database print-out omits the provenance of records or the name of the finder. You can sometimes find out more (and occasionally notice alarming discrepancies) by going through herbarium material, but it is very prodigal of time for contractors on fixed budgets. The database incorporates single collections or records, some of which will refer to the same site and even the same date. For example, it has no fewer than 16 records of *Bankera fuligineoalba* from Ascot, all collected in 1863 or 1864. So there are many fewer site records than species records. Of the 2,700 records in the GB database, only 953 refer to England alone.

Database records (NB this does not include new information collected in the course of the present survey.)

	Database records (GB figure in brackets)	No. of Vice-counties	No. of 10-km squares
Phellodon melaleucus	159 (239)	13	22
P. niger	121 (154)	13	NA
P. tomentosus	55 (122)	10	10
P. confluens	46 (54)	9	11
Hydnellum aurantiacum	2 (37)	2	2
'H. compactum'	36		NA
H. concrescens	198 (231)	22	34
H. ferrugineum	6 (24)	5	19
H. scrobiculatum	108 (133)*	18	25
H. spongiosipes	126 (128)	13	20
Sarcodon imbricatus	53 (120)	16	14
S. scabrosus	21 (34)	5	5
S. regalis	3	1	1
Bankera fuligineoalba	19 (109)	3	4

*Probably over-recorded

Although this database is the basis for judgements made in the Species Action Plan, it is incomplete. There is now a growing number of site reports from the New Forest, and a scatter of records held by county recorders or by individual mycologists. I have written to the leaders of county fungus groups, where they exist, requesting records or nil returns (since, for well-recorded areas, negative evidence is also informative). I have also tried to obtain more details of sites rich in stipitate hydnoids. This, too, is a time-consuming process, especially as, for various reasons, I prefer to write a personal letter than distribute a circular (I need to tell them what I know in order to elucidate from them what I don't know). The resultant data adds substantially to the database, and produces a sharper picture of the status of stipitate hydnoids in England.

3.6 How reliable are stipitate hydnoid records?

Identification is the ultimate basis of species conservation. If that is wrong, the database will perpetuate the mistake, and any action will be founded on an incorrect premise. Stipitate hydnoids are challenging species to identify for a number of reasons. They are not well

covered by field guides, and until the recent monograph and key, the surveyor would have needed access to specialist literature, mostly from continental Europe. Hence, field mycologists were working under difficult conditions. Older records face the additional problem of changing names and species concepts. The taxonomic history of this group is complex, and the present system of classification stabilised only as recently as 1975 in the great *Die terrestrischen Stachelpilze Europas* by Maas Geesteranus. In earlier decades, many field workers used the system of Donk (1933), which included two taxa, *Hydnellum velutinum* and *H. zonatum*, now absorbed under *H. spongiosipes* and *H. scrobiculatum*, and *H. concrescens* respectively. A specimen collected early in the century as *Hydnum ferrugineum* could have become *Hydnellum velutinum* and then *H. spongiosipes* in subsequent years. But without a specimen to determine, it could, and probably has, entered the database as *Hydnellum ferrugineum*. Similarly, an old record of *H. compactum* could perhaps be reassigned to *Hydnellum caeruleum*, or might be based on an incorrect identification, or might even refer to the continental *Hydnellum compactum*, in which case England has a new species. Without a specimen and a critical redetermination by an authority we shall never know. This (and these are just examples) means that nineteenth and early twentieth records of stipitate hydnoids must be treated with the greatest caution. Fortunately, at least at Kew, most old material was inspected and redetermined by Maas Geesternus in the 1950s, as part of his taxonomic revision of hydnaceous fungi, and is reliable. Similar caution has to be used with notebook records. Stipitate hydnoids are very variable, and naming them in the field is often difficult, even impossible. This applies particularly to three pairings of similar species, *Hydnellum concrescens* and *H. scrobiculatum*, *H. spongiosipes* and *H. ferrugineum*, and *Phellodon melaleucus* and *P. confluens*, and to some extent *Phellodon* generally. Arguments about identification continue, even among those experienced in the group. Some, possibly all, records of *H. scrobiculatum* from under oak (and there are many) may prove to be *H. concrescens*. In Gordon Dickson's experience, *H. scrobiculatum* is restricted to pine in Britain. Macroscopically, the two are almost indistinguishable, and even the distinguishing spore characters can be rather ambiguous, at least with English material (in Scotland, *H. scrobiculatum* looks more convincing). Even Maas Geesteranus, the world authority, found material with 'intermediate characters'. Two further examples may illustrate the problems of identification. *Phellodon melaleucus* was practically unknown in the New Forest until the 1999 season, when it turned up in several places. It is now known to be one of the commonest species there. Surely it must have been overlooked, and that we are now finding it because we know it is there. Similarly the comparative profusion of recent records of *Sarcodon scabrosus* compared with those of the better known *Sarcodon imbricatus* suggests that the latter may have been over-recorded in the past. The recent redetermination of British material of *Sarcodon imbricatus* as *S. squamosus* illustrates the lack of critical treatment of these fungi in Britain. In Scotland, Adrian Newton has found many mistakes in identification among the database records; sorting them out is extremely time-consuming. Such mistakes will obviously blur the real distribution of species of fungi in Britain, both spatially and ecologically.

There are records of stipitate hydnoids where the finder honestly admits he is uncertain of the species, and these are not without value. Since it is relatively easy to recognise a 'stip. hyd.' as such, they at least indicate the presence of a member of our group, and so a site worth further investigation. If we look at 'stipitate hydnoids' as a compact and ecologically-related group, we find that nearly every county in England has at least a record or two, in contrast to the maps of individual species.

4. County records of stipitate hydnoids in England

V.c. 1 and 2 Cornwall

There are only a handful of records from Cornwall, interestingly all from sheltered woods on or near the south coast. One site in the grounds of a Lizard school.

*Ethy SX 1357 *Hydnellum concrescens*, *H. spongiosipes*, *Phellodon confluens*. National Trust property. On mossy bank by path. 1998? E.E. Green.

St Gorrans School nr Gillan SW 772852 *Hydnellum spongiosipes*, *Phellodon confluens*, both on 4.11.1969. G.B. Miller.

Kilminorth Wood, Looe SX 2354 *Hydnellum concrescens* 28.9.1902, 18.10.1908 *Phellodon melaleucus* 29.9.1902, 25.10.1908.

'Nr Looe', 'West Looe' SX 2553 *Phellodon melaleucus* Hb Carlton Rea 7.9.1904, 7.8.1908. The grid square is mostly built up, and probably the lower end of Kilminorth Wood is meant.

Par Moor Wood SX 0652 *Sarcodon imbricatus* 1984.

V.c. 3 and 4 Devon

The scatter of records from north and south Devon suggest that stipitate hydnoids may be widespread in the county at low density, especially on wooded slopes above streams. The records of *Hydnellum scrobiculatum* under oak probably refer to *Hydnellum concrescens*, since the former is now believed to be over-recorded and restricted to pine. If so, only two species, *H. concrescens* and *Phellodon melaleucus*, have been recorded from Devon. These are our most widespread hydnoids, and are more tolerant of western oceanic conditions than the others, and occur on a wider range of soils, including clay and limestone. Unfortunately there was no reply to my request for records from Devon, and most of the following are from the database.

Furley nr Axminster *Phellodon melaleucus* Mossy streambank under beech and oak. P.D. Orton 25.10.1957, 19.9.1960. *Hydnellum velutinum* agg. (either *H. spongiosipes* or *H. scrobiculatum*) same site, P.D. Orton 19.9.1960. Membury *H. scrobiculatum* Bank of stream under oak, 19.9.1960 (database record; this is also the same site).

Great Haldon Forest SX 8884 *Phellodon melaleucus*, *Hydnellum concrescens*. Under beech in mixed forest, mainly planted. Peter Roberts. 24.10.2000.

Stover Park nr Newton Abbot SX 8375 *Phellodon melaleucus*, *Hydnellum concrescens*. In mixed woodland of pine, oak, birch and beech. Shelley Evans. 8.10.2000.

*Dunsford Woods. *Hydnellum concrescens*. R. Grimshaw 9.2000.

Bystock nature reserve, nr Budleigh Salterton *Hydnellum scrobiculatum* Under oak, 21.10.1977 (database record).

Clayhidon, Cullumpton (Blackdown Hills) ST 1615 *Hydnellum scrobiculatum* E.A. Marriage, 17.9.1962.

Slapton Wood, Slapton Ley nature reserve. SX 8345 *Phellodon melaleucus* On moss 'on clayey humus of streambank' D.L. Hawksworth, 6.10.1974.

Godsworthy Bottom SX 5077 *Phellodon melaleucus* 'On streambank under oak, beech etc' T.J. Wallace 30.8.1975.

*Ashculm Turberry nature reserve SX 97 *Phellodon melaleucus* John Keylock 20.10.1974.

Newton St Cyres SX 8797 *Hydnellum concrescens* Undated, Hb Carleton Rea.

Hybrook Park (?), Devon *Hydnellum concrescens* 10.1875.

'Devon' *Hydnellum concrescens* Undated 19th century Hb C.E. Broome.

V.c. 5 and 6 Somerset

The few records I have traced from Somerset are as follows:

Higher Merridge, Bridgwater, ST 2135 *Hydnellum scrobiculatum* 'Under beech' Mrs E.A. Marriage 8.10.1961. Probably *H. concrescens*.

Crowcombe, Quantocks ST 1334 *H. scrobiculatum* E.A. Marriage 5.10.1961.

Street ST 43 *Phellodon niger* Many collections in Kew from 1868-69. Also *Hydnellum concrescens* 23.10.1868. Street, in the Somerset Levels, was a popular venue for Victorian naturalists.

Batheaston ST 7767 *Phellodon niger* Undated 19th century.

Selworthy Combe SS 9146 *Phellodon tomentosus* Undated 19th century.

All but the last are from V.c 6 (North Somerset). The lack of recent records suggests either than tooth fungi have declined or that the area is under-recorded.

V.c. 7 & 8 Wiltshire

There seem to be no records of any of our species, though *Hydnum repandum* is fairly common and *Hericium cirrhatus* and *H. erinaceus* occur very locally. Since Wiltshire is a reasonably well-recorded county, with an active recording scheme, this apparent absence must be significant. In this mainly calcareous county, the most likely area is the Bagshot Sands in the SE corner. But Ted Gange, who lives on this formation, and has studied fungi in the county for at least 30 years, has not recorded any of our species.

V.c. 9 Dorset

Recent records from Dorset suggest that stipitate hydnoids may be widespread at low density in woods and plantations, especially on the Tertiary gravel beds in the Poole Basin around Moreton and Wareham. Pinewood seem to be the main habitat in this county.

*Moreton Plantation SY 8090, 8190 *Hydnellum scrobiculatum* 24.10.1991, *Sarcodon imbricatus* 20.10.1988, 19.10.1989, *Phellodon niger* 20.10.1988, 24.10.1991 John Keylock, Southern Fungus Recording Group.

Oakers Wood SY 8190 *Sarcodon imbricatus* Under pine 15.10.1989 Database. Oakers Wood adjoins Moreton Plantation and may be considered part of the same site.

'Wareham' *Hydnellum scrobiculatum* 'Under Pine' in 1962 and 1967, C.K. Schofield. *H. spongiosipes* 'under oak' C.K. Schofield 8.10.1958.

Abbotsbury Castle SY 5586 *Hydnellum spongiosipes* 'In deep *Polytrichum* at base of oak bole. Ben Brown 29.8.1973.

Fiddlers Wood, Sturminster Newton *Hydnellum concrescens* Hb. Broome 1867.

Radipole, nr Weymouth *Sarcodon imbricatus* Undated, probably *c.* 19th, Rev Mr Johnson.

V.c. 11 and 12 Hampshire

The New Forest is a 'Tooth-fungus Heaven', rivalled in England only by the Tertiary heaths, woods and parks of eastern Berkshire. The New Forest is the subject of a separate report (Ewald 2000) by the Hampshire Wildlife Trust, which need not be repeated in detail here. The commonest species in the Forest seem to be *Hydnellum concrescens*, *H. spongiosipes* and *Phellodon melaleucus*. *Phellodon niger*, *Phellodon confluens*, *Hydnellum scrobiculatum*, *Sarcodon imbricatus* and *Sarcodon scabrosus* are also present, but more localised. Old records of *Phellodon tomentosus* and *Hydnellum ferrugineum* lack confirmation. The ongoing surveys by the Trust indicate that stipitate hydnoids are widespread on woodbanks, roadsides, the edges of marl pits and on railway cuttings. The preferred habitat is among moss or open ground with little humus or litter. See also **Site Records**.

Outside the New Forest, our species are much rarer, but probably overlooked, with most records coming from the Tertiary gravel beds or the Greensand in the north-east of the county. The former forms part of a natural area stretching into Berkshire and including Windsor Great Park. Hampshire has an active local fungus group, and the absence of our species from the central chalklands may be real. Interestingly, there are no records from the Isle of Wight.

Non-New Forest records

**Hydnellum concrescens* Claycart Bottom, nr Aldershot SU 852524 D. & J. Dell, 1997. Brimstone Enclosure and Lynchborough Park, Woolmer Forest SU 7932 24.9.1913. *Setley Plain SU 300000 Graham Mattock 1998 (this site lies just outside the legal New Forest boundary).

Hydnellum spongiosipes Alice Holt, Rowledge SU 84 D. Reid & A. Thomas 9.10.1982.

Phellodon melaleucus Liss 10.1924.

**Sarcodon scabrosus* Hawley Lake SU 838569 12.9.1997, 17.9.1999; Woods at Hawley Common nr Farnborough SU 838569 D. & J. Dell, 1999.

Sarcodon imbricatus Pinewoods, Blackwater P. Newton-Schmidt, det Peter Roberts 18.10.1994.

V.c. 13 and 14 Sussex

Stipitate hydnoids are surprisingly scarce in Sussex compared with its neighbours. Probably this large well-wooded county is relatively under-recorded, but Patrick Leonard, the active leader of the West Weald Fungus Group, has not yet recorded any of our species, nor have they turned up in well-recorded sites such as The Mens or Ebernoe Common. One would expect more records from Ashdown Forest, given its similarity to the New Forest.

Dennis (1995) records 5 of our species from East and West Sussex, but two of these evidently refer to old records from Woolmer Forest, which is in Hampshire. Contrariwise, *Hydnellum spongiosipes*, listed in the database from Surrey, was in fact found in West Sussex. I have traced the following records:

West Sussex

Welch's (or Wetch's?) Common, Sutton *Phellodon tomentosus* 'On a bank above alder bog with standing water' Derek Reid & Audrey Thomas 16 & 18.9.1985.

'Linchmere' [Linchmere Common, nr Haslemere] *Hydnellum spongiosipes* Roadside Laura Ponsonby 21.10.1979.

East Sussex

Broadwater Forest. *Sarcodon imbricatus* Under Pine 14.10.1998 The database grid ref must be in error.

Ashdown Forest. *Hydnellum scrobiculatum* 'Bank under deciduous trees'. I. Fraser, 20.9.1992. Possibly this is *H. concrescens*.

V.c. 15 & 16 Kent

Dennis (1995) records 6 of our species from Kent, namely *Hydnellum spongiosipes*, *H. scrobiculatum*, *Phellodon melaleucus*, *P. niger*, *P. tomentosus* and *Sarcodon imbricatus*. *Sarcodon scabrosus*, *Hydnellum concrescens* and *Phellodon confluens* have turned up in the county since then, making a total of 9 species. Recent records are confined to a handful of sites, all in West Kent, centred on the Greensand and Tunbridge Wells Sands. *Pembury Walks (TQ 61 42) and *Mereworth Woods (TQ 63 53) have 5 and 3 species respectively, the sites being dry, sandy wood-banks, often associated with managed Sweet Chestnut (see **Site Records**). It may be significant that these are both large blocks of woodland. Other sites are:

*Shorne Country Park, nr Rochester TQ 6870 *Phellodon* sp., probably *Phellodon confluens*. Bare ground under sweet chestnut on calcareous clay, several patches. Jo Weightman, 14.10.2000.

*Oldbury Hill, nr Seal, Sevenoaks TQ 5856 *Hydnellum concrescens* Joyce Pitt 10.1999. Land owned by National Trust. There are 19th century records of *Sarcodon imbricatus* from Seal and 'Sevenoaks' E.M. Holmes, 14.10.1905

'Chart' [Presumably Seal Chart nr Sevenoaks] TQ 55 *Sarcodon imbricatus*. Undated.

Hosey Common, nr Brasted TQ 455525 *Hydnellum spongiosipes* Mossy roadside bank at edge of acid oak-birch woodland. Ewart Thomas det. Alick Henrici 1994.

Squerryes Court, nr Westerham TQ 4453 *Phellodon tomentosus* BMS foray 25.9.1960.

Crockham Hill, Edenbridge TQ 44 *Phellodon melaleucus* Under conifers and beech. Mrs Hilton, det J.B. Evans 1961. Crockham Hill lies just south of Squerryes Court.

Pauls Cray Common *Hydnellum scrobiculatum* TQ 46 19th century, Hb. Berkeley.

Otford TQ 55 *Phellodon niger* 19th century.

Woods near Shoreham TQ 56 *P. niger* 11.1875.

Maidstone TQ 7655 *Sarcodon imbricatus* Undated (Grid ref is the centre of Maidstone).

V.c. 17 Surrey

No fewer than 9 of our species have been found in Surrey (Dennis 1995), plus all three species of *Hericium* and both species of *Hydnum*. The major sites are heathy or wooded commons on the acid Bagshot Beds, notably Esher Common (perhaps the best-studied mycological site in the world), Witley Common, and Oxshott Heath, which contain respectively 4, 4 and 6 species (see Site Records).

Other Surrey records

*Penny Hill, Camberley SU 8962 is noted for stipitate hydnoids of the 'Windsor group' (Ted Green pers. comm.). Mature Sweet Chestnut coppice on Bagshot sands, see Berkshire.

Nork, nr Banstead *Hydnellum concrescens* Larch and fir plantation P.D. Orton 13.10.1958.

Ockham Common by Bolder Mere TQ 0758 *H. concrescens* Under Sweet Chestnut in mixed woodland 14. and 22.9.1987. Database record.

Hydon Heath, Godalming (SU 93) *Hydnellum scrobiculatum* and '*H. velutinum*' (possibly = *H. spongiosipes*) Under Sweet Chestnut, Derek Reid 24.9.1967. Godalming *H. concrescens* and *Phellodon tomentosus* C.T. Green 12.10.1924, may be this site.

Grayswood, Haslemere [Grayswood Common?] *Hydnellum concrescens*, *Phellodon melaleucus* BMS Foray, 9.1945. Also 'Haslemere SU 9032 *Sarcodon imbricatus*, *H. concrescens* 9.1905, *Phellodon niger*, 1945. This area needs re-surveying.

Englefield Green SU 98 *Hydnellum scrobiculatum* Under Sweet Chestnut 28.8.1961.

Near Guildford (TQ 04) *Phellodon melaleucus* Mrs Powell 11.1978.

Polesden Lacey (TQ 15) *Phellodon niger* Under dense yew and beech, P.D. Orton 17.10.1958.

Shere (TQ 04) *Hydnellum scrobiculatum* 1865 Hb Berkeley.

Virginia Water. See **Site Records** and **County Records**, Berkshire.

V.c. 18 and 19 Essex

Only 5 old records of 4 species from Essex, all but one from the Epping Forest area, the other from the Stour estuary. The record of *Hydnellum aurantiacum* is one of only two in England (the other is in Yorkshire). I have not tracked down the specimen; it is not in Kew, and the Kew monograph ignores it. However this species is not easily confused, and given the undoubted past occurrence of another native pinewood species, *Bankera fuligineoalba* at Ascot, it does not seem impossible.

Epping Forest TQ 39 and 49 Formerly perhaps a rich site, but no recent records. *Hydnellum scrobiculatum* 1876, *H. aurantiacum* 1950, *H. concrescens* Undated, 19th century, *Phellodon niger* TQ 4197 10.1906. The ref is close to the present-day Conservation Centre.

Wrabness TM 13 *Phellodon niger* Undated, 19th century.

V.c. 20 Hertfordshire

Mycologically, Herts is one of the best-studied counties in Britain, with a continuous series of fungal records stretching back to the 1890s; it has been home to such luminaries as Worthington G. Smith and M.C. Cooke. Alan Outen holds what he estimates to be in excess of 1.5 million fungus records for the county, and a *Fungi of Hertfordshire*, by Outen, Kerry Robinson and the late Margaret Holden is in the process of publication.

Despite this, there are no recent records of any of our species, suggesting that they either do not occur in present-day Herts, or that they fruit very rarely (by contrast, all three species of *Hericium* occur here). The only record is an old one for *Sarcodon imbricatus*, High Scrubs (SP 90) 'under larch', November 1920 and 1926. The site has been revisited, but Alan Outen reports that it seems to be mycologically poor. Certainly the species has not reappeared.

V.c. 22 Berkshire

Next to the New Forest, Berkshire is the richest area in England for stipitate hydnoid fungi. The area of interest is quite large, bounded in the east by Camberley, Bracknell, Windsor and Woking while further west there are several records from around Newbury. These are known amongst mycologists as 'Windsor sites' because this area once formed the Windsor

Forest. The old herbarium labels 'Windsor' and 'near Ascot' give a misleading impression of the full extent of 'Stipitate Hydnoid Country' - especially as most sites are nearer to Bracknell and Sunningdale than Windsor. Since the 1960s, the area has been well-surveyed by mycologists Derek Reid, Ted Green and Martyn Ainsworth, whose help has been invaluable.

Some 7 species occur in what we will call the 'Windsor area', namely *Hydnellum concrescens*, *H. spongiosipes*, *Phellodon niger*, *P. melaleucus*, *P. confluens*, *Sarcodon imbricatus* and *S. scabrosus*. The only known site and type locality of *Sarcodon regalis*, new to science when discovered in 1968, has been lost to housing development. In addition there are many records of '*Hydnellum velutinum* var. *scrobiculatum*', but these are now referred to as *H. concrescens*. In addition, there are numerous collections in herbaria from 'Ascot' of *Bankera fuligineoalba* (1863-1864) and *Phellodon tomentosus* (1863-87), but seemingly none from the past hundred years. There are also unconfirmed records of *Hydnellum ferrugineum* from 'Reading' and 'Silwood', and '*Sarcodon leucopus*' from 'near Ascot' (1863) and 'Maidenhead' (1863). The principal habitat for all species except *S. imbricatus* is mature Sweet Chestnut, formerly managed as coppice, usually on barish mossy artificial banks or natural slopes, and often by roadsides or forest tracks. They are threatened locally by rhododendron invasion (see below) and, potentially, by bracken invasion on forest edges. Martyn Ainsworth has also observed that stipitate hydnoids have disappeared from the part of Swinley Park bordering the housing estates of Bracknell new town, an area open to car emissions and the drift of garden chemicals, as well as the urine and turds of dogs.

The main areas where stipitate hydnoid fungi have been found are marked on the 1:25000 map sent in confidence to English Nature. Stipitate hydnoid fungi have been recorded from 'Windsor' since the mid-19th century, when M.C. Cooke and others collected from around Ascot. Mycological visitors from London would catch the train to Ascot and probably set out on foot to the then open heaths and woods to the south and south-west, hence the 'Ascot' label on most old herbarium sheets. The area was then more open, but with managed Sweet Chestnut copses and pine plantations as well as scrubby heathland. Much of Swinley Park and neighbouring areas of former heath on Crown land north of the present A30 has since been planted, mainly with Scots pine, since the end of the 19th century. Nevertheless patches of open heath and semi-natural woodland survive as well as lakes, bogs and marshy scrub. The area including Bagshot Heath between Bracknell and Camberley has recently been proposed as a SAC, mainly on the grounds of its bird populations. Unfortunately Swinley Park and Buttersteep, an area rich in fungi, including BAP species, was omitted from the SAC. Not only is Swinley Park a top site for stipitate hydnoids, but it contains several trees bearing brackets of *Buglossoporus pulvinus*, one of only four fungi protected by law.

Nearly all the areas where stipitate hydnoids have been found lie on the very acid soils of the Bagshot Beds, in the woods around Virginia Water and Fort Belvedere, and further west in Swinley Park, Buttersteep and the vast nameless plantations between Bracknell and Camberley. The only site in Windsor Great Park itself is by the track just west of Sandpit Gate. Two of the more famous sites, Caesar's Camp (SU 863660) and Buttersteep Hill (SU 910665), have virtually a full suite of 'Windsor' species, that is *Sarcodon scabrosus*, *Phellodon niger*, *P. melaleucus*, *P. confluens*, *Hydnellum concrescens* and *H. spongiosipes*, all occurring on seemingly the same kind of open ground under shade, with a characteristic mixture of bare soil, moss and pockets of leaf litter. As in the New Forest they tend to occur in places where tall vegetation is very sparse or absent. According to Ted Green, fruiting can begin as early as July in some seasons, and goes on until late autumn, when the slanting light and thick

chestnut litter can make searching for them difficult. Most sites are under mature or at least maturing Sweet Chestnut on banks. An unusual habitat at Buttersteep is the mouths of rabbit and badger burrows (Ted Green pers. comm.).

Invasive rhododendron, which grows up to 7m high on these soils and can form a dense understorey beneath Scots pine, is a real nuisance and is hard to eradicate. Over the past ten years, conservation work parties, helped by a Millennium conservation project grant, have endeavoured to clear rhododendron from Buttersteep Hill, to safeguard its rich population of stipitate hydnoids and other fungi. Under Ted Green's direction, the growth has been cut or winched and removed from the site before being burned, and no chemicals have been used. This is the only example, to our knowledge, of direct conservation action to save rare fungi. Old rhododendron stands tend to leave a skin of black humus which may need to be raked back before fungi can re-establish. Buttersteep Hill has been preserved as old chestnut woodland by the Crown estate by private agreement.

See **Site Records** for details of separate localities.

West Berkshire

Although the database has no records from the county west of Reading, stipitate hydnoids have been found on sandy soils around Newbury at Fence wood, Snelsmore Common, Bucklebury Common (in an area known as The Slade) and Newtown Common. This area needs more survey.

*Newtown Common SU 474632 *Hydnellum concrescens* 29.9.1985, *Phellodon melaleucus* 10.10.1992. Both around shallow pits (old gravel workings?) on Tertiary gravel beds in mixed woodland, just W. of minor road from Newtown to Burghclere. Neville Diserens. The area is quite rich in fungi. Neville Diserens has colour photos.

*The Slade, Bucklebury Common SU 534696 *Hydnellum or Phellodon sp.* found on 15.10.1994 and 27.9.97. Dried material destroyed by insects, but probably either *Hydnellum congrescens* or *Phellodon confluens*. Malcolm Storey.

*Fence Wood, Hermitage SU 513724 *Phellodon tomentosus* On minor road bank, probably under Sweet Chestnut, near banks of Grimsbury Castle. E.E. Green, det. 'a mycologist from Leiden', Holland, who has the specimen. About 1990.

*Snelsmore Common Country Park nr. Newbury. *Sarcodon imbricatus*. According to Ted Green, the late F.B. Hora found this species here in the 1960s. A specimen may be preserved in his herbarium. Snelsmore's woods are birch and pine on Tertiary gravels, which is right for this species.

V.c. 23 Oxfordshire

*Davenport Wood SU 822861 *Hydnellum congrescens* : 8 tufts under beech on roadside bank, 24.9.2000. Malcolm Storey.

V.c. 24 Buckinghamshire

Bucks is a relatively well-recorded county mycologically. Alan Outen has been leading forays here since 1978 as part of his Berkhamsted-based WEA course on fungal identification. His records have recently been passed to the present recorder, Dr Derek Schafer. They contain none of our species, and we may conclude from this that stipitate hydnoids are definitely rare in Bucks. However with at least 4 species, Burnham Beeches is an important site.

*Burnham Beeches SU 9585 This site was a venue for the BMS foray in October 2000. A stipitate hydnoid collected from one area and initially identified as *Phellodon niger*, was redetermined as a *Phellodon* sp., with characters closest to *P. confluens*, though more fresh material is needed to be sure. [Peter Roberts found *Phellodon melaleucus* and *Hydnellum concrescens*. Both together under beech.]

There is also a fairly recent record if *Sarcodon scabrosus* from under oak (but with sweet chestnut nearby) on 20.9.1958 by D.A. Reid. There are two records of *Hydnellum scrobiculatum* on the database (1930, 1969), which may turn out to be *H. concrescens*. A *c.* 19th specimen from Burnham Beeches in Hb. Broome was redetermined as this species by Maas Geesteranus in 1957.

Fingest *Hydnellum concrescens* E.J.H. Corner 27.9.1927.

Nr Slough (SU 98) *Hydnellum concrescens* Undated 19th century. Possibly Burnham Beeches.

A surprising record of *Hydnellum ferrugineum* in 1997 from Shabbington Wood on the Oxford Clay was apparently based on a young specimen exuding red guttation drops typical of, but not unique to, this species. Confirmation is needed; I suggest it might have been *Heteroporus biennis*, which can resemble a 'stip. hyd.' and exude red droplets.

V.c. 30 Bedfordshire

Beds has been well-studied mycologically over the past 60 years by some of Britain's most distinguished field mycologists, including Alan Outen, Derek Reid and R.W.G. Dennis. In all that time not a single stipitate hydnum turned up (though *Hericium cirrhatus* occurs here). Alan Outen considers it is unlikely that any are present, since there is not enough suitable habitat left. The only record from the county is one of the oldest we have, from the *Flora Bedfordiensis* by Charles Abbot (1798), which has *Sarcodon imbricatus* under 'fir' (that is, Scots Pine) near 'Warden', wherever that was.

V.c. 28 and 26 Suffolk

There are surprisingly few records from Suffolk, given the extensive areas of potentially suitable ground on the Breck and the Sandlings, and that the county is reasonably well recorded. The checklist of Suffolk fungi (1992) by Martin and Pam Ellis lists 4,275 species, nearly half the fungi known to occur in Britain. Stipitate hydnoids may be under-recorded here, but they must also be rare. All three species of *Hericium* occur in the county.

Brandon Country Park TL 78 *Sarcodon imbricatus*. It appeared again at this 19th century site in 1976.

Bungay Common TM 38 *Sarcodon imbricatus* Undated 19th and 20th centuries. There are also old records of '*Hydnellum compactum*' from 'Bungay' and nearby Earsham Wood (TM 3289). This is a continental species, not reliably recorded from Britain, but it might be overlooked.

East Skipton, Bury St Edmunds *Hydnellum spongiosipes*, *Hydnellum* sp. Hb. Berkeley, 1879.

V.c. 27 and 28 Norfolk

Most of the few records from Norfolk come from just one site in the Broads (v.c. 27), which has 4 recorded species. Wheatfen Broad, Surlingham was the home of Ted Ellis, the naturalist, and so, with the possible exception of Wicken Fen, Cambs, it is the best-recorded fen in Britain. This suggests that here we are mapping the recorders, not the fungi. An additional record, from Holt in v.c. 28, came in as this report was being written.

Surlingham (TG 3106). Records are also labelled 'Wheatfen' or 'Smee Lake' or all three, but it is all the same general site. *Hydnellum concrescens* G.C. Dickson, 10.10.1993. *H. spongiosipes* Home Marsh, by path under trees and 'on raised bank bordering field' P.D. Orton, Smee Lake R.W.G. Dennis 22.9.1964 and 25.10.1971. *H. scrobiculatum*. Surlingham, Smee Lake. 25.10.1971. *Phellodon confluens* Under oak, wet soil of Smee Lake 25.10.1967 R.W.G. Dennis.

*Holt, Gresham's School TG 089396. *Hydnellum concrescens* Single fused mass under oak and Rhododendron Det A.R. Leech 10.10.1999. This is an area of sandy, acid soils.

Felthorpe Woods *Hydnellum scrobiculatum* Alec Bull 1968. Probably *H. concrescens*.

'Norfolk' *Hydnellum concrescens* Undated 19th century.

V.c. 31 Cambridgeshire

The local recorder, Sheila Wells, had no records of our species from modern Cambridgeshire. The county includes the well-recorded Hayley Wood and Monks Wood, as well as Wicken Fen, and the absence of stipitate hydnoids from these places is probably real. The database record from Cambs is an error; Brandon Country Park is in Suffolk.

V.c. 32 Northamptonshire

Although this was the county of the great Reverend Berkeley, there is only one old, probably misapplied record on the database:

Cotterstock TL 0490 *Hydnellum ferrugineum*. Undated, 19th century.

Most old records of *H. ferrugineum* were reassigned by Maas Geesteranus in the 1950s. Bedford Purlieus, often visited by the Huntingdon Fungus Group has no records of any stipitate hydnoids.

V.c. 33 and 34 Gloucestershire

The database has only two old records from Glos. However R.W.G. Dennis and the Dean Fungus Group have records of 4 species, suggesting that stipitate hydnoids are present, possibly widespread at low density, especially in the Wye Valley and the Forest of Dean. However, there were no records from the Woolhope Club who forayed in the Forest of Dean in 1887 and 1888, nor, more recently, has the Cotswold Fungus Group found any. Most of the following records were kindly passed on by Dr Jack Marriott.

**Hydnellum concrescens* Highnam Wood SO 7719 Undated, R.W.G. Dennis.

**Hydnellum concrescens* Wench Ford, Dean SO 6508 25.9.1988 Dean Fungus Group.

**Hydnellum concrescens* Dursley ST 7597 10.10.1889 W.B. Grove.

Hydnellum concrescens Coldwell Rock SO 51 11.10.1897 Database record.

Hydnellum spongiosipes Lydbrook, Dean SO 6015 Undated, R.W.G. Dennis.

**Phellodon niger* Soudley Ponds, Dean SO 6611 12.10.1996 Dean Fungus Group. Painswick Beacon, Cotswolds SO 8612 Undated, R.W.G. Dennis.

Phellodon tomentosus Hangerberry, Dean SO 5914 26.9.1987 Dean Fungus Group.

V.c. 36 Herefordshire

Thanks to 'the Woolhope', there are local records running back to the mid-19th century in this well-recorded county, and the rarity of stipitate hydnoids may therefore be real. Two recent records from the Wye Valley suggest that stipitate hydnoids may be being overlooked there. They are in the same mycologically rich area, and are unusual in being on limestone.

Hydnellum spongiosipes King Arthur's Cave, Great Doward. Under beech, 4.9.1999 Shelley Evans.

H. concrescens White Rocks SO 5415 6.10.1999 Shelley Evans.

Sarcodon imbricatus Haugh Woods SO 5637 18.9.1951.

There are 19th century records of *Phellodon melaleucus*, *Hydnellum concrescens* and '*Hydnellum mirabile*' (presumably a misapplied name, identity uncertain) from 'Hereford', and *Phellodon tomentosum* at 'Hereford Show' SO 53.

V.c. 37 Worcestershire

Carleton Rea lived all his life at Worcester, which may be why there are 2 or 3 old records but only one recent one. Some Worcs sites on the database are in Herefordshire.

Hydnellum scrobiculatum Hartlebury Common SO 8270 Under oak 4.9.1987. Possibly *H. concrescens*.

Phellodon melaleucus Birchen Grove, Henwick. Under oak 10.1855.

Phellodon melaleucus Birchen Grove, St John's, Worcester 10.1855. Evidently the same place.

Phellodon melaleucus 'Near Worcester' Undated 19th century. Possibly also the same place.

V.c. 38 Warwickshire

Fungus Flora of Warwickshire (1980) contains only one old record of a stipitate hydnoid, although there is another on the database.

Alverton Pastures SP 23 *Hydnellum scrobiculatum* J.E. Bagnall 1860.

Near Coleshill SP 1989 *H. scrobiculatum* 28.10.1882, *H. ferrugineum* Undated 19th century.

Given the changes in synonymy since then, both records are dubious, and likely to be *H. concrescens* and *H. spongiosipes*. The latter grid square is now occupied by bypasses and suburbs.

V.c. 39 Staffordshire

There are very few records of stipitate hydnoids from the Midlands counties. One of them is:

Belvide SJ 8510 *Hydnellum concrescens* 9.1978. Database record.

Nothing is known about it locally. Staff was well recorded mycologically by the late Mike Austin. Stipitate hydnoids must certainly be rare there.

V.c. 40 Shropshire

It may be significant that the few records from this county were either from the BMS 'Shrewsbury foray' in 1917 or from Bomere, a popular destination for Victorian naturalists.

Bomere SJ 4719. Old records of 4 species: *Phellodon melaleucus* 1877, *P. niger* 'Bomere Wood, near the pool' 1877, *P. tomentosus* 1877, *Hydnellum scrobiculatum* 1917. The place still exists, but do the fungi?

Tick Wood SJ 6402 *Hydnellum concrescens* 27.9.1917.

Whitcliffe nr Ludlow SO 5074 *Hydnellum concrescens* Undated 19th century.

Vice-counties 41 to 52 are in Wales and so none of our business.

V.c. 53 and 54 Lincolnshire

Only two records from this large agricultural county, both old. There is a local field mycology group, but no further records yet.

Holton le Moor TF 0897 *Hydnellum concrescens* 28.9.1916.

Tumby TF 25 *Hydnellum concrescens* 1909.

V.c. 55 Leicestershire and Rutland

There is only a single record of an unidentified *Hydnellum* without habitat details:

*Merry's Meadow, Rutland SK 938157 1.11.1990. From a list of Rutland Naturalists records, supplied to the local fungus group by Linda Worrall.

Stipitate hydnoids are certainly very rare in Leicestershire, unless people are consistently looking in the wrong places. The local database goes back to 1975, and the local recorder, Tom Hering, has attended 150 forays in the county, as well as collecting on his own.

V.c. 61-65 Yorkshire

At least 5 species have been recorded from Yorkshire. Moreover, judging from the spread of sites, stipitate hydnoids may even be widespread in the county at low density. However, local mycologists believe they must be very scarce. Of particular interest are *Bankera fuligineoalba* and *Hydnellum aurantiacum*. The former, which was collected from Crimsworth Dean in 1892 and the York area in 1971, is otherwise known only from the Scottish pinewoods, although it seems to have flourished near Ascot, Berks in the 1860s. Were these species introduced with Scottish or imported conifers, or are they more widespread than we know? A third rare species, *Hydnellum ferrugineum*, was recorded from V.c 61 (SE Yorks) and 63 (SW Yorks) in *A Fungus Flora of Yorkshire*, but old records of this species are very doubtful without a backing specimen. An additional record has been sent to me by local recorder, Andy Woodall.

Bullcliff Wood East SE 2915 (V.c 63) *Phellodon confluens* Under oak in mixed woodland 26.9.1995.

*Thornton Park SE 404856 (V.c 62) *Hydnellum scrobiculatum* 16.10.1999 Andy Woodall.

Forge Valley (V.c 62) *Hydnellum aurantiacum* 1915.

Crimsworth Dean nr Hebden Bridge SD 93 (V.c 64) *Bankera fuligineoalba* 10.1892.

Probably Strensall Common, nr York (V.c 61) *Bankera fuligineoalba* 27.9.1971. The specimen was among recently collected fungi from a foray around York.

Boynton TA 16 (V.c 61) *Hydnellum concrescens* Undated 19th century.
Littlebeck NZ 80 (V.c 62) *H. concrescens* 8.1880.

Seamer TA 08 (V.c 62) *Sarcodon imbricatus* Undated 19th century.

V.c. 66, 67 and 68 Northumberland and Durham

The near absence of stipitate hydnoids from north-east England is surprising. Possibly, as in the Scottish Borders, the woods are too small and fragmented to retain stipitate hydnoids, though I would not be surprised if they turned up in the vast plantations of the North

Pennines, such as Kielder Forest. There are no records at all from Durham (V.c 66), now a reasonably well-recorded county, and from Northumberland but one record, backed by a poorly preserved specimen, probably of *Sarcodon imbricatus*, although it is too decayed and mouldy to make identification certain. The site was the grounds of *Cragside Estate, Rothbury (NU 00), during a foray led by Gordon Beakes on 9.10.1994. Alan Legg, the active leader of the North Eastern Fungus Study Group keeps the dried specimen in a box of 'oddments' for use at talks.

V.c. 60, 69 and 70 North Lancashire, Westmorland and Cumbria

The only records from North Lancs are from Silverdale, mycologically a well-recorded area thanks to the efforts of Pat Livermore. Ted Green remembers finding stipitate hydnoids hereabouts (near Merlewood?) in the 1960s, but no details. The main site, Gait Barrows, is on hard Carboniferous limestone, although the fungi seem to have been found in more acidic pockets in the wooded parts. *Hydnellum concrescens* was found on the base of a birch tree, well above ground level, on 26 September 1992. A week later, on 3 October, Livermore found *Phellodon melaleucus* under yew and 'in ± open ground among grass and Dog's Mercury, ivy and seedling ash'. *Hydnellum scrobiculatum* was found at Eaves Wood, Silverdale (SD 47) in 1970 and 1978, with *Phellodon niger* also found on the latter occasion.

The few database records from the Lake District are:

Slackhead, Westmorland. *Phellodon niger*, *Hydnellum concrescens* 'On ground in coniferous and mixed woodland' Sept 1967 M. Hussey, det J.B. Evans.

Beethan, Westmorland (SD 47) *Hydnellum scrobiculatum* 'Mixed woodland' Oct 1969. Database.

'Carlisle' *Phellodon melaleucus* [as *Hydnellum cyathiforme*] Hb Berkeley 1886; also in Hb Cooke, *Hydnellum concrescens* 1884, (NY 3955) *Hydnellum scrobiculatum* 9 & 10.1886.

Summary: Distribution of stipitate hydnoid fungi by English vice-county (includes all records to date)

Bankera fuligineoalba	Post-1960: 61. Pre-1960: 22, 63.
Phellodon melaleucus	Post-1960: 3, 11, 17, 22, 24, 60. Pre-1960: 2, 12, 13, 36, 37, 40, 70.
P. tomentosus	Post-1960: 3, 13, 16, 22, 34. Pre-1960: 5, 11? 17, 36, 40.
P. confluens	Post-1960: 1, 2, 11, 16, 17, 22, 27, 63. Pre-1960: 3.
P. niger	Post-1960: 9, 11, 16, 22, 34, 60, 69. Pre-1960: 6, 12, 17, 18, 19, 33.
Hydnellum aurantiacum	Pre-1960: 18, 62.

H. concrescens	Post-1960: 2, 3, 11, 12, 13, 16, 17, 22, 27, 28, 34, 60, 69. Pre-1960: 6, 9, 18, 24, 36, 40, 54, 61, 62.
H. scrobiculatum	Post-1960: 3, 5, 9, 11, 14, 16, 17, 22, 24, 27, 37, 60, 62, 69. Pre-1960: 18, 38, 40, 70.
H. ferrugineum	Pre-1960: 11, 17, 22, 32, 38
H. spongiosipes	Post-1960: 1, 2, 3, 9, 11, 12, 16, 17, 22, 27, 36, 61. Pre-1960: 34.
Sarcodon imbricatus	Post-1960: 2, 9, 11, 12, 14, 17, 22, 25, 26, 67? Pre-1960: 16, 20, 30, 36, 37, 61.
S. scabrosus	Post-1960: 11, 12, 16, 22, 24.
S. regalis	Post-1960: 22.

5. Species records

The Species Action Plan (1997) for the 14 threatened stipitate hydnoid fungi has this to say about their status: 'although these are all considered to be threatened in the UK, they are almost certainly under-recorded due to their inconspicuous nature and absence of people with skills to identify species in this group'. At that point, only one species (*Hydnellum spongiosipes*) was known to occur in more than 15 post-1970 10 km squares (that species occurred in 16). For some species eg *Hydnellum concrescens*, *H. scrobiculatum* and *Sarcodon imbricatus*, old records outnumbered recent ones, which seemed to suggest a decline. On the basis of what was known then, one species, *Hydnellum aurantiacum*, was categorised as *Critically Endangered*, four (*H. caeruleum*, *H. ferrugineum*, *Bankera fuligineoalba*, *Sarcodon scabrosus*) as *Endangered*, while all but one of the remaining nine were considered *Vulnerable*. *Phellodon niger* was merely *Rare*, whilst the then newly discovered *Sarcodon glaucopus* 'probably merits *Endangered* status'. *Sarcodon regalis* was extinct.

The number of grid square records as at 1997 was as below:

	England		GB	
	Post-1970	Pre-1970	Post-1970	Pre-1970
Bankera fuligineoalba	1	3	9	10
Hydnellum aurantiacum	0	2	3	5
H. caeruleum	0	2	7	5
H. concrescens	12	22	14	28
H. ferrugineum	3	14	6	18
H. peckii	0	1	11	6
H. scrobiculatum	8	17	9	22
H. spongiosipes	14	3	16	3
Phellodon confluens	7	3	9	4
P. melaleucus	9	13	13	20
P. tomentosus	2	9	11	12
P. niger	n.a.	n.a.	n.a.	n.a.
Sarcodon glaucopus	0	0	2	0
S. imbricatus	5	10	14	17
S. scabrosus	3	2	5	2

In the monograph (Pegler *et al.* 1997), also published in 1997, the authors made the following remarks on the status of each species in England.

Bankera fuligineoalba	Very rare, possibly extinct; a few old records from Berks plus a more recent report from Yorkshire.
Phellodon melaleucus	Widespread and rather common.
P. tomentosus	Widespread but uncommon.
P. niger	Widespread but uncommon.
P. confluens	Widespread but not common in southern England.
Hydnellum aurantiacum	English records not mentioned.
H. concrescens	Widely distributed but most frequent in southern England.
H. scrobiculatum	Widely distributed but uncommon.
H. ferrugineum	Rare, known from parts of south and south-east England.
H. spongiosipes	Scarce, mostly in southern England and East Anglia.
Sarcodon imbricatus	Widespread but rare, mainly south-east England and East Anglia.
S. regalis	Regarded as extinct in Britain.
S. scabrosus	Rare, from parts of south and south-east England.

Records of *Hydnellum compactum* (12), *H. mirabile* (2) and *Sarcodon leucopus* (5) were considered doubtful.

The status of stipitate hydnoid fungi will need to be substantially revised in the light of new evidence from recent surveys in Scotland and the New Forest, as well as new records collected in the course of compiling the present report. However I want to comment here on the limits of recording schemes for stipitate hydnoids and other fungi since it seems they are not being sufficiently recognised by conservation planners. Contemporary records of stipitate hydnoids come from field mycologists with excellent field skills - perhaps fewer than 50 people. With such a small number competent to recognise and identify stipitate hydnoids, we are inevitably recording *the places where they have been found*, not their real distribution. In turn, the finds are focussed on places *where they have been looked for*, in England most notably the Thames Valley heaths, parks and commons, and the New Forest. Like all fungi, they must be grossly under-recorded, though we can be confident, from foray data, that over much of the countryside they are definitely uncommon or absent.

A comparison of post-1970 and pre-1970 records might suggest a substantial decline of stipitate hydnoids. However records go back to the mid-19th century (the earliest of all in 1795 - for *Sarcodon imbricatus* in Bedfordshire), so that the pre-1970 period covers 150 years compared with only 30 for the post-1970 period. Since many early mycologists kept a herbarium, there is quite a lot of old material available, which in at least some cases has been redetermined by a modern authority and so is useable. By contrast, only in the past decade

has there been any organised attempt to pool records and survey these species. In the circumstances, it is hardly surprising if there are more old records than new ones. Properly interpreted, it does not necessarily signify a decline.

Any comparison of old and new records should also take taxonomic revisions into account. For example, most database records of *Hydnellum spongiosipes* are recent. Before, this species was submerged under different names: older mycologists knew it as *Hydnellum velutinum* - but here the species concept was broader - and still older ones probably recorded it as *Hydnellum ferrugineum*. This is the reason why there are few old records of *H. spongiosipes* and few recent ones of *H. ferrugineum*. The same is true of *H. peckii*, which was unknown in Europe until 1950. Undoubtedly it was being found, but was probably again being recorded as *H. ferrugineum*. A large proportion of records of *Hydnellum scrobiculatum* are old and were originally recorded as *H. velutinum* var. *scrobiculatum* or still older synonyms. This species and its near-twin *H. concrescens* have been (and probably still are) much confused and the apparent decline of *H. scrobiculatum* may be due entirely to changing species concepts. A similar confusion may have blurred the true status of *Sarcodon imbricatus* and *S. scabrosus*, and potentially all of the *Phellodons*.

Once this is taken into account, the map evidence for a severe decline is less strong than it appears (I believe the sample size to be too small for statistically significant results). This does not mean that there has not been a decline. From the well-attested declines in the Netherlands, Denmark, Poland and parts of West Germany, it would be surprising if lowland England had escaped, especially as we share in the most probable cause - soil eutrophication. Moreover there is some evidence that stipitate hydnoids are less common than they used to be on some regularly visited sites such as Esher Common. On the other hand, there is no evidence of decline in the New Forest and in the Abernethy-Rothiemurchus pinewoods in Scotland. Quite the contrary, virtually all species are commoner than was realised. Roughly, these areas seem more like the situation in Norway, whilst in intensively farmed countryside the situation may be closer to that of the Netherlands.

On present evidence, there is some doubt whether *Hydnellum ferrugineum* occurs in England at all. However the ephemeral records of other pinewood species, notably *Bankera fuligineoalba*, *Hydnellum aurantiacum* and possibly *H. caeruleum*, might suggest that these species are introduced to England now and again, perhaps in soil from planted pines, but do not persist. *Sarcodon imbricatus* and perhaps *Hydnellum scrobiculatum* are pinewood species which seem much more firmly established in England, perhaps for as long as there have been pines. The remaining English species are characteristic of broadleaved or mixed woodland, and their distribution seems to reflect their individual ecological tolerances. While all of them are potentially widespread in terms of their ecology and dispersal, *Phellodon tomentosus* seems to be restricted to more acid soils, while *P. melaleucus*, *P. niger*, *Hydnellum concrescens*, *H. spongiosipes* and *Sarcodon scabrosum* can occur on alkaline clays, and the first four have even been found on limestone. Low nutrient status is presumably more important than soil pH (however acid soils can occur even on limestone, especially in the west).

British stipitate hydnoids seem to fall between highland, mainly coniferous, species and lowland, mainly deciduous, ones. In the former we have *Bankera fuligineoalba*, *Hydnellum peckii*, *H. aurantiacum*, *H. caeruleum*, *H. ferrugineum*, *Phellodon tomentosus*, *Sarcodon imbricatus* and *S. glaucopus*; in the latter *Hydnellum concrescens*, *H. spongiosipes*, *Phellodon melaleucus*, *P. confluens* and maybe *Sarcodon regalis*, with *Sarcodon scabrosus*, *Hydnellum*

scrobiculatum and *Phellodon niger* found in both. The following is my own interpretation of the status of the species occurring in England, on the basis of records made available to me.

Bankera fuligineoalba

Status probably accidentally introduced. Extinct or overlooked. Except in Scandinavia, where it also occurs under spruce, this is strictly a species of pinewoods on acid mineral soil with little humus or litter. It is not uncommon by tracks under Scots pine and heather in central and north-east Scotland, but in England there are records only from Berkshire and Yorkshire. The database includes no fewer than 16 collections from 'Ascot', 'near Ascot' or 'near Maidenhead', all from 1863 or 1864, collected by M.C. Cooke (and others?). The two with ecosystem data indicate 'fir plantation' (which in the 19th century usually indicated pine) and *Abies* plantation (unless *Abies* is a probably mistaken extrapolation from 'fir'). The site or sites were probably within walking distance of Ascot railway station. In Yorkshire, *Bankera fuligineoalba* was collected at Crimsworth Dean, near Hebden Bridge in October 1892. The latest record was a specimen identified in a collection from a foray near York in September 1971, most probably from Strensall Common. It has not been refound. Although it seems to have been quite common near Ascot for at least a couple of seasons, the evidence points to a short-lived introduction.

Hydnellum aurantiacum

Status: Probably accidentally introduced. Extinct or overlooked. This rare and attractive pinewood species has been recorded only twice from England: from the Forge Valley in north Yorkshire in 1915 and from Epping Forest in Essex in 1950. I have not seen any material, but this is an easily recognised species. Though categorised as *Critically Endangered*, it is not uncommon within a restricted area of Scotland, at least in good seasons. Over most of Europe it is a pinewood species, but in Scandinavia it also occurs in spruce and mixed forests on a variety of soils.

Hydnellum caeruleum

Status: Probably accidentally introduced or misidentified. This rare pinewood species was recorded, together with *Hydnellum compactum*, from Sandhurst, Berks by Michael Terry in 1871. Another record of *Hydnellum compactum* from near Bungay in Suffolk, date unknown, has been added to the distribution map of this species on the basis of possible synonomy. In Scotland, as in Europe, it is a species of nutrient-poor, acid pinewoods.

Hydnellum concrescens

Status: Native. Widespread but local in broadleaved woods, especially in southern England. Many herbarium specimens of this species are labelled *H. zonatum* or *H. velutinum* var. *zonatum*. It has been much confused with *Hydnellum scrobiculatum* (see below). Under current ideas about the species in Britain, *H. scrobiculatum* collected from under oak or other deciduous trees may need to be reassigned as *H. concrescens* eg. the *H. velutinum* var. *scrobiculatum* collected from under Sweet Chestnut at Buttersteep in the 1960s is now considered to be *H. concrescens*. If so, *H. concrescens* would certainly be the most widespread, and probably the least rare, of the 14 stipitate hydnoids in the Species Action Plan. However, according to some European accounts (eg Breilenbach & Kranzlin, 1986), *H. concrescens* can also occur in coniferous woods. The species has been recorded from at

least 25 English vice-counties, of which 14 are post-1960 records. It is widespread in the New Forest and is also known from commons, parks and woods in the Thames valley and SE England, usually under oak or sweet chestnut, on banks, tracksides, streambanks and managed chestnut coppice. It has also been found associated with pine, larch, beech and birch, although Scottish specimens from under pine may be *H. scrobiculatum*. It occurs on a variety of soils, from fairly acid sands to alkaline clays. A characteristic New Forest habitat is the edge of old marl pits. Like other stipitate hydnoids, it prefers open ground with little humus. Though widespread, it is confined to oakwoods in Scotland, and is most frequent in parts of southern England, where it can be very locally common.

Hydnellum ferrugineum

Status uncertain. This species is very similar to the much commoner *Hydnellum spongiosipes*, differing in its paler cap when young, paler flesh and exudation of red droplets, and also by its preference for pine rather than broadleaved trees. In Scotland, it has been confused with *Hydnellum peckii*, distinguished by an acrid taste, and microscopically by the presence of clamp-connections. Most of the old material named as *H. ferrugineum* has been reassigned, and at present there does not seem to be a single recent confirmed record of the species from England. There are a few 19th century records from E. Berks, and a collection in **Kew** from the New Forest by Dr H.C. Harris in 1962 was determined as this species by J.B. Evans. Maas Geesteranus determined as this species a specimen collected in 1924 from Betws-y-Coed in Wales (**Kew**). It should be looked for under Scots pine on dry, mineral soils, especially in the New Forest and the Windsor-Ascot area. It may possibly be a rare introduction with planted pine, like *Bankera fuligineoalba*. In Scotland it is native in Scots pine woods and old plantations. In Norway it is considered 'one of the more common *Hydnellum* species'.

Hydnellum scrobiculatum

Status: Native or long-established introduction, but much confused with other species, especially *H. concrescens*. The problem with this species is the lack of consistent characters to distinguish it: the radially grooved cap, green reaction in alkali solution and thin-fleshed brownish pileus are all shared to some extent by *H. concrescens*. According to Maas Geesteranus, the two species can only be reliably separated by their spores, but workers have experienced difficulty even there. In his key, Dickson (2000) separates them by tree host: *H. scrobiculatum* is associated with pine, *H. concrescens* with oak or chestnut. Hence, since the New Forest survey is concentrating on broadleaved woods, nearly all records are of *H. concrescens*. Unfortunately, many database records of *Hydnellum scrobiculatum* are from under oak or sweet chestnut, while a few of *H. concrescens* are from under conifers! If we reserved *H. scrobiculatum* for records from under pine or 'conifers', its status would alter radically from one of the commonest species to one of the rarest! Apparently material of *H. scrobiculatum* from Scottish pinewoods is more convincing, especially in the spore characters (Martyn Ainsworth, pers. comm.). Records assigned to *Hydnellum scrobiculatum* are scattered across much of England, but as usual, are most frequent in the New Forest, E. Berks and some of the Surrey commons, such as Esher (25 collections 1979-97, from pine and sweet chestnut) or Oxshott (7 collections, the two with habitat data from oak and 'Ericaceae'). Unless or until some reliable means is found to separate this species, its true status in England must remain unclear. If it is really confined to Scots pine and other conifers then it is presumably a well-established introduction.

Hydnellum spongiosipes

Status: Native, very locally common in broadleaved woodland, mainly in southern England but with isolated records from SE Yorks, E. Norfolk and the Wye Valley. This species is easily distinguished from other species except *H. ferrugineum* by its pale 'lumpy' pileus and tomentose, rooting stipe. Perhaps partly for that reason, and because most records are from the past 30 years, habitat details for *Hydnellum spongiosipes* are unusually consistent. It is associated with oak, sweet chestnut or, more rarely, beech, alder, birch or hawthorn in well-established broadleaved woodland. Though typical of acid, sandy soils, it is also found on alkaline clay (eg the Headon Beds of the New Forest) and on limestone, usually on bare or mossy banks, marl pits, streambanks or other open habitats. It is perhaps the third commonest species in southern England, after *H. concrescens* and *Phellodon melaleucus*. It is the second commonest species in the Windsor area. In Scotland it occurs very locally in oakwoods. By contrast, it has suffered one of the severest declines in the Netherlands and West Germany, where it is now considered to be endangered.

Phellodon confluens

Status: Native. Apparently rare in broadleaved woodland, mainly in SE England. Records of *Phellodon confluens* are rather few, but this rather critical species can easily be missed and it is probably under-recorded. It is certainly one of the rarest species in the New Forest, but seems to be more frequent in east Berkshire and the south-east. From its European distribution, one would expect it to be confined to broadleaved, especially oak, woodland, and in warmer areas. However records of *Phellodon confluens* from the Scottish pinewoods, if correct, indicate a second, wholly different habitat. English records are mainly from oak or sweet chestnut, with a few from beech, silver birch and pine. Habitats include sandy heathland and tracksides, woodbanks and the edges of marl-pits. On the continent it is associated with oak or beech on the southern coasts of Norway and Sweden, and formerly in shrubby oak forests on acid soils in the Netherlands.

Phellodon melaleucus

Status: Native and widespread but local in broadleaved or coniferous woods on sandy or clay soils, especially in southern England. *Phellodon melaleucus* is one of the most widespread of the stipitate hydnoids in England, occurring in Devon and Cornwall and Cumbria, as well as south-east England. It is easily overlooked, and its true status in the New Forest only became apparent during the 1999 and 2000 seasons, as surveyors gathered experience with the group. Gordon Dickson has found *Phellodon melaleucus* on sandy soil, associated with pine, spruce and birch, but most of the New Forest and Windsor-Ascot records are from under oak and sweet chestnut respectively. It has also been found under beech. At Gait Barrows in Cumbria it is associated with yew. Evidently *Phellodon melaleucus* can utilise a wide variety of host trees, including conifers as well as broadleaves. Its European distribution indicates this to be a species of warm areas. It is rare in Scandinavia, but widespread further south. This seems to be borne out by the GB distribution, for it seems to be rather rare in Scotland. It is the species with the most records from the oceanic west, including Wales, and W. Ireland. It has been found on a wide range of soil pH, from acid sand and needle litter to marl and limestone, usually on barish or mossy substrates with little humus. Given its wide ecological

range, one would not be surprised if *Phellodon melaleucus* emerges as the commonest species in England. Old records from the western marches need reinvestigation.

Phellodon niger

Status: Native, very local in broadleaved and mixed woods on sandy or clay soils. Records of *Phellodon niger* may have been confused with other *Phellodon* species, but in typical form this is an easily recognised species with its black, silky, white fringed pileus, and often striking violet colouration on the underside of young specimens. Most English records are from under oak, sweet chestnut or beech, with two records from under yew. In Scotland it occurs in pinewoods and spruce plantations. Gordon Dickson associates this species with heavy marls in the New Forest, although it also occurs on woodbanks on acid soils. In south-east England it is associated with woodland and sandy mossy banks areas, often near managed sweet chestnut coppice. At Slackhead in Westmorland it was found under a mixture of conifers and broadleaved trees, and the same seems to be true of some New Forest records.

Although this species was left off the Species Action Plan on the grounds that it was considered *Rare* rather than *Vulnerable*, this is a nonsense. In England *Phellodon niger* is found less frequently than *Hydnellum concrescens*, *H. spongiosipes* or *Phellodon melaleucus*. Its GB distribution indicates a widespread, if very local, species, and probably, like the others, under-recorded as well as misrecorded.

Phellodon tomentosus

Status: Native or well-established accidental introduction, rare and possibly much declined, mainly in pinewoods. On the continent, *Phellodon tomentosus* is associated with very acidic pinewoods among carpets of moss and lichen, with wisps of heather and bilberry. The few recent English records contrast with the many 19th century collections (as *Hydnum cyathiforme*) from 'Ascot' and other sites, inviting the conclusion that this species has suffered a severe decline. Possibly, in view of its preferred habitat, it is vulnerable to eutrophication, or possibly, like other pinewood stipitate hydnoids, its occurrence may be more irregular or ephemeral. It has not been seen for many years in the New Forest or the Windsor-Ascot area, and there are only a handful of recent records from England in W. Sussex, W. Kent, and W. Glos, where the precise habitat is either not adequately described or ambiguous. In Berks, Ted Green found it under sweet chestnut. There is a fairly recent record from Wales, while in Scotland it is locally frequent in pinewoods and has also been found in conifer plantations. On present evidence, while it is not endangered in Britain, it may be so in England, but more information is needed.

Sarcodon imbricatus (= *S. squamosus*)

Status: Native or long-established accidental introduction. *Sarcodon imbricatus* is associated only with pine, or rarely, larch in England, although on the continent it grows equally under spruce. It is the best known of the stipitate hydnoids through its regular appearance in field guides and its commercial importance as a foodstuff and the source of a dye, and, given its familiarity, this species does seem to be distinctly rare in England. The proportion of old to new records is greater than most other species, and there are no post-1960 records for at least 7 vice-counties. While this might be because recent searches have been made mainly in broadleaved woods, this species does seem to be less widespread than formerly, though it may well occur unseen in the extensive, little worked conifer forests of northern England.

Possibly its pinewood habitat is particularly vulnerable to eutrophication and increased competition from vascular plants, and also to periodic disturbance from timber management. The available evidence indicates that *Sarcodon imbricatus* is only well-established on the Tertiary sands and gravels of Berks and Hants, with outlying areas in Dorset, the New Forest, and the Breckland. I would judge the BAP's assessment of *Vulnerable* to be correct for England. However it is, by contrast, one of the commonest species in Scotland, and so safe enough on a GB basis.

Sarcodon regalis

Status: Apparently extinct native. This mysterious species, not listed in the Species Action Plan, was new to science when discovered under oak at Swinley Park, south of Bracknell, Berks on 3 October 1968 by R.A. Maas Geesteranus. This collection became the type material, described in 1975 (Maas Geesteranus 1975). *Sarcodon regalis* fruited again next year, but this area has since been cleared for housing and the exact site is now a perimeter road. The species has since been recorded from continental Europe. Given the large area of similar habitat in the area, it seems premature to write off *Sarcodon regalis* as extinct.

Sarcodon scabrosus

Status: Native, local and rare in broadleaved woodland on sand and clay. Most records of *Sarcodon scabrosus* are from the past 25 years. It has probably been passed over many times for *Sarcodon imbricatus*, from which it differs in its coarser, upturned scales and greenish-grey stipe base, and, microscopically, by its lack of clamp connections (NB. *Sarcodon imbricatus sensu stricto* also has coarse, upturned scales, while *S. squamosus* has soft, flat ones). In England, it has been recorded most frequently from oak woodland or sweet chestnut coppice, usually on banks. It also occurs under hazel on the bank of a New Forest marl-pit. In Scotland, it occurs in native pinewoods. In the European literature *Sarcodon scabrosus* is considered to be a species of mixed or coniferous forests on nutritionally-poor, dry soils. Judging from collections, this species occurs most regularly at Swinley Park and Buttersteep, between Bracknell and Ascot. The discovery of *S. scabrosus* elsewhere, in Kent, Hants and Bucks, suggests it is much under-recorded.

6. Sites and conservation

The most important centres for stipitate hydnoids in England are the New Forest and east Berkshire, currently under separate investigation by Hampshire Wildlife Trust and Ted Green respectively. Here I will touch on the New Forest only in a general way, since the details are in separate reports.

In general, detailed site information is hard to come by without visiting the site! The database contains no maps, and it is rarely possible to localise the exact site (which might be only a few square metres) even with a full grid reference. So I depend on local mycologists for information. However, unless fungi are being searched for and mapped for a specific reason, as with the survey of hydnoid fungi in the New Forest, it is unlikely that their precise sites have been mapped. You know from experience how hard it is to find out exactly where a particular mushroom out of a large collection came from. It may, for example, have been collected by someone who cannot remember where they were at the time, or has gone home. It can also be difficult to locate the exact position on a map, particularly in woodland.

With macro-fungi, one of course records only the visible fruit bodies, which are highly seasonal. The actual area occupied by the fungus may be much larger, although, in England at least, stipitate hydnoid species do seem to be highly localised, with restricted, often linear sites. In any particular season, it is likely that only a proportion of the fungi will produce fruit bodies. The odds against you finding one in a new site are great, unless it is a very good site or you are very observant, or very lucky. Only surveys with conservation data as the aim are likely to produce detailed, mapped site reports.

How do you rate the mycological importance of a site? In the only organised scheme that is up and running, the grassland survey, the site's relative value is scored according to the number of *Hygrocybe* (waxcap) species present. Waxcaps are fairly popular and accessible, with their own monograph. Moreover many species share broadly similar habitat preferences, notably natural oligotrophic grasslands, and rich sites have been called 'waxcap grasslands'. What is most striking with this method is that very small sites, like old lawns or acre-sized churchyards may be very rich in waxcaps, with 15 or more species present. A site with 15 waxcaps would simply score 15, irrespective of the species, though the eventual report will probably include a special weighting for rare or BAP species.

I would propose the same treatment for stipitate hydnoids. Such a method has been used in the Netherlands and Norway, with the inclusion of species of *Hydnum*, *Auriscalpium* and *Albatrellus confluens* (but not *Hericium*, though these are rare in those countries). Of the English species, 6 are fairly widespread and should count as one each. Perhaps there could be a double score for the rarer species, *Phellodon confluens*, *P. tomentosus*, *Sarcodon scabrosus* and *Bankera fuligineoalba*, but if recorded on a GB basis, as most of us would hope, I would simply give them all a score of one each. We really need more survey data before making our minds up about degrees of rarity.

Where do you draw the line around a site? The New Forest could be regarded as a single continuous large site, or as an unusually dense constellation of small ones. It is obviously a unit, historically and ecologically, but it cannot readily be compared with commons and copses at the other end of the scale. The same applies to the other 'constellation', the 'Windsor sites'. In these areas - the Cairngorm pine forests is another - stipitate hydnoids may be found generally over a large area. Elsewhere, the site may be localised, but to define the full area in which stipitate hydnoids may occur will require more survey work.

Conservation

Stipitate hydnoids seem to have much in common ecologically, although further study would no doubt reveal significant differences between them. Characteristic habitats in England include:

- managed or neglected sweet chestnut coppice, generally on slopes and banks, or on disused ground eg ditches or burrows

- oak-dominated stands within long-established woodland. In the New Forest they may benefit from heavy grazing and browsing by ponies and deer, maintaining relatively open ground. In Scotland, some pinewood stands rich in these species are heavily deer-grazed

- plantations, either mixed with beech, or of Scots pine. Again, banks and tracksides seem to be favoured.

There is a very strong association with woodbanks. Many of the strongest sites in south-east England, at least, are of formations of the Tertiary sand and gravel, often on well-wooded commons (which, almost by definition, were heavily grazed, at least until recent times), or present on former Crown Forests.

To conserve stipitate hydnoids actively we need to know much more than we do (see below). However there are several measures that would safeguard or benefit them:

- the retention of woodbanks and ditches, along with their trees, particularly where they border a drive or ride. This important micro-habitat is vulnerable to track widening and maintenance. Identifying mycologically important banks should be a priority on SSSIs and public land, so that contractors can be instructed not to harm them. Such banks may also be vulnerable to erosion (eg from mountain bikes) and eutrophication (eg from dog turds or travellers camps) on heavily used sites eg Swinley Park closest to Bracknell, or as a source of aggregate material for surfacing rides

- sympathetic woodland management - yes, but what kind of management? Current knowledge, mainly from surveys at Windsor and the New Forest, indicate that stipitate hydnoids like mineral soils without deep leaf litter, where the ground can be warmed by the slanting autumn sun at certain times of the day. Hence ideal management might be open grazing in near-natural conditions, as in the New Forest, or in coppicing as with some sites in West Kent. At Windsor, where the best sites are under neglected chestnut coppice, some renewed coppicing and thinning would probably benefit stipitate hydnoids by reducing the litter layer and exposing more of the ground to the sun. There is room for experimental management here, for example in comparing the effects of raking the leaf litter to expose the soil surface, or in digging ditches or even building earth banks to see whether fruit bodies show up there

- tackling invasive species. At Windsor, many former sites are threatened by the spread of rhododendron, which forms dense thickets, blocking out native vegetation, and effectively sterilising the ground from toxic chemicals produced from the fallen leaves and the roots. Ted Green and his helpers have valiantly fought the rhododendron menace at Buttersteep Hill, but the ground surface remains partly sterilised by a peaty layer overlying the mineral soil, and may need 'screefing' and raking to restore to its original condition. In general, management should aim to tackle rhododendron before it reaches this state (cf NT and CCW work in Snowdonia National Park). Ted Green comments that invasive bracken, too, can be a problem on the more open stipitate hydnoid sites and again best tackled before it becomes a menace

- scrub clearance. Some good sites eg the Surrey commons, are being restored to heathland by 'scrub bashing' and the introduction of grazing animals. While this may not threaten stipitate hydnoids directly, it would be as well to find out where they occur, so as not to fell the wrong trees

- better communications. On multi-purpose land, site damage often follows because one party fails to inform another. Martyn Ainsworth cites a recent example at Windsor, where it was only by chance that he and Ted learned that an orienteering route was to pass straight through one hydnoid site

- nitrogen pollution. Stipitate hydnoids seem vulnerable to chemical pollution from any source - spray drift, car emissions, dogs, spillages. Hence car parks and public recreation areas may affect hydnoid sites, while isolated woods bordering arable fields may be vulnerable to downwash seepage or drift from sprays and fertilizers. The problem of pollution is general and can only be tackled as part of a wider environmental policy, but good planning and an awareness of the problems could help to conserve hydnoid sites, and also show the agencies what to object to

- stipitate hydnoids seem to be good indicators of mycologically rich environments. This should be born in mind where radical changes are afoot in important hydnoid sites. Judging from surveys elsewhere in Europe some of England's woods and commons may be assuming the status of international refuges for certain fungi. Wider mycological surveys of important hydnoid sites is desirable.

Research Proposals

Before recommending further research, it is important to pool together what we already know - all the more so with different agencies commissioning research and survey work on stipitate hydnoids. So my first suggestion is that:

- English Nature, with SNH sponsor a workshop to bring together experts with experience of these fungi, notably from Scotland, Windsor and the New Forest. It would also be advantageous to invite English speaking guests from Holland, Denmark, Germany and Scandinavia, which have experience with this group of fungi eg Eef Arnolds of Wageningen Agricultural University in the Netherlands. The workshop would cover conservation, ecological and taxonomic issues, and would probably need to be spread over two days

- a review of the international literature on stipitate hydnoids. Kew and the BMS could assist with this. While some of the literature is in English, or at least with an English Summary, translations of key papers would be needed for German, Czech, Polish and other languages. The reviewer should also correspond with international authorities in Europe and America. For all we know the problems for which we need answers may already be under investigation

- the three-year review by SNH in Scotland has stimulated much more interest in stipitate hydnoids, and also macro-fungi in general: it has had a significant promotional element as well as doing the job it was designed for. Using the experiences gained with this study, a survey of similar scope for England and Wales should be considered. Fundamental ecological research on fungi in Britain has suffered greatly in recent years from inadequate funding. Most commissioned work is directed toward horticultural and tropical mycology, with very little on British macrofungi (one of the few exceptions I know is the work on mycorrhizas at Sheffield). In the past few years, some senior posts in mycology have been scrapped eg Hawksworth's, Pegler's at Kew, Watling's at Edinburgh. Nearly all the work on

British Fungi in the field is done by professionals and amateurs in their spare time. Conservation has the potential to rescue and redirect mycology, and restore Britain's international reputation. However, long neglect has produced a situation where the research base has shrunk, and it may be hard to find experts capable of doing the work. The situation should be clarified through Jenny Duckworth's investigations of university departments and other scientific institutions this year.

I cannot offer a detailed breakdown of fundamental research needs, but the following is a start:

- **taxonomic**. Uncertainty surrounds the identification of several stipitate hydnoids recorded in Britain, particularly the delimitation of a number of "species pairs and complexes". This uncertainty must be addressed, and prevailing species concepts harmonised in order to formulate meaningful conservation measures. Martyn Ainsworth suggests a three year project to assess whether a molecular approach could help to resolve these issues. This would require cooperation with various Herbaria and field mycologists with experience of basidiomatal morphological variation at several sites. Sampling from as many collections and populations as possible would be desirable (including continental European examples?) and it is essential that the stronghold populations in southern England (Windsor and New Forests) and Scottish Highlands are compared. Particular attention should be paid to the following species pairs and their closest relatives: *Hydnellum scrobiculatum* and *H concrescens*, *H ferrugineum* and *H spongiosipes*, *H aurantiacum* and *H auratile*. Other poorly known taxa should also be highlighted in the study, eg is *H compactum* a British species and how many species of *Phellodon* exist in Britain? Data generated from extant British sites could also be used to map population structure and answer more ecologically-based questions if time permitted

- **molecular markers** would also tell us how much genetic diversity there is in local populations, and help to answer such questions as: How big an area is covered by a hydnoid genet (the same genetic individual)? How long do they live? Where and how often do they fruit? Stipitate hydnoids do not seem to grow in fairy rings, tethered to tree roots, but fruit in much the same place year after year. What, exactly, is their relationship with the host tree?

- **physiological research**. We know about stipitate hydnoid chemistry only in general terms, mostly from empirical evidence. It seems they are killed off by an excess of active nitrogen. They may be restricted to natural woodland soils and unable to colonise secondary woodland on nitrogenous soils, but this needs testing. Nor do we know much about how they interact with other fungi or with one another. Experimental evidence could show which chemicals harm stipitate hydnoids, and hence which are the key chemical factors which affect them in the soil

- **ecological research**. To get a better idea of site management for stipitate hydnoids, various possibilities need field testing. For example, to investigate the observed possibility that stipitate hydnoids may exploit surface soil conditions of relatively high drought and heat stress, and mineral-poor conditions, would require establishing mycorrhizal experiments under controlled conditions (Martyn Ainsworth, pers.

comm.). Mycorrhizal research would also help establish which tree species are used by stipitate hydnoids, and at what stage they are first colonised, and begin to fruit

- **translocation**. The Species Action Plan proposes research into 'translocation to new woods' to aid understanding and help expand their range. This latter proposal has probably been overtaken by events, but it might be interesting to monitor how these fungi survive on prepared sites with a range of soil conditions and microclimate. As a conservation technique, however, I would afford it a very low priority. We will need to find out more about fungal ecology and physiology for translocation to work. Nor do I see any great need for it on any site at present.

General Comment

The increasing number of field mycologists competent to name macrofungi, coupled with the dearth of other resources, makes the present highly conducive to field survey, but not very conducive to fundamental research. The most cost-effective work the agencies can commission is mycological survey work of rare species ans rich sites. This would have the added benefit of creating a market for good field mycologists and increasing their professionalism and involvement with conservation projects. The focus on certain rare species, through the Biodiversity Action Plan, threatens in my view to dissipate resources into narrow and potentially resources-hungry areas while missing the greater need to conserve important fungal habitats. There is more to be said for grouping certain families or genera of fungi of high conservation interest like hydnaceous fungi, waxcaps, boletes, earth-stars and so on, on the grounds that they indicate mycologically rich habitats. A strong aim of any conservation project on field mycology in Britain should be building bridges between mycology and the conservation industry, coupled with good public relations.

Important sites for stipitate hydnoid fungi (known number of species in brackets)

(3) Cornwall, wood at Ethy SX 1357 *Phellodon confluens, Hydnellum concrescens, H. spongiosipes*. National Trust woodland bordering the Fowey. Fungi on mossy bank by public path. They were safeguarded by the Trust during recent path renovation at request of the finder, Ted Green. Contact him for site details (see also County Records).

(3) Devon, wood at Furley ST 274045 *Phellodon melaleucus, 'Hydnellum velutinum', H. scrobiculatum*. W. facing woodland and streambank. No recent records, but likely to be still present. See County records.

(3) Dorset, Moreton Plantation SY 8090, 8190 *Phellodon niger, Hydnellum scrobiculatum, Sarcodon imbricatus*. Pine plantation and mixed woodland on Tertiary sand, owned by Forest Enterprise. Heathland areas within it are SSSI. See County records.

(8) Hampshire, New Forest

Surveys are ongoing in the New Forest, and the 2000 season will undoubtedly add significantly to what is known already. The New Forest species are *Phellodon melaleucus, P. niger, P. confluens, Sarcodon imbricatus, S. scabrosus, Hydnellum concrescens, H. spongiosipes* and, less certainly, *H. scrobiculatum*. There are old records

of *H. ferrugineum* and *P. tomentosum*. On the basis of the 1999 season, and on fieldwork by Gordon Dickson and others, the following sites are known to have 3 or more species (see Hampshire Wildlife Trust for details):

Brock Hill SU 2605 (3), Crockford Bridge SZ 3598 (3), East End Wood SZ 3697 (5), Holmsley Inclosure SU 2100 (3), Knightwood Inclosure SU 2506 (4), Mark Ash Wood SU 2507 (4), Millyford Bridge SU 2607 (3), Norley Wood SZ 3597 (4), Roydon Woods SU 3000 (3), Set Thorns Inclosure SU 2600 (5), Stubbs Wood SU 3602 (4), Wormstall Wood SZ 3598 (4).

(5) Kent, Pembury Walks TQ 615428 *Phellodon niger*, *P. confluens*, *Sarcodon scabrosus*, *Hydnellum scrobiculatum*, *H. spongiosipes*. Managed sweet chestnut coppice and planted conifers on Tunbridge Wells sand on ancient woodland site, probably originally sessile oak. Most sites on acid sandy woodbanks, but one *S. scabrosus* site on woodland floor close to dumped brick rubble (creating drier conditions?). Part of Pembury Walks is a nature reserve belonging to the RSPB.

Jo Weightman tells me *Phellodon niger* appears most years in one place, and in 1999 was found in another. There is some doubt about *P. confluens*, and good material is needed for checking. *Sarcodon scabrosus* was found in 1994 and 1999 in 2 sites. *H. spongiosipes* was also found in 1994 and 1999. There is also a record of *Sarcodon imbricatus*, but this also needs checking.

(3) Kent, Mereworth Woods TQ 633538 *Phellodon confluens*, *Hydnellum concrescens*, *H. spongiosipes*. The first two were recorded by R.J. Bray in 1994 and 1995 in managed sweet chestnut coppice on sandy Hythe beds. The exact site is a mossy woodbank by a track. Ted Green also remembers seeing stipitate hydnoids here in the 1960s, but not the species. His recollection is that they were quite plentiful, and that this is a major site.

(4) Surrey, Esher Common TQ 1262 *Phellodon melaleucus*, *Hydnellum concrescens*, *H. scrobiculatum*, *H. spongiosipes*. SSSI, owned and managed by local council as public open space. *H. concrescens* was collected from 'mixed woodland' or 'mixed deciduous woodland'. *H. scrobiculatum* from pine plantation or 'mixed woodland', in at least one case under sweet chestnut. *H. spongiosipes* from 'mixed woodland', in 5 cases under sweet chestnut and in one under conifers. *Phellodon melaleucus* from 'mixed woodland', in 3 cases under pine, in 2 under birch and in 2 cases in grass.

Database records from Esher Common deal mainly with dates of collection. These suggest that *Hydnellum scrobiculatum* is the most frequent species with 25 collections from 8 seasons 1979-97, followed by *Phellodon melaleucus* (17 collections from 6 seasons), *Hydnellum spongiosipes* (15 from 4) and *Hydnellum concrescens* (14 from 4). In no season were all four species collected. Three species were found in 1982 and 1984. No collections of *H. concrescens* have been made since 1984, but this may be due to taxonomic ambiguities. Brian Spooner comments that stipitate hydnoids seem to be scarcer here than formerly, though there is no obvious reason for this.

(5) Surrey, Oxshott Heath TQ 1361 *Phellodon confluens*, *Phellodon melaleucus*, *Hydnellum concrescens*, *H. scrobiculatum*, *H. spongiosipes*. SSSI. Oxshott Heath lies adjacent to Esher Common and lies within the SSSI. It is managed by the conservators of Elmbridge Borough Council. The single record of *H. concrescens* was from under pine in 1945. 7 collections of *H. scrobiculatum* were made in 1955 and 1961-62, only one particularised as among heather. 3 collections of *H. spongiosipes*, all in 1987, in two cases under birch. 2 collections of *Phellodon confluens*, both from 1979 in sandy heathland under birch. Much the commonest species is *Phellodon melaleucus* with 23 collections 1934-82 from pine woodland or mixed woodland, and in 3 cases particularised as 'bank', 'ditch-side' and 'ground'. The scarcity of recent records may or may not be significant.

(3) Surrey, Witley Common SU 928404 *Phellodon melaleucus*, *Hydnellum concrescens*, *Sarcodon imbricatus*. The site is a nature reserve and part of Thursley Common SAC. The collections date from 1979 and 1982, with a maximum of 4 for *Phellodon melaleucus*. There are no details, but *Sarcodon imbricatus* apparently comes from a separate area at 'Mare's Wood'. There is a record of possible *Hydnellum scrobiculatum* from 1982.

'Windsor sites', East Berkshire and W. Surrey

(6) Swinley Park, Bracknell

I use this name to cover the large (about 4 square miles) area of plantations, and semi-natural woods between Bracknell and Camberley, and including Swinley Park proper, which lies just west of Bracknell and the Buttersteep plantations further east, separated from Swinley Park by the straight A322 (following an ancient route called Swinley Road). It also includes the plantations to the north of the Royal Military Academy at Sandhurst (Windsor Ride). Stipitate hydnoid have been found at scattered places throughout this area since the 1960s when it was explored by Ted Green and Derek Reid. It has since been visited regularly by mycologists Martyn Ainsworth and Alan Lucas. In the 1960s, Maas Geesteranus regarded the Buttersteep area as one of the best he had seen anywhere in Europe (Ted Green, pers. comm.). The sites lie mainly on acid soil derived from Tertiary Bagshot Beds, on mossy banks by tracks and 'lanes' (eg. Windsor Ride, Abury Lane), forest compartment banks and ditches, ancient earthworks (Caesar's Camp) and natural slopes (Buttersteep Hill), mainly under Sweet Chestnut. Stipitate hydnoids have also been found on disturbed ground near rabbit and badger burrows (eg. at 'Buttersteep 2' compartment). One good area along Laundry Ride and Gravelpit Ride at SU 8867 has been lost to housing, as has the only known site for *Sarcodon regalis* near Windsor Ride at SU 883669. The species found here, in descending order of abundance, are *Hydnellum concrescens*, *H. spongiosipes*, *Phellodon niger*, *P. melaleucus*, *P. confluens* and *Sarcodon scabrosus*, and possibly also *Sarcodon imbricatus* under Scots pine. *Hydnellum scrobiculatum* may also be present, while *Bankera fuligineoalba* and *Phellodon tomentosus* flourished near Ascot, possibly in the Buttersteep area, in the 19th century. If all these species still occur, this would be the single richest site for stipitate hydnoids in England. It is also of wider mycological interest - Ted Green has provided details to English Nature and the JNCC. Part of this area (The Brickpits) is SSSI, while an area around Englemere Pond is a local Nature Reserve. See also County Records.

(?) Bagshot Heath, Camberley

Bagshot Heath lies contiguous to 'Swinley Park' on the border of Berkshire and Surrey, including the area called Penny Hill (SU 8962), on the outskirts of Camberley and probably across the M3 in Lightwater Country Park. The area has not been well explored, but, as in Swinley Park, stipitate hydnoids have been found on banks by tracks and compartment boundaries (eg. un-named track at 633895) and under the mature chestnut coppice at Penny Hill. I have been given no separate list of species for this area, but any of the Swinley Park species should be expected. Part of this area is within a proposed SAC, and ENGLISH NATURE/JNCC will have details.

(?4) Silwood Park SU 9468. The woods around Silwood College lie on very acid gravelly soils and are of considerable mycological interest. Stipitate hydnoids have occasionally been found here by Ted Green and others. There are Silwood specimens of *Phellodon confluens* and *P. niger* in Kew, collected in the 1960s, and an old record of 'Hydnellum ferrugineum', which is most likely *H. spongiosipes*. *Hydnellum concrescens*, which is general across the whole of the Windsor-Ascot area is also found here.

(5) Woods around Virginia Water. Virginia Water lies at the southern end of Windsor Greak Park, with the Saville and Valley Gardens on the north side and the royal retreat of Fort Belvedere to the south. The area in which stipitate hydnoids have been found is large, mostly comprising trackside and roadside banks at High Flyer's Hill (SU 966696), Egham Wick Plantation (Wick Lane) (983699), Clockcase Wood (9868), extensive parts of the London Road (A30) and Belvedere Wood (approx 970682 & 967678). Stipitate hydnoids in Kew collected from this broad area are *Phellodon melaleucus*, *P. niger*, *Sarcodon imbricatus*, *Hydnellum scrobiculatum* and *H. concrescens*.

(1) Windsor South Forest, nr Sandpit Gate SU 946719. Much of Windsor Great Park and Windsor Forest (Cranbourne Chase) lies on clay soils where stipitate hydnoids seem absent. The one site near the Great Park is this one, on a trackside bank about 200m west of Sandpit Gate, where *Hydnellum spongiosipes* has been recorded.

(5) Bucks, Burnham Beeches SU 9585 *Phellodon melaleucus*, *?P. confluens*, *Hydnellum concrescens*, *H. scrobiculatum*, *Sarcodon scabrosus*. SSSI and public open space managed by London Corporation. At least three species were recorded on the recent BMS foray in October 2000 (see County records) indicating the site is still viable. Most records are under beech or sweet chestnut.

(4) Norfolk, Wheatfen Broad, Surlingham TG 3106 *Phellodon confluens*, *Hydnellum concrescens*, *H. scrobiculatum*, *H. spongiosipes*. SSSI, partly a private nature reserve. See County records. Given the interest of this well-recorded site, a mycological survey of the wider Broads would be interesting.

(4) Cumbria, Gait Barrows and Eaves Wood, Silverdale SD 4877 *Phellodon melaleucus*, *P. niger*, *Hydnellum concrescens*, *H. scrobiculatum*. Gait Barrows is a National Nature Reserve. See County records. No further details are available, and

the recorder is deceased. Further survey is desirable; Ted Green remembers finding stipitate hydnoids in the Silverdale peninsula in the 1960s, possibly near Merlewood.

7. Conclusions

The status of our mycota of stipitate hydnoids is healthier than it would appear from their high ranking in the (very) provisional list of rare, vulnerable and endangered fungi. On-going surveys in Scotland and the New Forest are continually producing new records and sites, and a large number of additional sites have been discovered in the present report through 'proactive communication' with field mycologists. While it might be premature to revise the present BAP listing, one can now say with confidence that the premise on which these species were BAP-listed is wrong, that many species are widespread and not uncommon locally, and that probably no species are endangered in Britain - though this does not mean that the group is not of significance for nature conservation, for example as sensitive environmental indicators. A new picture is emerging of a group of fungi with broadly similar ecological requirements characteristic of nutrient-poor mineral soils in association with trees, especially Scots pine (in Scotland), sweet chestnut and oak. In England they are characteristic of mossy banks within woodland without competing vascular vegetation. Fruit bodies are produced on bare earth, often where the ground has been disturbed. Though the richest sites tend to be large blocks of woodland, or mature plantations of pine and chestnut, stipitate hydnoids have also been found in small, fragmented woods, especially in south-west England. They may be threatened locally by housing development, road maintenance or invasive species, but the greatest overall threat is from nitrogen pollution from air and water resulting in enriched soils. This, however, is a threat to our mycorrhizal fungi generally, and not the stipitate hydnoids alone.

Stipitate hydnoids have a raised conservation profile because of pan-European interest and concern. In Britain their status seems to be healthier than in most lowland European countries. Why that may be is an interesting question, though the presence in southern England of extensive areas of nutrient-poor sandy soil and their preservation on Crown land in the New Forest and East Berkshire may form part of the answer.

Conservation policy-makers should recognise that identifying fungi accurately is often fraught with difficulties. Even today, many field mycologists find stipitate hydnoids 'opaque' and hard to name, even with the aid of a microscope; witness the uncertainty over which species it was that formed the BMS's significant 2000th fungus in the year 2000 - it was initially misidentified. Hence a question mark must hang over many of the records (especially those without a collection) and taxonomic uncertainty will tend to blur distinct ecologies and distribution patterns among our 18 or so species. Further work is needed to see whether morphological characters match generic ones, and whether current species concepts are right. Much more fieldwork will be needed before we get a better idea of their individual ecologies, though the 3-year Scottish study by Adrian Newton and Liz Holden should throw some light, at least in a Scottish context.

I have written this report in the knowledge that because conservation agencies and NGOs are strangers to fungi, any report on the conservation of fungi will have to be well-chewed and digested. That is why this report is longer than it perhaps otherwise needed to be. I hope it will nonetheless take its modest place in what is for all of us involved a learning process, that it will raise the profile of fungi just a little, and perhaps interest a few more people.

Acknowledgements

Thanks to Drs Peter Roberts and Brian Spooner for access to material at Kew and to Valerie Barkham for photocopying for me items from the BMS library. Also to Paul Kirk for a print-out of all records on the current database, and to Adrian Newton for sharing some of the results from the Scottish survey he is undertaking with Liz Holden. I am indebted to the following for comments and/or field records: Martyn Ainsworth, Ray Bray, Gordon Dickson, Jenny Duckworth, Neville Deserens, Pam Ellis, Edward Gange, Ted Green, Steve Guy, Tom Hering, John Keylock, Tony Leech, Alan Legg, Patrick Leonard, Camilla Lovatt, Jack Marriott, Graham Mattock, Alan Outen, Helen Read, Derek Schafer, David Shorten, Malcolm Storey, Jo Weightman, Sheila Wells, Andrew Woodall.

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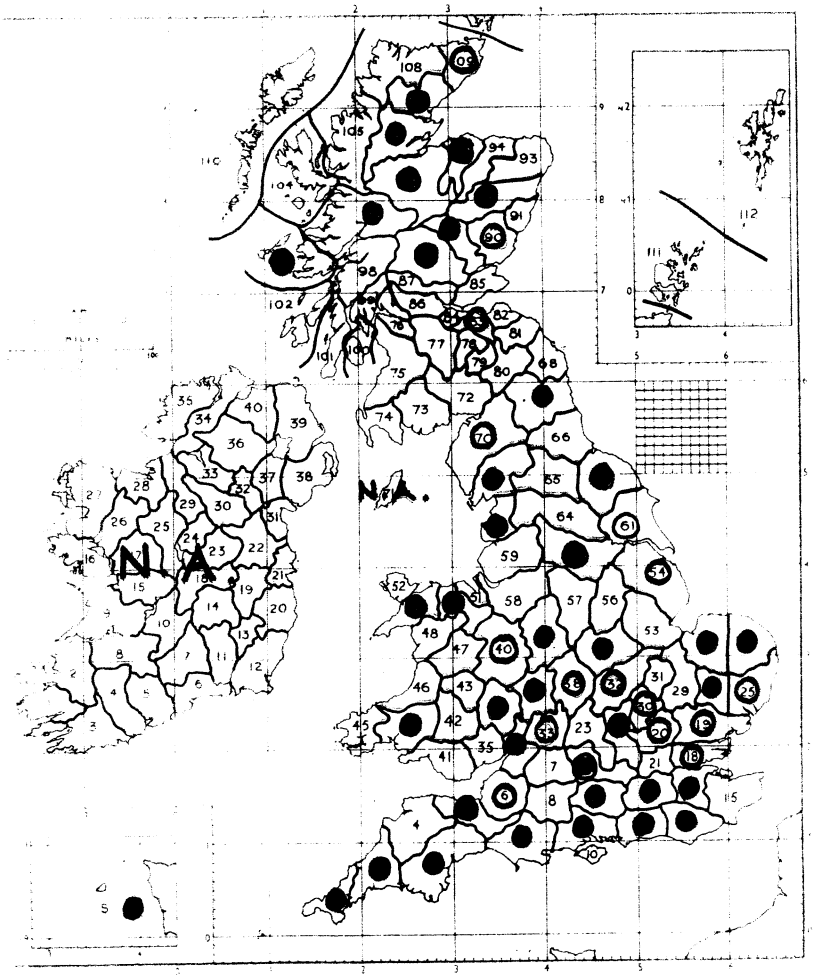
Appendix A – Distribution Maps

ALL BAP STIPITATE HYDNOIDS



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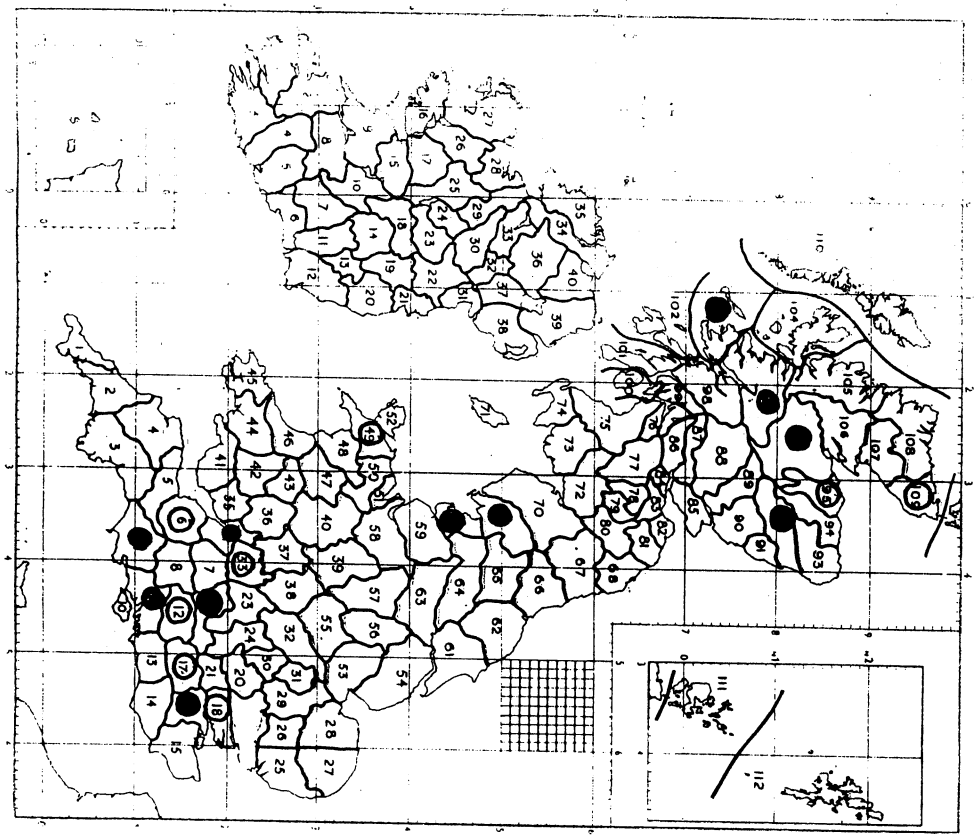

Phellodon niger

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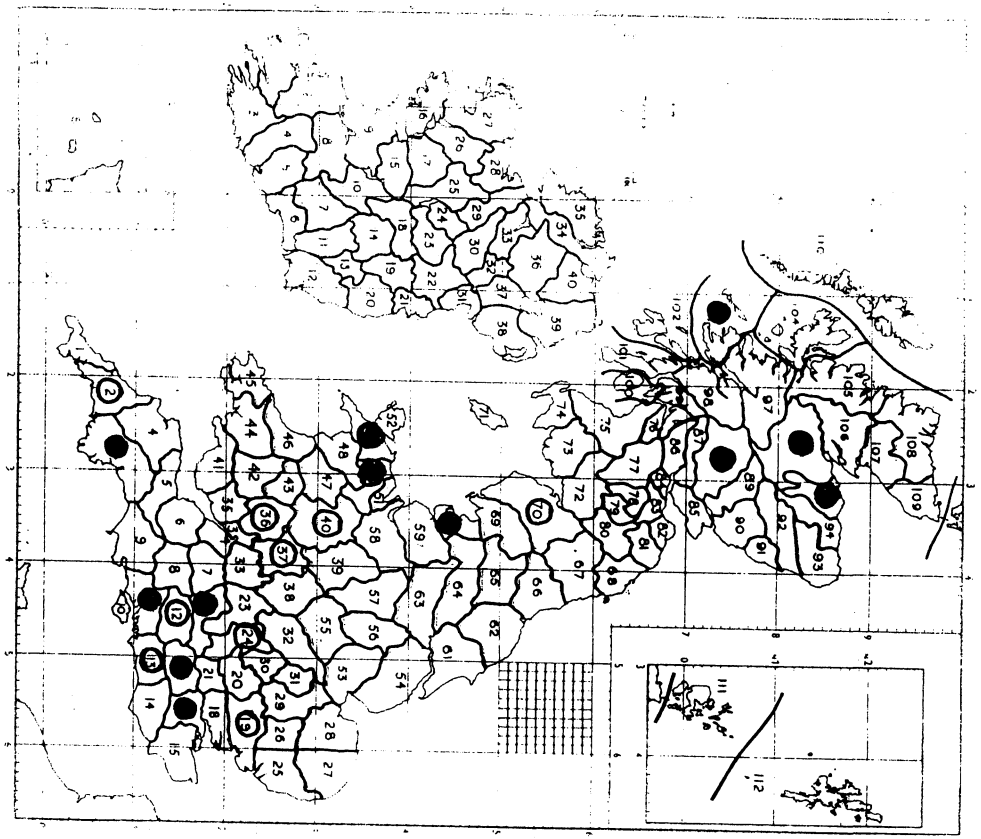
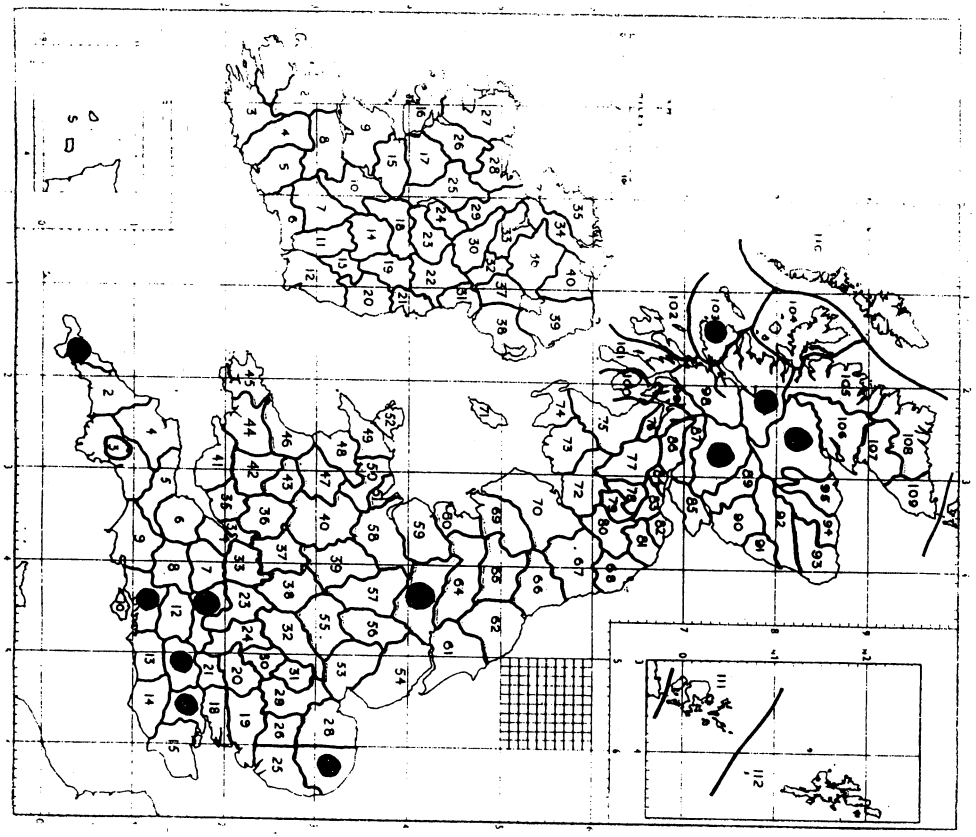


Phellodon melaleucum.



Phellodon confluens.

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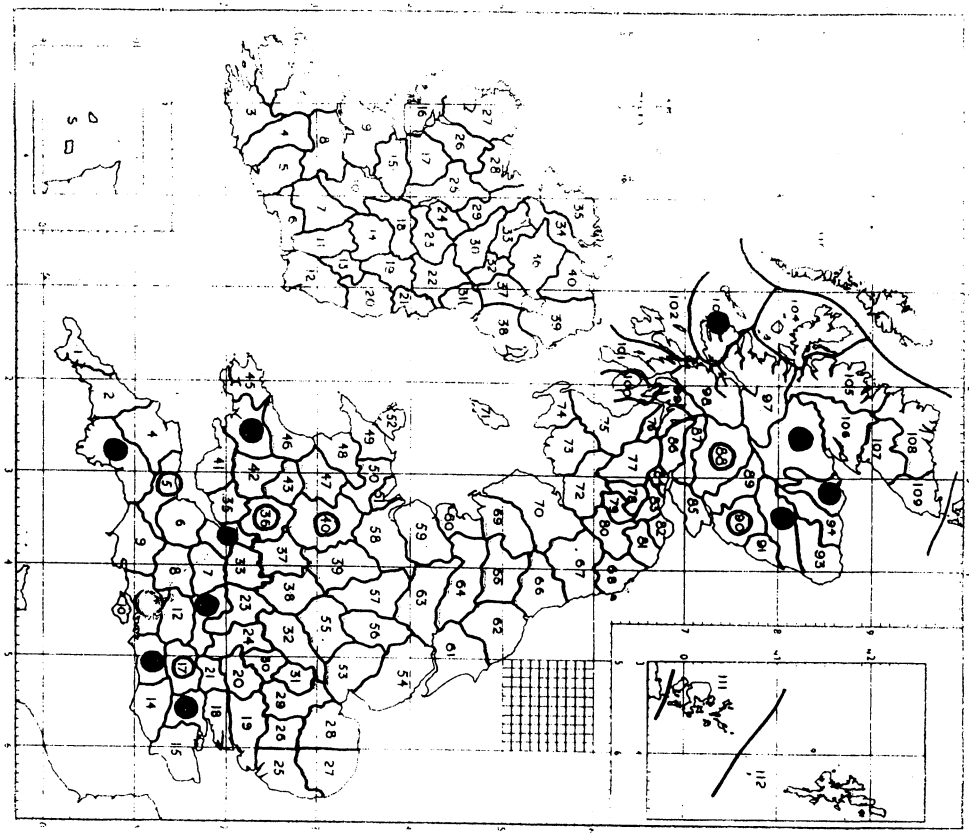
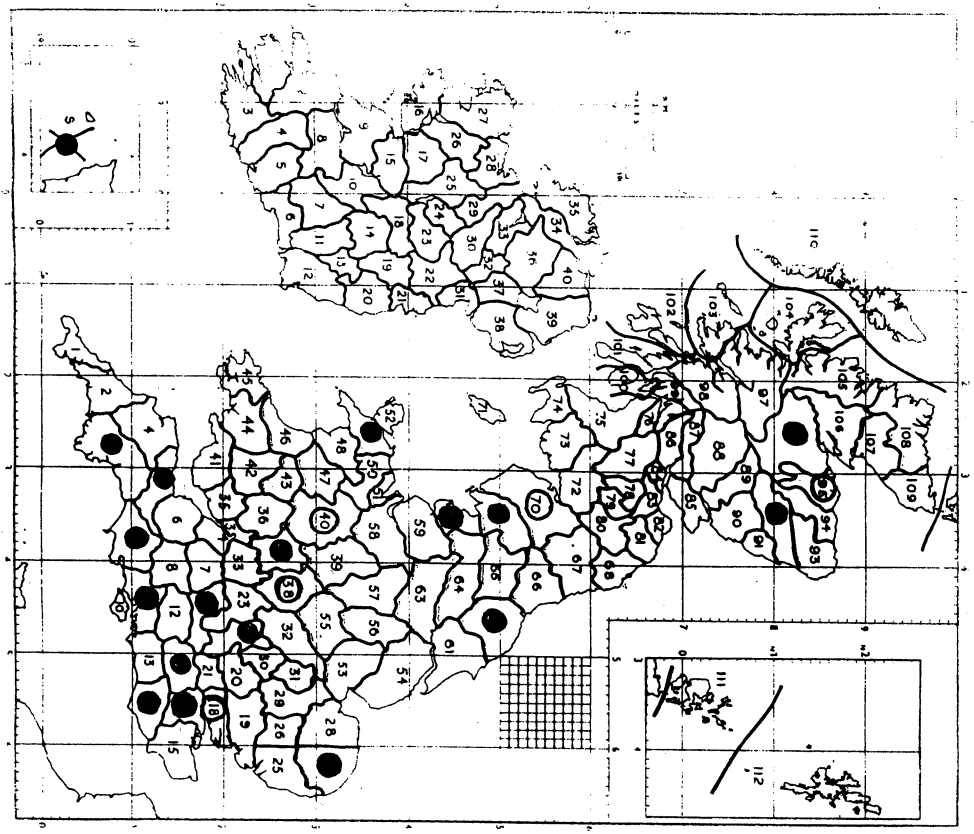


Phellodon tomentosus

ton tomentosus

? S Wales doubtful.

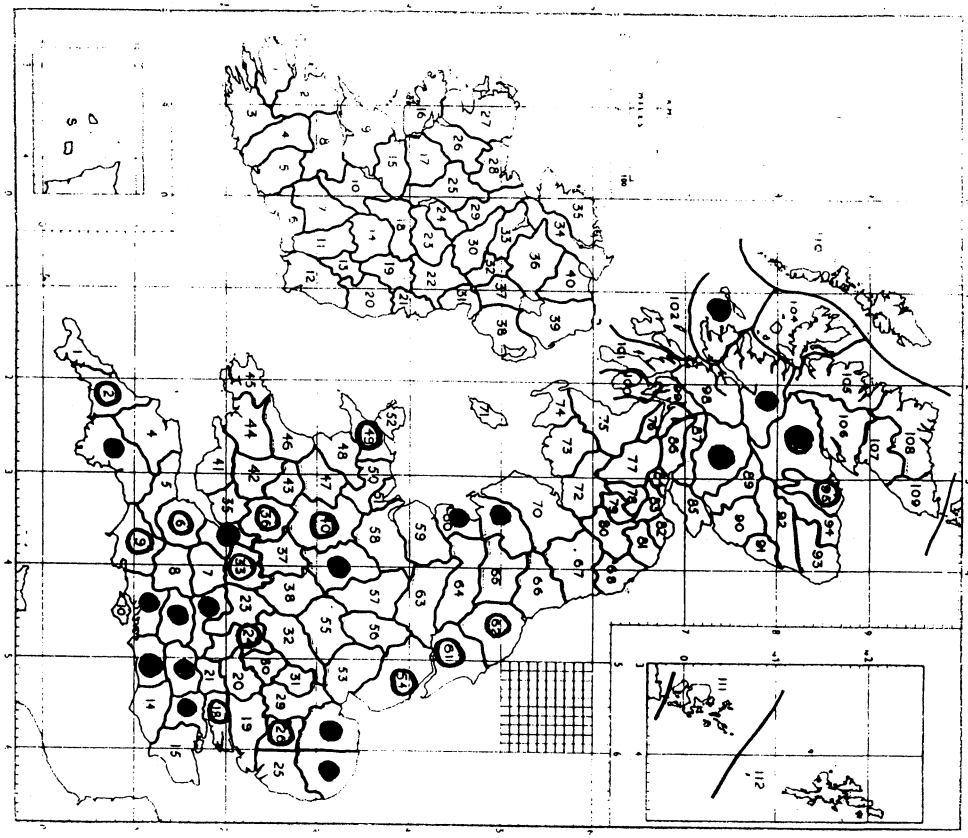
● Post 1960
○ Pre 1960



• Post 1960
○ Pre 1960

Hydnellum scrobiculatum

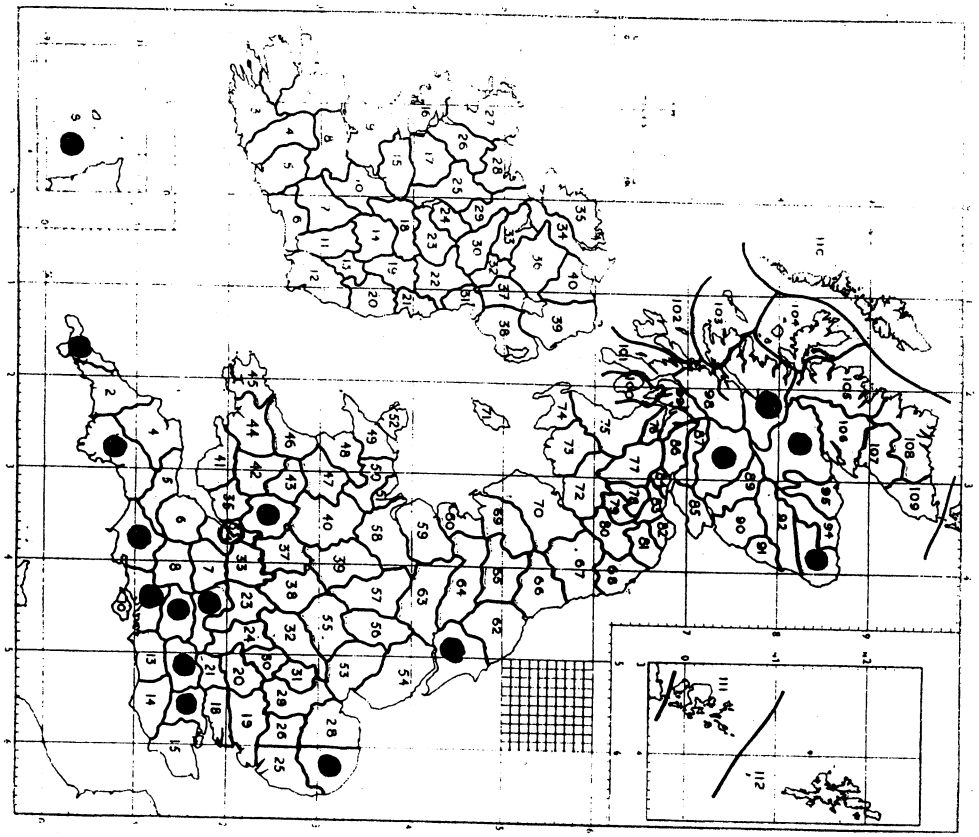
Probably over-recorded.



• Post 60
○ Pre 1960

Hydnellum concrescens

+1



Hydnellum spongiosipes

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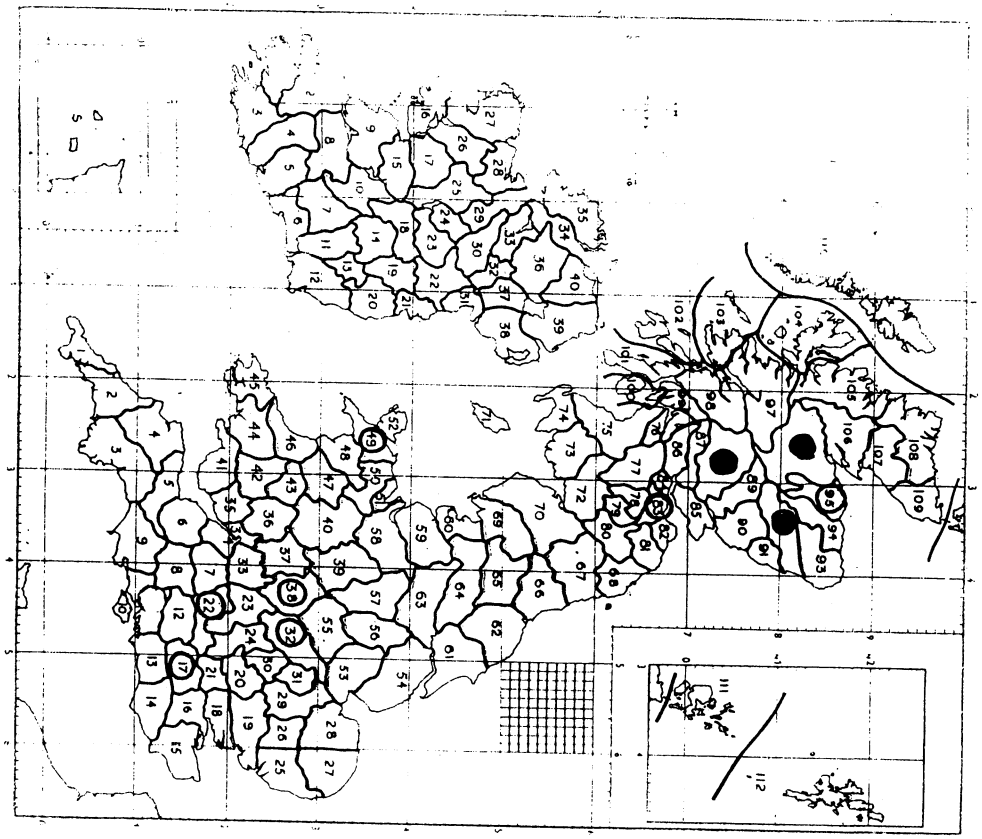
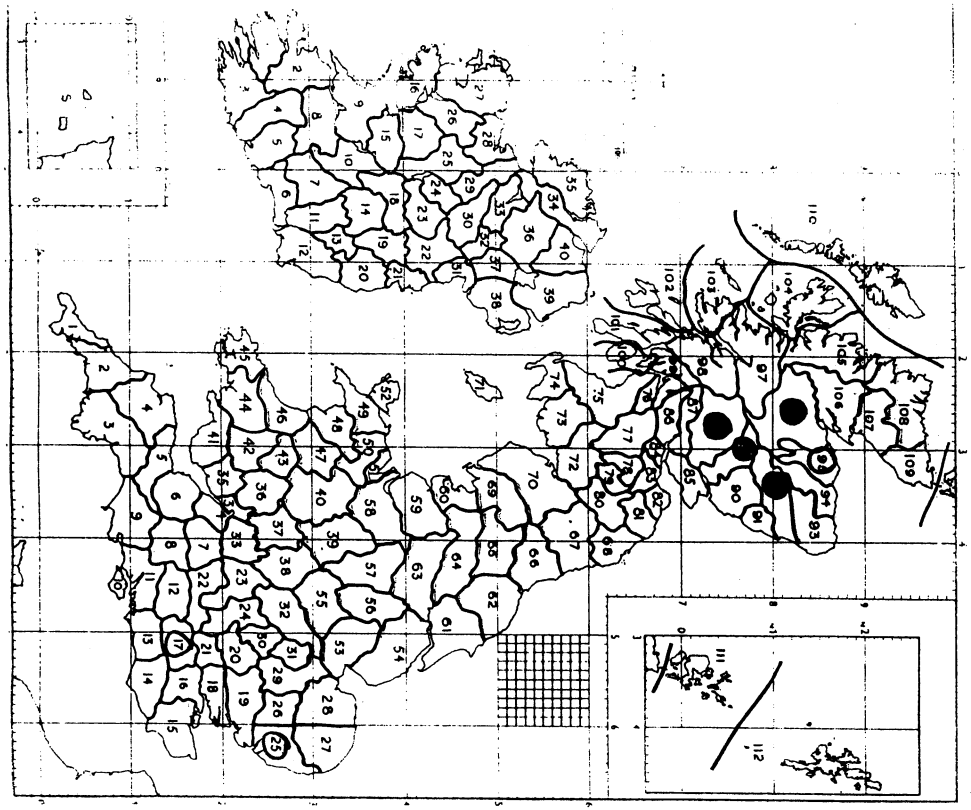


Hydnellum ferrugineum

English records require confirmation

Not extinct

ICE-COUNTIES



Hydnellum caeruleum
English record doubtful.

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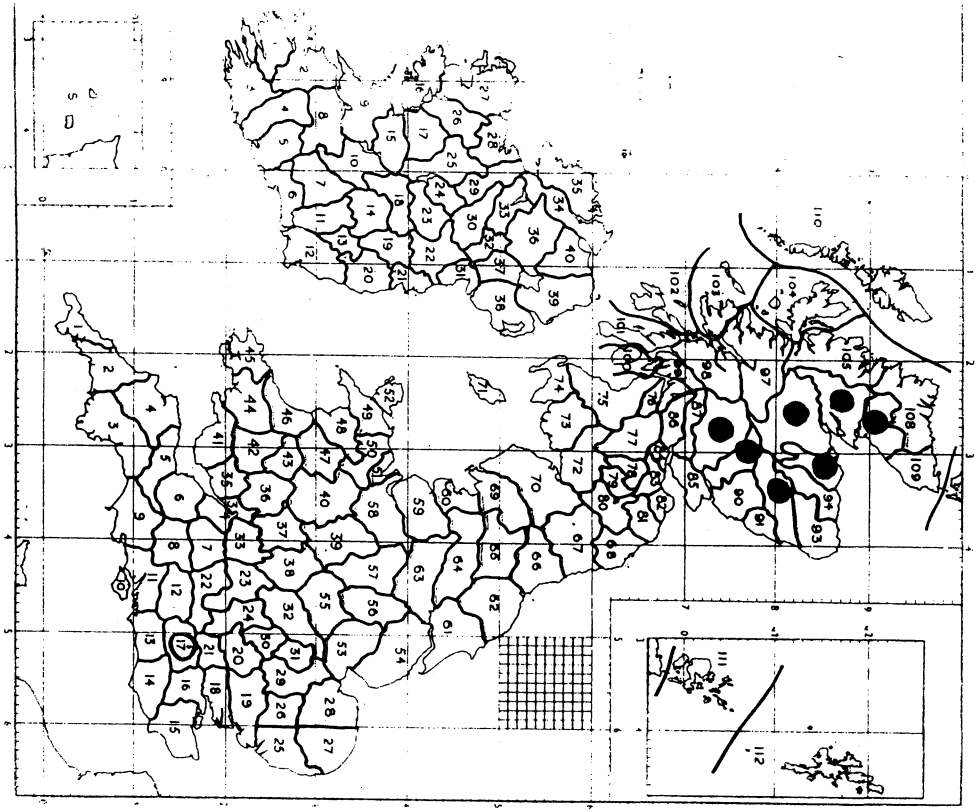
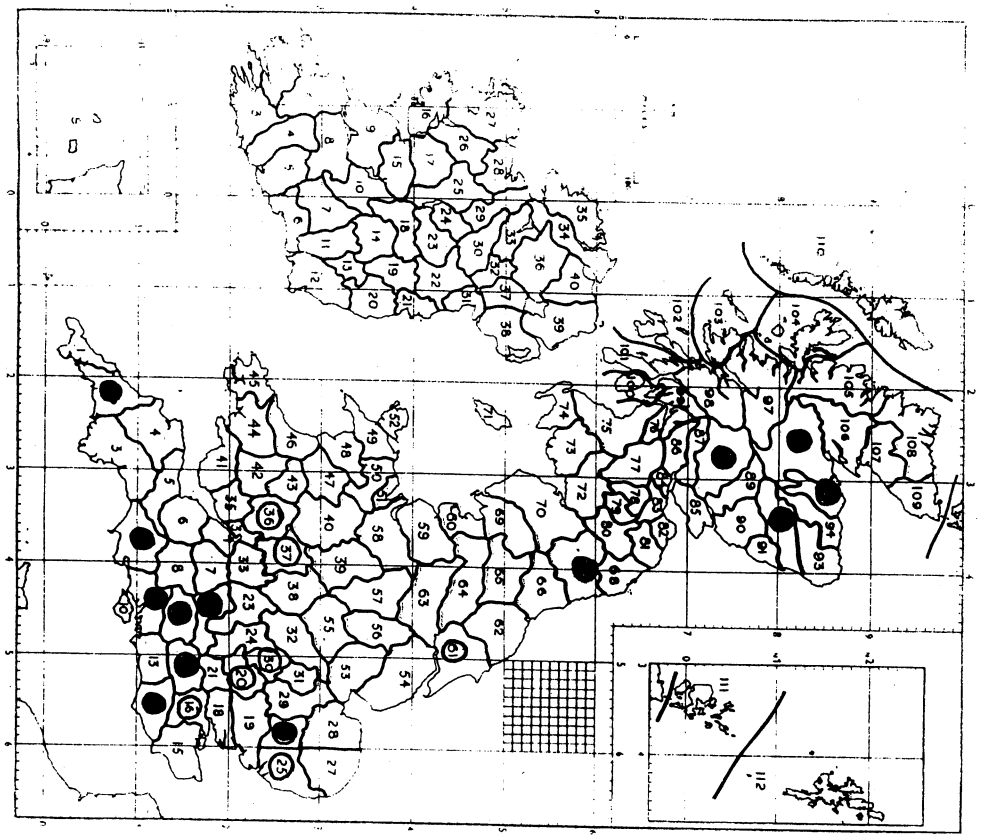


Hydnellum peckii
English record doubtful.



Sarcodon imbricatum

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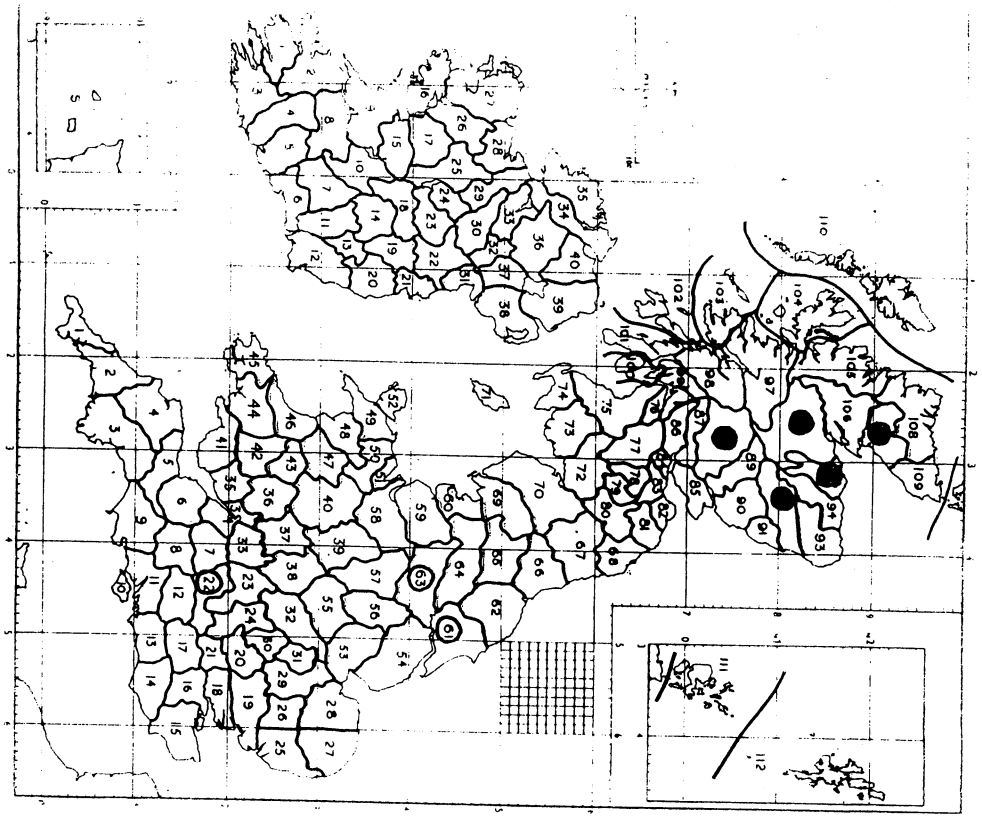
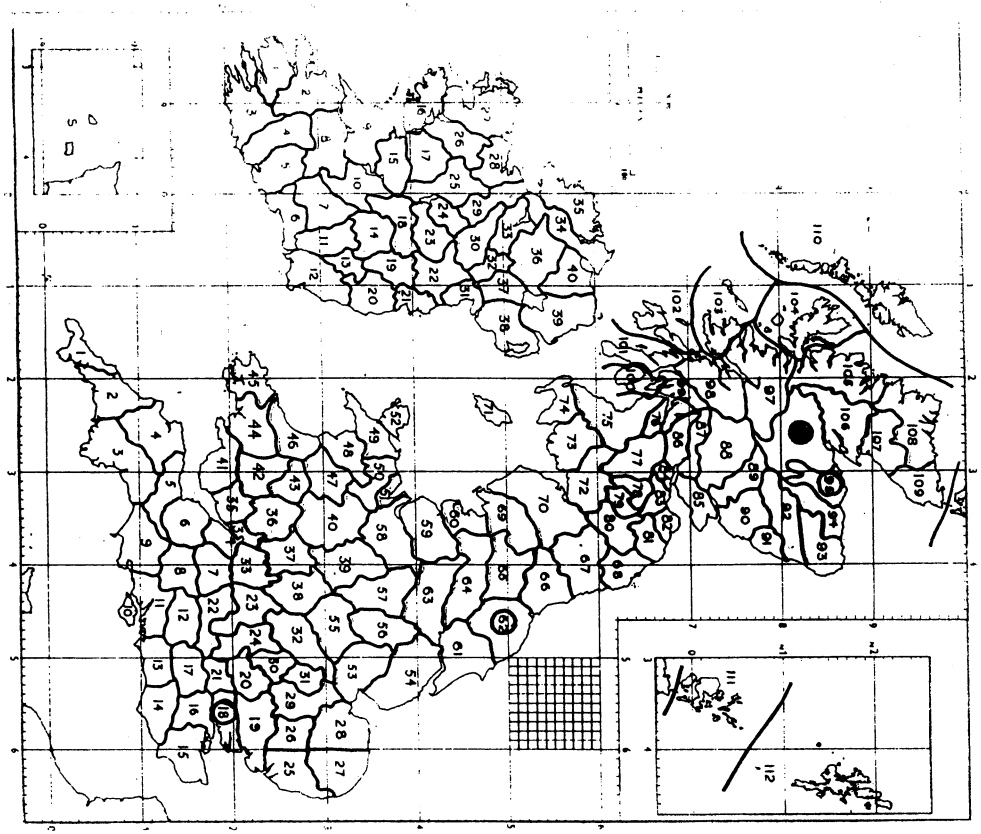


Bankera fuligineoalba

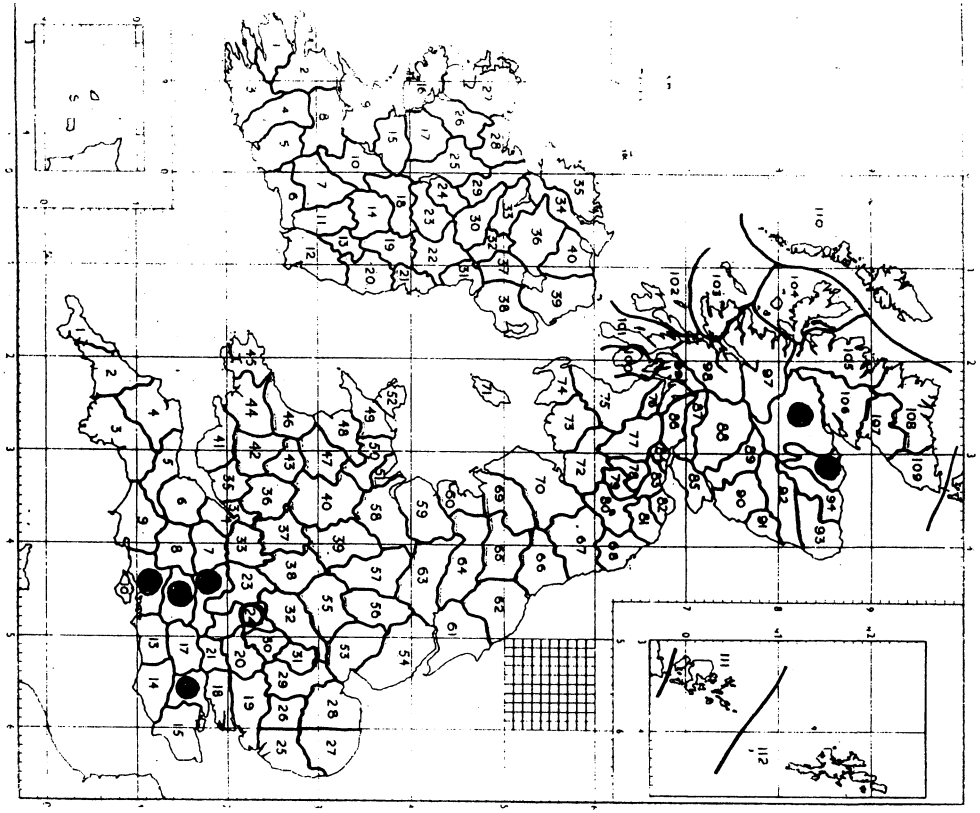
English status needs confirmation

VICE-COUNTIES



Hydnellum aurantiacum

VICE-COUNTIES

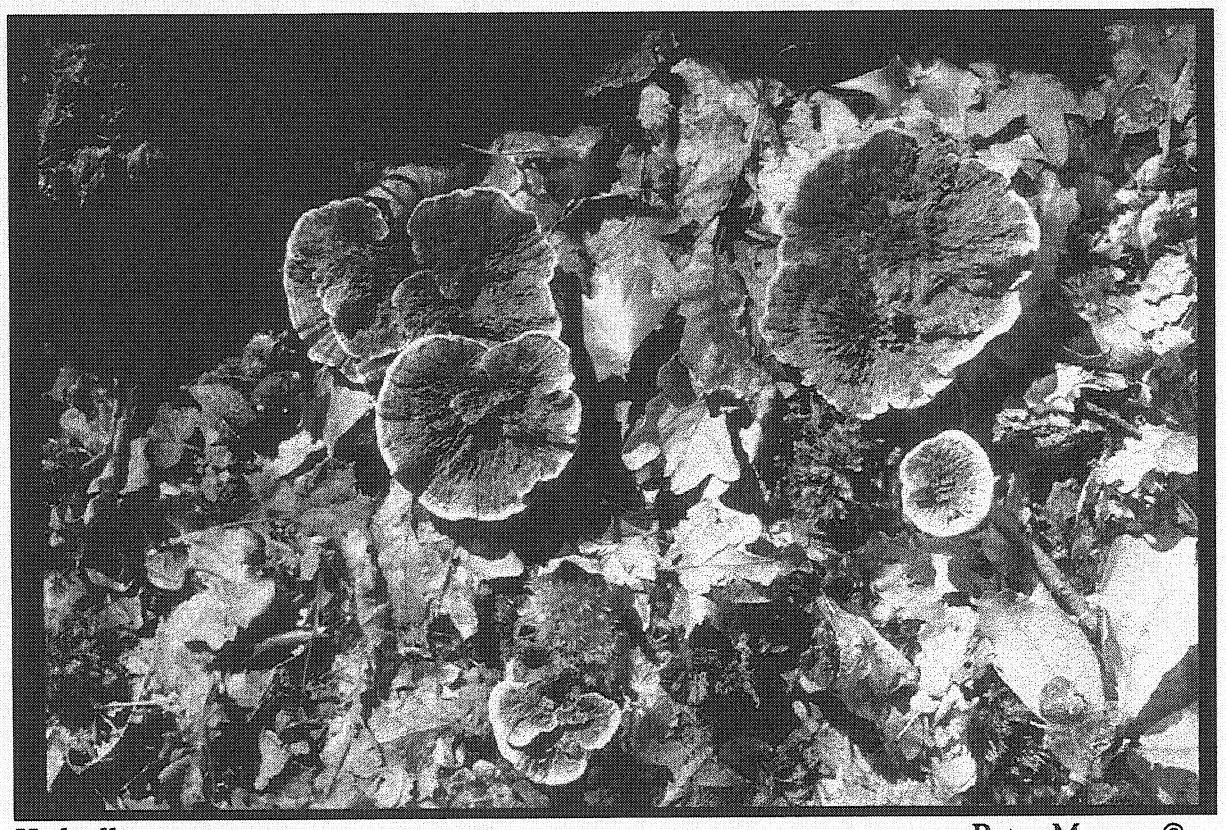


Sarcodon scabrosus

Possibly under-recorded

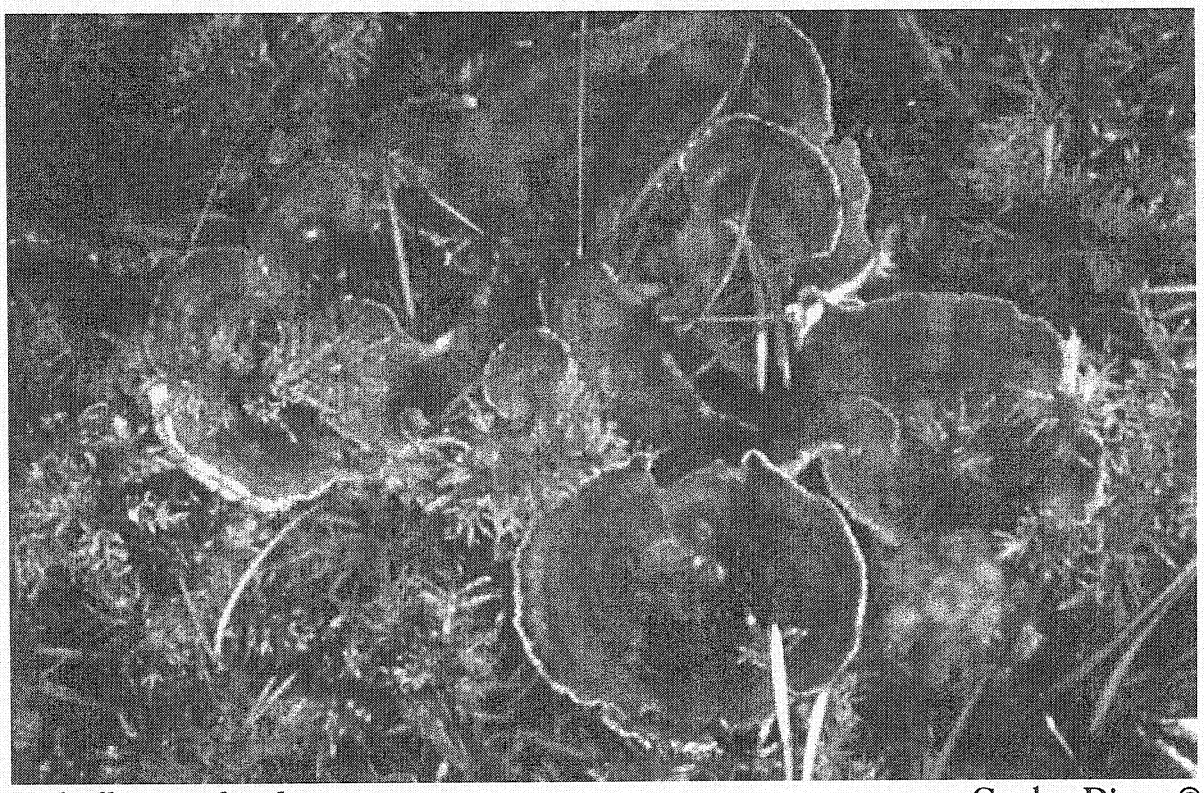
Appendix B – Illustrations

Hydnellum concrescens Peter Marren ©



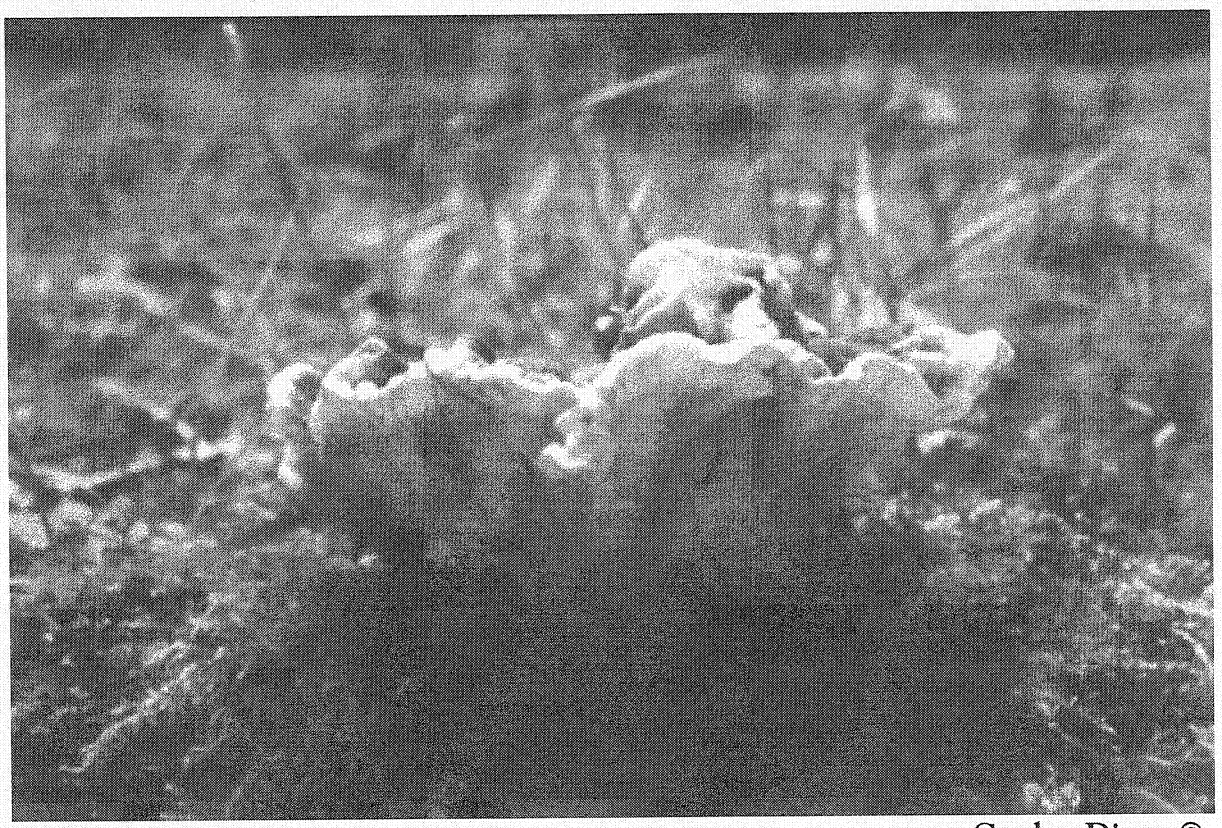
Hydnellum concrescens Peter Marren ©

Hydnellum concrescens Gordon Dixon ©

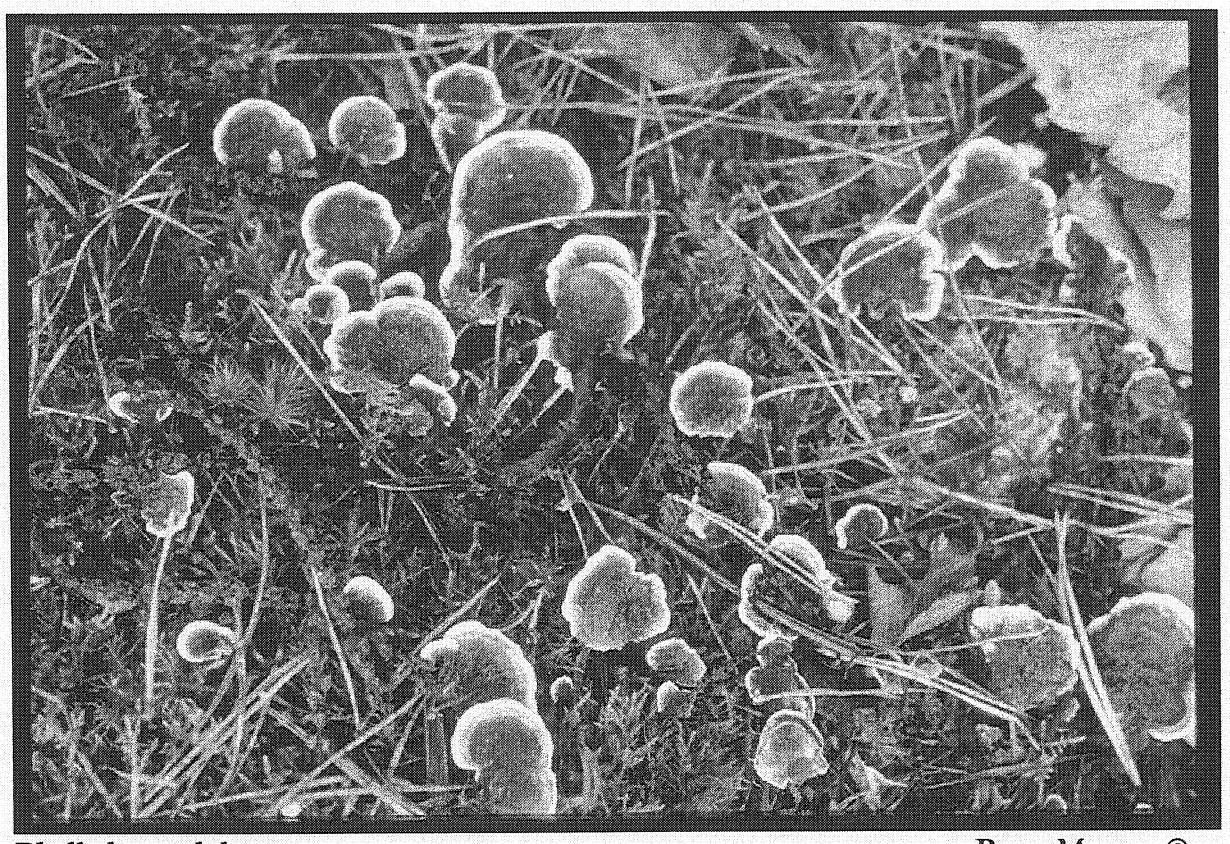


Hydnellum scrobiculatum Gordon Dixon ©

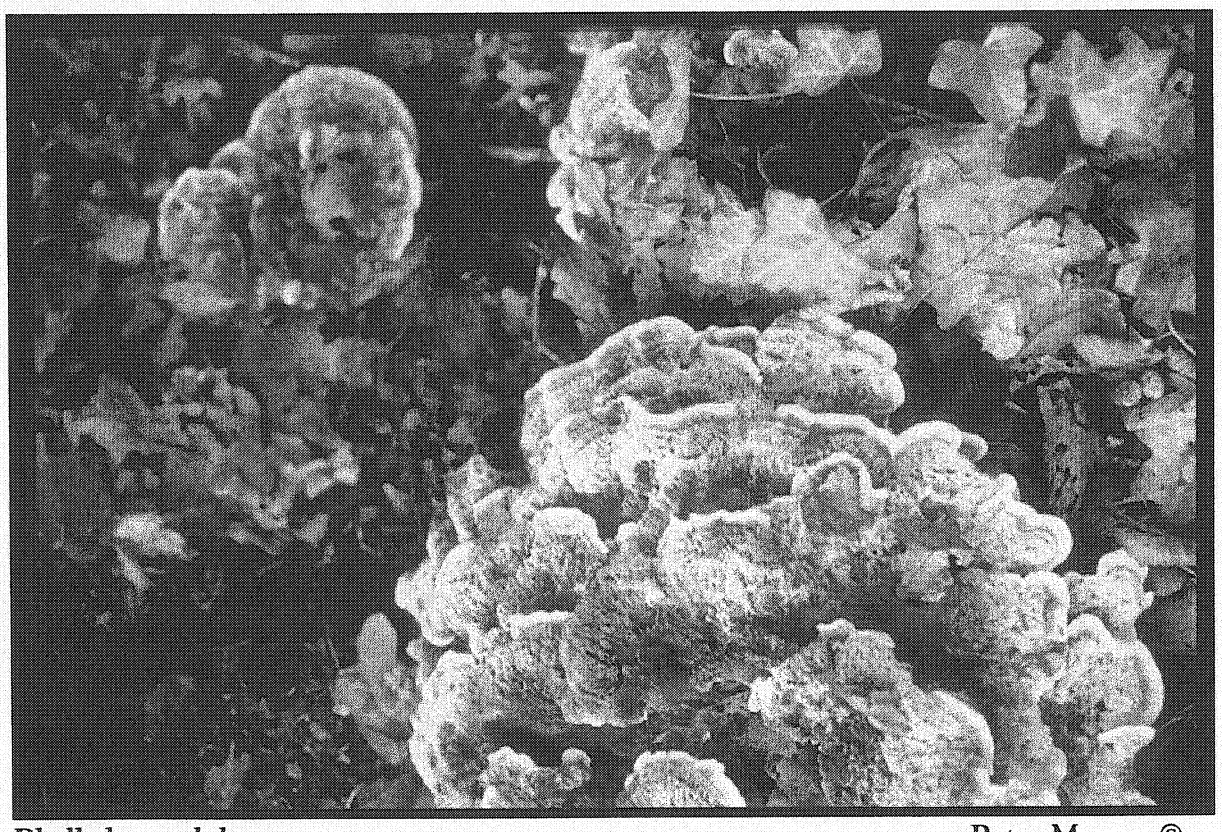
Hydnellum spongiosipes Gordon Dixon ©



Phellodon confluens Gordon Dixon ©



Phellodon melaleucus Peter Marren ©



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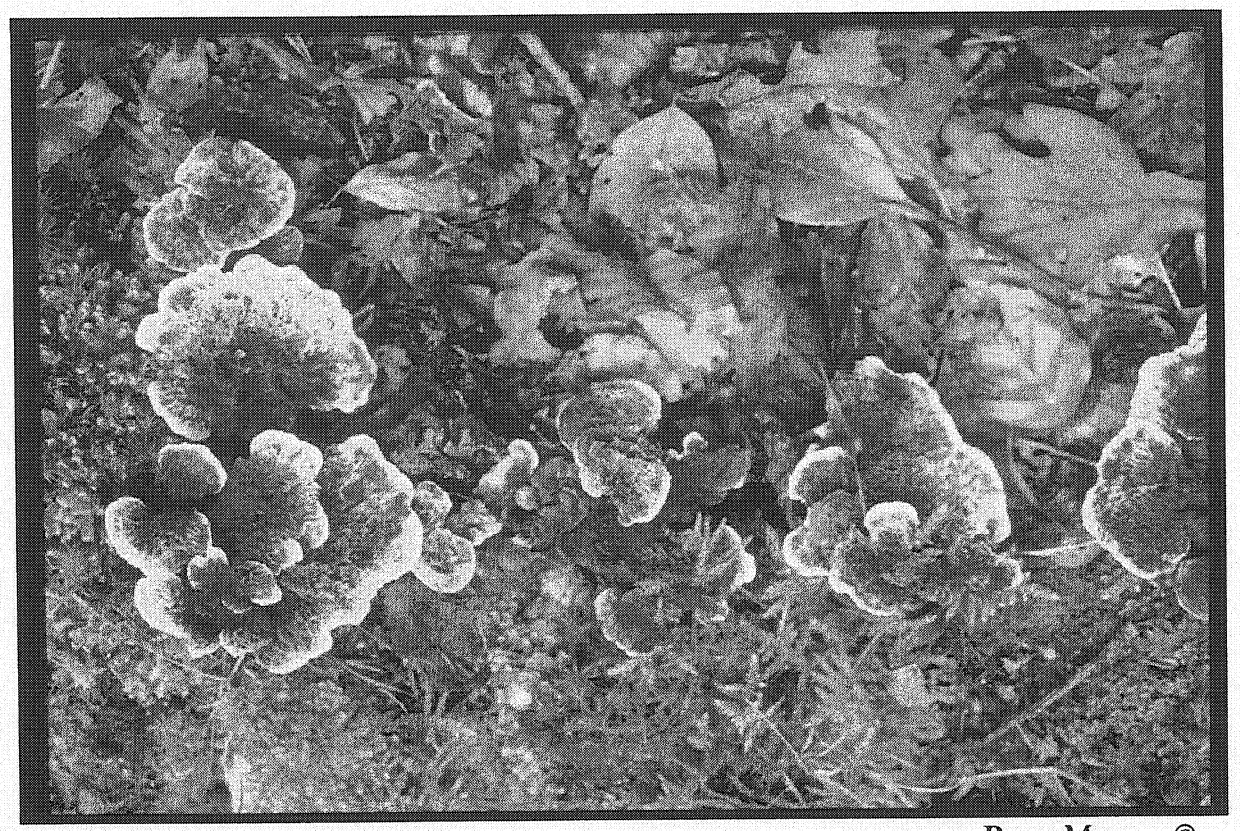

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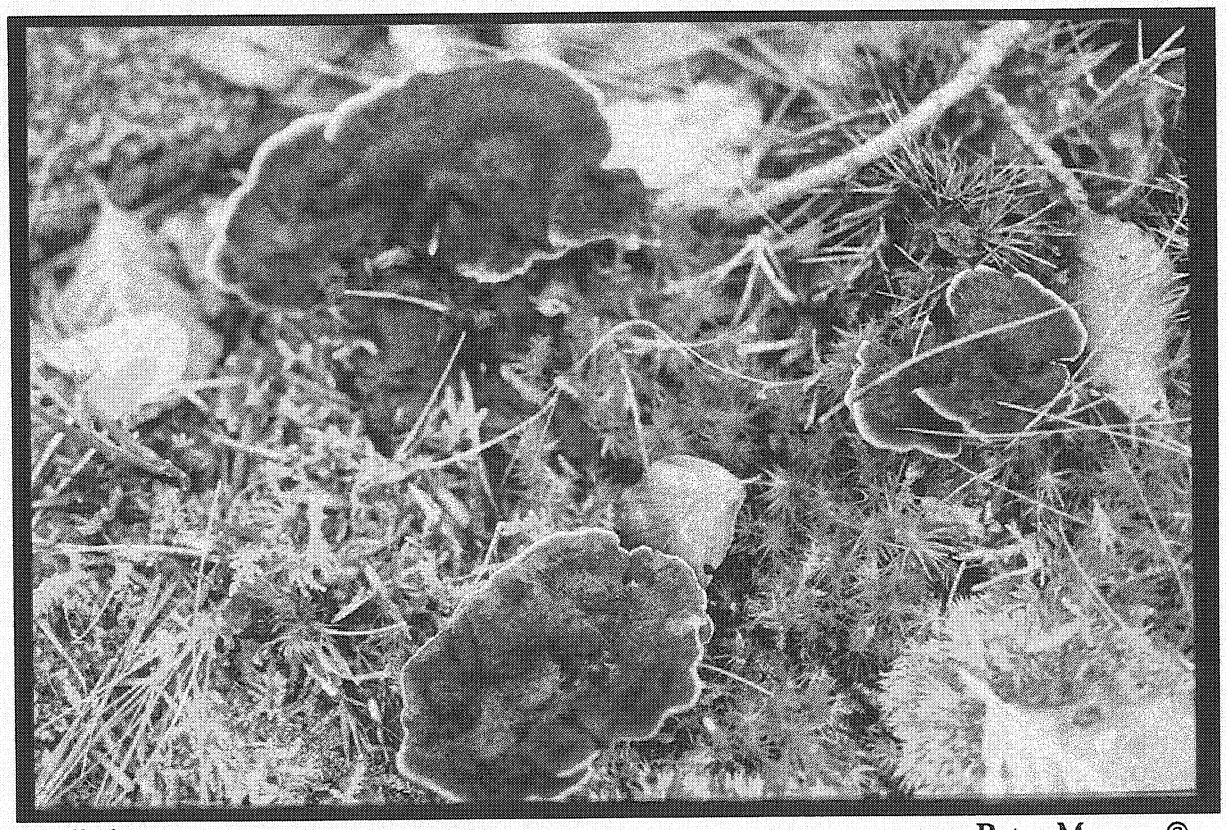

Phellodon niger Peter Marren ©