ALIENS IN THE FLOWERBEDS

The fungal biodiversity of ornamental woodchips

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The occurrence of exotic fungi in ornamental or garden settings has been known about for many years. The fragile caps of tropical *Leucocoprinus* species (notably *L. denudatus* and *L. birnbaumii*) frequently turn up in greenhouses, while Vellinga (1999) recently described the discovery in Belgium of the American fungus *Smithiomyces mexicanus* under a bush by an ornamental pool. Spooner (1994) described the first outdoor European collection of the Australian 'starfish fungus' *Aseroe rubra* "a significant distance from houses" in Surrey. Last & Watling (1998) found the widespread tropical mycorrhizal symbiont *Laccaria fraterna* under a garden *Eucalyptus* in Scotland, and many have found it since.

The aim of this article is to highlight the unintended mycological benefits arising from the recent trend in gardening practice to use woodchips as a weed-suppressing mulch. Woodchips have become increasingly popular as a form of garden management over the last 15 years. Even a thin layer helps suppress weeds, while near-total weed control can be achieved by deep (>5cm) beds

Agrocybe praecox, often abundant on woodchip beds particularly early in the season. The prominent veil on the stem is clearly visible here. Photograph © Peter Shaw.

Stropharia percevalii, note the deep purple-black spores on the surface of the cap at the top, and the fragile, poorly formed ring on the stem. Photograph © Geoffrey Kibby.

due to smothering and nitrogen immobilisation. The chips are a waste product from forestry and tree surgery, so are continuously produced and cheap to buy, though of very variable composition. There do not appear to be data on area under woodchips in the UK, but all anecdotal reports indicate a steady increase in usage over the last decade, usually in conjunction with low-maintenance ground-cover planting.

This mass exposure of decaying woodchips has inevitably been colonised by many species of wood-decaying fungi. This is to be expected, but what makes this substrate even more mycologically exciting is its colonisation by several species alien to the UK. Many mycologists are not aware that they stand a good chance of turning up 'scarce' species in highly managed urban settings by inspecting imported woodchip mulch. Behind the surprising finds of exotic species in mundane settings lies a still-unexplored story about the creation of a new habitat, its colonisation by exotic fungi, and their accidental transport around the country.

Aliens and oddities

In the south east of England there are two fungi which epitomise the interest of woodchip communities. Although very different species, they share many similarities. Both are members of the Strophariaceae. Both are certainly not native to the UK so must be assumed to have been accidental imports. Both are described as scarce, in the books which mention them at all. Both can form dense aggregations of many thousands of fruitbodies, and both are widely encountered on beds with ornamental woodchips, especially in large formal gardens in the south. These are *Stropharia aurantiaca* and *Psilocybe cyanescens* (for 'profiles' of both see Pegler & Legon 1998b). Phillips (1976) called these species rare, Courtecuisse & Duhem (1995) only show *S. aurantiaca* (which is called rare), while Lange & Hora (1976) and Bon (1987) omitted even to mention them.

Psilocybe cyanescens was first described from ornamental beds in Kew Gardens by Wakefield in 1946 but she had already collected it at Kew on several previous occasions (1910, 1911, 1925). Its native home is probably the north-western forests of the USA (there is some contention here, since Wakefield's type specimen was said to have cystidia very scarce or absent, while Paul Stamets (1996) found them abundant on specimens from the USA). This species is easily identified by its wavy cap, purple-brown spore print and the rapid bluing of stem and cap on bruising. The bluing is

often visible even on undamaged specimens, and reflects the high psilocin/psilocybin content of this fungus. The fruitbodies are solitary, but can be so tightly packed as to form dense clumps. GK has seen a riding track surfaced in woodchips where the margins for a hundred yards were covered in a mass fruiting of this fungus, with estimates of the number of fruitbodies around 10,000.

Stropharia aurantiaca in the UK and Western Europe only seems to occur on woodchip mulches, but possibly came in from Australia where it may have been described as *Psilocybe ceres* (Watling & Gregory, 1987). It is even more distinctive than *P. cyanescens*, since its cap is bright orange, and it routinely fruits in dense (and brightly-coloured) clumps. This is one of the few fungi that can be identified from a moving car! It appears to be more widespread than *P. cyanescens*, fruiting in even small patches of bushes with a skimpy covering of woodchips. Recently Reid & Eiker (1999) reported *S. aurantiaca* as newly recorded in South Africa, again on ornamental wood chips.

Using mycological research as an excuse to visit several major ornamental gardens last autumn, PS turned up another noteworthy species in the woodchips, this time an infrequent native. This was the handsome black and orange *Macrocystidia cucumis*, whose salmon-pink spore print puzzled at first, because several field guides insisted that agaric genera in Europe with pink spores mostly belong to the Pluteaceae and Entolomataceae. Its odour of fish and cucumber provides a powerful clue to its identity. The same gardens contained a rich community of other wood decayers, including *P. cyanescens*, *S. aurantiaca*, *Hohenbuehelia* sp., *Coprinus picaceus*, *Lepista saeva*, and several *Psathyrella* species, while some areas were so dominated by *Ramaria stricta* that it would have been hard to put one's foot down without squashing fruitbodies. The yellow hummocks pushing up the mulch looked like a strange ground-cover or bedding plant.

The most remarkable records that we have turned up so far from woodchips come from a small planting scheme on a roundabout near Leatherhead, which happens to be on PS's route into work. This was created and mulched with woodchips in July 1999, and produced no fungi until May 2000 when a flush of creamy-yellow fruitbodies came up. These proved to contain four different agarics: *Volvariella gloiocephala* (formerly *V. speciosa*), *Agrocybe praecox* (a common vernal species with a ring on its stem), *Agrocybe*

Psilocybe percevalii and *Agrocybe putaminum* growing together on woodchips in a roadside planting scheme in Surrey. Photograph © Peter Shaw.

putaminum and *Psilocybe percevalii*. *A. putaminum* resembles the better known *A. molesta* but is typically more massive, lacks a ring on its roughened stem and probably comes from North America.

Psilocybe (= Stropharia) percevalii was almost as unexpected: Watling & Gregory (1987) describe it as '...known from several localities in the UK but rarely seen', and neither of us had ever met the species before. It resembles a large *Stropharia*, and most field guides suggested *S. hornemannii* as the closest identification (although the spores of *P. percevalii* are significantly larger than those of *S. hornemannii*). It has no bluing reaction, suggesting it contains no psilocybin. There was taxonomic confusion involved with this species, the description in Watling & Gregory actually referring to *P. magnivelaris* (included by them as a synonym), a related species described from North America with a prominent ring as opposed to the indistinct ring-zone of *P. percevalii*. The habitat also appears to differ, with *P. magnivelaris* occuring in woods of willow and alder, often on river banks with sandy soil and decaying wood (see Nordic Macromycetes 2:265 (1992)).

Thus a minor roadside planting scheme has turned up two exceptionally unusual fungi in its first year. The woodchips were bought from a commercial supplier in Essex, but how they acquired their strange mycota is still unclear.

Why the strange species?

On the face of it there is no reason why ornamental woodchips should support an unusual fungal community. Fungi have been decaying woody material for vastly longer than the UK has existed, and mature woodland will contain dozens of species of lignicolous fungi. However there are aspects of woodchip beds which are rarely if ever encountered in nature. Firstly, the homogeneity, depth and large surface area of woodchip beds will not often be found in woodland debris. Secondly, ornamental woodchips are subject to regular disturbance, as part of normal garden management. The chips should be raked aside before fertiliser is applied to the soil (otherwise the decomposer community will tend to absorb and immobilise nutrients) and they tend to be raked over every few years to inhibit weed colonisation. Thirdly, woodchip material may be gathered together from many sources and stored in large piles prior to usage, a mixing of materials that gives aggressive colonists an opportunity to establish a long-lasting foothold in storage mounds.

Woodchip beds pose a different set of problems for decomposers to the equivalent thickness of solid wood. Within a log the hyphae are sheltered from mechanical damage but have to force their way into the matrix. Fungi in a bed of woodchips have much greater potential to put out colonising mycelium, extending hyphae in the space between chips. However these connections are vulnerable to mechanical damage, with any disturbance or gardening activities tearing mycelial connections apart. When one examines ornamental woodchips the majority will be found to be covered in dense white mycelium, firmly attached to individual chips. The loose structure of woodchips is also met in piles of leaves, but obviously these have different chemistry to woody debris. This combination of deep, loose, soil-free woody material with regular disturbance and replenishment has no exact analogy in natural woodland systems. Hence it is arguable that in piling up woodchips, gardeners have created a qualitatively new habitat type. The characteristics of this habitat select for wood-decayers which colonise rapidly (both by spores and mycelium) but which tolerate total mycelial disruption on a regular basis. Successful species will have mycelia that remain viable for long periods on or in woody debris and can rapidly put out hyphae when suitable conditions arise.

Research questions

Unravelling the set of factors which define the composition of the woodchip community is an unresolved research question. There are a number of possible variables to consider. The nature of the mulch is clearly an issue here. The garden centre standard (flaked pine bark, wood-free) is very widely applied and has different decay characteristics to woody material. The subjective impression is

that this bark mulch is particularly recalcitrant to decay, and gives depauperate communities compared to chipped woody material, but there are no good data to support this. Coniferous wood chips may support different fungi to angiosperm chips due to the resin content. The age of the chips is very likely to affect their fungal community. Decomposer successions have been identified many times since classic work in the 1960s (Kendrick & Burges 1962, Frankland 1966), and successive annual observations of a woodchip bed would be expected to produce a changing community composition. Site management is almost certain to influence the fungal community. Intensively managed beds which are raked annually may well have different fungi to mulch which is simply abandoned.

Then there are questions about the transport of fungi between sites, and their ability to naturalise in the UK. Near to PS's pine forest study site at Ironhill, Liphook (Shaw & Lankey, 1994) is an area where coniferous chippings are stockpiled as a by-product of forestry work. These piles are several metres high, cover about a quarter of a hectare, and support dense populations of native wood decayers including *Gymnopilus penetrans*, *Pleurotus ostreatus* and *Hypholoma fasciculare*. Despite annual visits over ten years, no species of *Stropharia* or *Psilocybe* has ever been found fruiting. This looks like a simple failure of colonisation – the chippings are produced on-site then exported, so that there is no possibility of mycelium being carried in to infect the piles. The nearest known sources of woodchip aliens are about 10km away, which may be too great a distance for effective colonisation.

The balance of evidence at the moment suggests that the key factor in the dispersal of woodchip aliens is mycelial transport as bulk woodchips are moved around the country. This raises the tantalising possibility that, scattered around the country, there may be large heaps of woodchips colonised by alien saprophytes, to be introduced unwittingly into ornamental borders. How they first 'escaped' from Kew gardens (or wherever they first colonised) may never be known with confidence. The authors would be fasci-

Agrocybe putaminum, a species which appears to be rapidly expanding its range and is now a frequent member of the woodchip community. It has been reported from a number of localities in the greater London area. Photograph © Peter Shaw.

nated to hear of readers who know of the movements or stockpiling procedures employed by commercial woodchip suppliers.

The final question concerns naturalisation. Will the exotic fungi of woodchip beds remain confined to this habitat, or will some of them naturalise and establish themselves in natural UK ecosystems? GK has recorded *P. cyanescens* deep in Epping Forest and two other sites in southern England, growing on fallen branches and decaying wood well away from ornamental areas. Neither author has encountered *S. aurantiaca* away from ornamental beds, and we would welcome records of these fungi in natural habitats, as well as any records of *P. cyanescens*, *S. aurantiaca* or other noteworthy fungi on ornamental woodchip beds.

In conclusion, modern gardening techniques have inadvertently created an artificial habitat type with no exact natural analogue, and a species-rich assemblage of saprophytic fungi (some alien) has taken advantage of this new niche. The definitive study of this community remains to be written, and there are great opportunities for amateur mycologists to produce valuable observations. It should be noted that this habitat does tend to throw up species not found in most field guides, and that expert help should be sought in the event of identification difficulties.

Volvariella gloiocephala, a large and now common associate of woodchip beds. Photo © P. Shaw.

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