Herefordshire Fungus Survey Group

News Sheet N^{o} 16:Autumn 2008

Polycephalomyces tomentosus on Trichia decipiens (Wigmore Rolls Wood – 26/3/08)

Contents

President & Recorder:	Ted Blackwell
Chairman:	Roger Evans
Secretary:	Mike Stroud
Treasurer:	Steve Rolph

Welcome to the Autumn 2008 News Sheet

Looking through previous issues, since we started with this style of News Sheet in Spring 2002, it is apparent how the character of the articles has changed. In particular, we now seem to have more of the longer (more esoteric?) contributions which, necessarily, put pressure on space in the layout. I am, therefore, trying an experiment with this issue, in that I have reduced the font size, in the hope of keeping the whole thing reasonably manageable. Please do tell me if it is now unreadable!

The goodies on offer this time include:

- the first of a two-part series on the interaction between the fungus and insect worlds, by Ted Blackwell.
- Roger Evans encourages us to 'cultivate' and study aquatic fungi – hopefully, he will also, at some stage in the future, give us some guidance on identifying them as well!
- Steve Rolph entertains us again with the second in his series about Fungus Folklore & Mythology – this time looking at the Fairy Ring Mushroom.
- Tom Preece has written about the influential 19th Century naturalist, Rev. Thomas Houghton, who was active in our neighbouring county, Shropshire. We, in HFSG, have come across his name in finds of such species as *Clitocybe houghtonii.*
- Debbie Evans waxes lyrical about her finds of new and uncommon rusts in North Wales and again, hopefully, will inspire us all to keep a lookout for these in Herefordshire.
- In a new departure for this News Sheet, we include a recipe for Elizabethan Pickled Mushrooms which, if you make them soon, will be ready for Christmas. It is contributed by Nick who, I can vouch from personal experience, is one of the best and most enterprising chefs I have ever come across.

May I remind everyone that our AGM is at Woolhope Village Hall, on Sat. Nov. 22nd, after lunch following the Lea & Pagets foray that morning. Amongst other items on the agenda will be the election of a new Recorder, to follow Ted's retirement after many years of hard and dedicated labour.

After this issue I shall be sending out an updated index (Excel version only) to our News Sheets. This now contains about 1000 different species of fungi that we have referred to. If you are not already on the circulation list and would like to be included, please let me know.

Finally, congratulations to Sheila Spence, on her appointment as the new BMSRN Co-ordinator - she will take over this role from Liz Holden in January 2009. Also, to her and George, for yet another Gold Medal with the BMS stand at the Malvern Autumn Show.

In the meantime, happy reading!

Mike Stroud
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RECORDER'S REPORT, January - August 2008.

WIGMORE ROLLS (SO 3968), 26th March 2008
The rather dry site had also been exposed to recent frosts, but nevertheless yielded two Agarics, *Psathyrella spadiceogrisea* and *Pholiota graminis*.

Psathyrella spadiceogrisea – Wigmore Rolls (26/3/08)

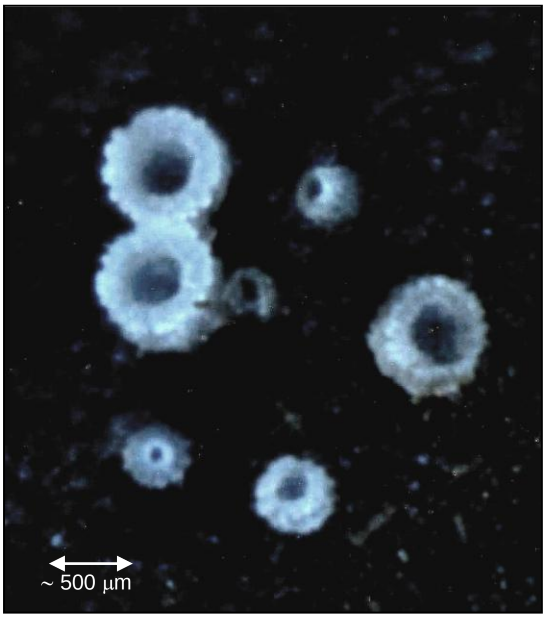
The conspicuous bright red discs of the Scarlet Elf Cup, *Sarcoscypha austriaca,* were found several times. One of the three Myxomycetes also found sported the impressive-looking mould *Polycephalomyces tomentosus* (front cover photograph) - the generic name means 'many headed' - which is thought to be the Ascomycete anamorph of *Byssostilbe stilbigera*. A rather short list was redeemed in some measure by a variety of lichens. A total of about 31 fungi, 16 lichen & 3 Myxomycete species identified.

WAPLEY HILL (SO 3562), 23rd April 2008
The persisting dry conditions resulted in few Agarics, but St. George's Mushroom, *Calocybe gambosa,* appeared right on cue as the foray coincided with the Saint's Day. *Coprinus domesticus* occurred amongst the Agarics, perhaps notable as one of the *Coprini* producing a fur-like foxy-coloured mycelial growth known as ozonium.

Coprinus domesticus – Wapley Hill (23/4/08)

Dead herbaceous stems and beech cupules were the susbtrate for a number of records and the site produced several seldom recorded microfungi. There are only three previous records of *Eutypa scabrosa*, only six of *Hyaloscpha leuconica*, only 10 of *Bertia moriformis*, and only four of *Zignoella ovoidea*. A total of about 41 fungi and one lichen species identified.

WOODBURY HILL WOOD (SO 3342 – 3441), 7th May 2008



Unguicularia costata – Woodbury Hill (7/5/08)

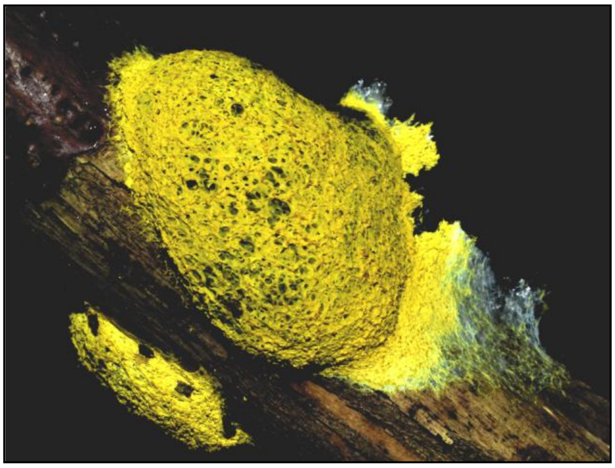
The lack of rain again resulted in dry ground conditions and a low count of species, particularly of Agarics. There was some compensation in the find of *Pirottaea nigrostriata* on dead hogweed stem (only the second VC36 record) and of other less common microfungi on dead stems such as *Micropodia pteridina* on bracken and *Unguicularia costata* on rush. The abundance of bramble-stem rust was particularly noticeable, and a variety of microfungi were found on damp-cultured deer dung, amongst which *Ascobolus mancus* appears to be a first VC36 record - but hardly remarkable due to the general under-recording of coprophilus microfungi in the vice-county. A total of about 34 species identified.

FRITH WOOD, LEDBURY (SO 72 40), 24th May 2008

Coprinus auricomus – Frith Wood (24/5/08)

The site is on free-draining limestone which, taken with the continuing low rainfall, resulted in another short list. Nevertheless, a fair spread of species across taxonomic groups was achieved. Among the Agarics were *Agrocybe praecox* and *Coprinus auricomus*, and the list included some of the less frequently recorded species, such as *Boletus porosporus* and *Hypomyces aurantius* and, among the micros, *Stemonitopsis typhina* and *Helminthosporium velutina*. A total of about 27 species identified.

MORETON WOOD, ULLINGSWICK (SO 5948), 11th June 2008



Fuligo septica – Moreton Wood (11/6/08)

Dry ground conditions again limited the finding of Agarics and brackets, but at least some of the microfungi were in evidence, such as the initial signs of Powdery Mildews (*Erysiphe*), several rusts (*Puccinia* and *Gymnosporangium*), a smut (*Ustilago/Microbotryum*) and a number of Ascomycete microfungi, together with repeated finds of two common Myxomycetes, "Wolf's milk" (*Lycogala*) and "Flowers of Tan" (*Fuligo septica*). An unusual character of the rust *Puccinia punctiformis* on Creeping Thistle is the pleasant fragrance of the initial rust stage, employed by the fungus to attract insects to disseminate its spermatia. A total of about 33 fungi and one lichen recorded.

BROCKHAMPTON ESTATE (SO 6854/6855), 16th July 2008.

An easing of the dry conditions resulted in a rewarding list, spanning an interesting range of taxonomic groups from both park grassland and broadleaf woodland. The diminutive litter-colonising *Mycena speira* occurred amongst the twenty or so Agarics, as also *Entoloma hebes* and *Melanoleuca strictipes* Among the numerous stumps and great hulks of fallen parkland trees there were frequent finds of the Artist's Fungus, *Ganoderma adspersum* and Dryad's Saddle, *Polyporus squamosus*. There are only four previous records of *Mastigosporium muticum* on Cocksfoot all from the years 1957-63, where they occur among the records of the government AAS laboratory dealing with diseases of farm crops. There is only one previous record of *Nodulisporoium umbrinum* - from Mains Wood in 2003; hitherto this Hyphomycete was regarded as an anamorph of various *Hypoxylon* spp., but more recently is thought to be a parasite of certain *Hypoxylon* spp. *Puccinina striiformis* var. *dactylidis* on *Dactylidis glomerata* was a first VC36 record, and, after a gap of more than a century, *Venturia pirina* on an attached pear, recorded only once before in 18xx at Holme Lacy Park and at Hereford. A total of about 76 fungi and 25 lichens identified.

Top: Mycena speirea (left), Melanoleuca strictipes (right).
Bottom: Nodulisporum umbrinum (left), Entoloma hebes (centre), Polyporus squamosus (right) – all at Brockhampton (16/7/08)

NOTES OF UNUSUAL RECORDS 2008.

In addition to those from programmed forays some records of interest were reported from Herefordshire and neighbouring counties, of which the following are a selection.

+ = First VC36 record;
(+) = last record from 1800s

A deformed fruitbody of *Tubaria furfuracea*, (the deformation being technically known as a teratological malformation) featuring a sponge-like collar at stipe apex; growing on woody debris. Sned Wood path; SO398654, 5/1/08, collected by Jo Weightman. Accessioned at Kew as K(M) 155776, Dr. Spooner commenting that the deformity may be due to virus infection.

Byssomerulius corium on *Euphorbia wulfenii*. Orleton, SO4967, 24/1/2008, Jo Weightman. Due to interest in the occurrence on an unusual host, accepted and accessioned at Kew (as K(M)155771).

Licea erddigensis+, and *L. microscopica+,* on damp-cultured bark. British camp, Malvern Hills, SO755395, 3/3/2008, Joy Ricketts.

Physarum auriscalpium+ on damp-cultured apple bark. Half Hyde orchard. SO664468, 19/1/08, Joy Ricketts.

Physarum compressum+ on damp-cultured apple bark. British Camp; SO765406, 5/5/2008, Joy Ricketts.

Physarum limonium+ on damp-cultured apple bark. Tidnor orchard. SO560397, 1/2/2008, David Mitchell.

Lasiosphaeria strigosa+, fallen branch, Bodenham Lakes, SO5251, 9/3/08, Jo Weightman.

Ceramothyrium europaeum+ (a sooty mould), on living holly leaves, Orleton churchyard, SO4867, 21/2/08, Jo Weightman. Identified at Kew.

Peniophora proxima+ on dead attached branch of an old Box shrub, *Buxus sempervirens*, Lingen, SO377670, 18/3/08, Cherry Greenway. Kew confirmed this as probably the most northerly occurrence for any collection to be held at Kew. Accessioned at Kew as K(M) 157050.

Mitrophora semilibera on grass verge. Ledbury. SO7136. 14/4/08. Richard Hadley.

Lycogala confusum+: Linton Wood, S. Herefordshire, SO 667265, 5/5/08. collected by Mrs J. Wynne-Jones, identified Dr. Bruce Ing.

Tuber aestivum (+) (the Summer Truffle), found in a garden lawn near birch and pine. Withington, SO5643, 22/6/2008, The specimen was sent for identification to Hereford Museum by an anonymous finder. The only previous record on the VC36 database was in 1873 at Hereford recorded by the celebrated Dr. Henry Bull.

Helicosporium state of *Tubeufia helicoma*, Fishpool Valley. SO4565, 24/6/08, Jo Weightman. The conidia have an unusual shape and are coiled like clock-springs.

OUT OF COUNTY
Gyromitra esculenta (two occurrences) on sandy soil of garden at Astley Burf, Worcestershire. SO808677. 15 & 21/3/08. Jane & Dave Scott, reported by John Bingham. Also at Sallow Vallets Inclosure, Forest of Dean, Gloucestershire, under Pine. SO6013. 29/3/08. Cherry Greenway.

Uromyces appendiculatus aecia on bean leaf, the aecial stage is seldom recorded. Wernrheolydd, Raglan, Monmouthdshire, SO3912. 16/7/2008. Roger Evans.

Hymenoscyphus scutula var. *solani* on Japanese Knotweed dead stem. Cwmdu, Crickhowell, Brecon. SO1723, 13/8/08, Shelly Stroud.

Protomyces macrosporus on *Aegopopdium podagraria*, at Llynclys, Shropshire, SO2723. 10/8/08, Tom Preece. There is only one VC36 record (also by Tom Preece, at Bredwardine in 1992). Then found later at Cwmdu, Crickhowell, Brecon, SO1723, 5/9/08, Shelly Stroud.

Hymenoscyphus scutula var. *solani*

The total of Herefordshire county records continues to grow increasing the diversity of species recorded. Thanks are due to all collectors and recorders for lists and reports and for the results of diligent home-work, whose contribution continues to expand the knowledge of Herefordshire fungi.

Ted Blackwell, Recorder

ELIZABETHAN PICKLED MUSHROOMS

Here's a recipe you can eat between forays and not spoil your appetite. This dish has a couple of interesting features:

- Firstly, that it really does seem to have it's origins in the 16th century, when mushrooms with mace were a common confection;
- Secondly, that when there is nothing suitable in the wild, the ubiquitous supermarket, closed-cup mushroom works splendidly. Whatever you use, be sure it is robust in texture (think, 'Horse Mushroom'!) and safe to eat raw.

Easily made in small batches, utilising salvaged chutney or jam jars, the finished condiment is ready to eat from 6 weeks….just in time to accompany the Boxing Day leftovers!

Don't forget to sterilise your jars and lids in boiling water…we wouldn't want any random fungal growths spoiling the finished product, eh?

INGREDIENTS;
½ pint sweet white wine
1 oz ginger root peeled & sliced
1 blade of mace
1 eggcup water
1 lb button mushrooms
1 tablespoon sea salt

METHOD:
1. In a saucepan, bring the wine and water to the boil.
2. Add the peppercorns, ginger & mace and simmer for 5 minutes; then allow to cool.
3. Throw the mushrooms and salt into a dry pan and heat, shaking so as to avoid sticking, until they have lost a little of their juice and started to become tender; then allow to cool.
4. Pack the mushrooms in jars and cover with the spiced liquid.
5. Seal the jars and allow to mature for 6 weeks before eating.

Contributed by Nick

FUNGI IN WATER

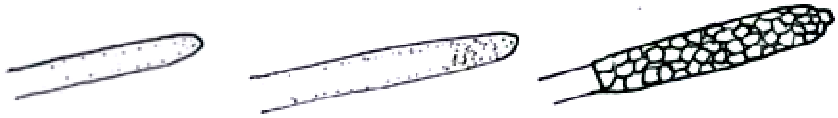


Fig. 1 Tip of vegetative hypha Developing zoosporangium Mature zoosporangium

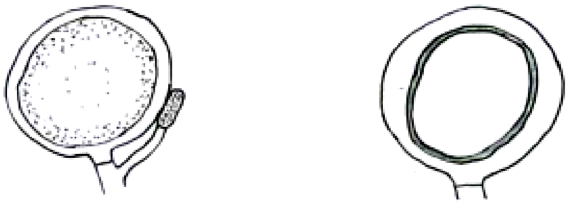


Fig. 2 Oosporangium and antheridium Mature oospore

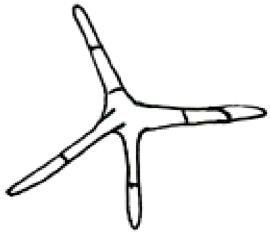


Fig. 4 Tetraradiate hyphomycete spore

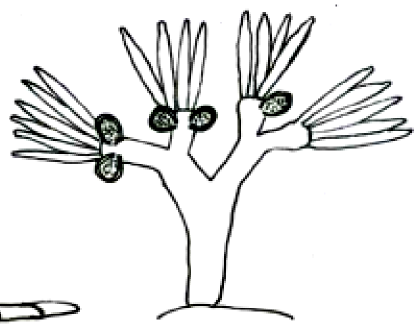


Fig. 3 Blastocladia

Many members of the group have a microscope, so I wondered whether anyone had looked at water moulds. You might find it interesting in the spring or early summer, when the larger fungi we usually examine may be rather sparse.

Just taking a drop of water from a pond or stream, putting it on a slide and examining will usually yield little of interest. To see water moulds you have to use bait.

- Take a clear or translucent lid to a plastic box and place in this 0.5 -1cm depth of water from a pond or stream.

- Then add the bait: boiled hemp (cannabis) seeds are very good, but perhaps not easy to get hold of these days (at one time they were sold as food for pet birds). Grass seeds are quite good, but you might try any type of old seed you have - just boil them for a few minutes before you use them. An alternative is minute pieces of the white of a hard boiled egg.

- The most important thing with any of these baits is to use just two or three seeds, or bits of egg white: if you use more, then bacteria will grow rapidly in the water and turn it into a soup in which the fungi will not grow.

- Now place the baited water onto a windowsill, out of direct sunlight and leave for 1-2 days.

If moulds are present and the bait suitable, you will see fine unbranched “hairs” growing out of the seed. The whole container can be now put on the microscope stage; the seeds will slosh about at first, but will gradually settle down and can be moved. The tips of the hyphae can then be examined under a x4 or x10 lens.

There will be many rotifers and other creatures in the water, but you should see some broad, unbranched, vegetative hyphae. These will be of *Saprolegnia,* or its relatives. The asexual reproduction stage of developing and mature zoosporangia should also be present (see Fig.1).

If you leave the seeds for a few more days – say, 5 to 7 – then the sexual stages may have developed and these can easily be seen under the x10 lens. There will be large round oogonia and club shaped antheridia (see Fig. 2).

When the contents of the oogonium has been fertilised a thick-walled spore, known as an oospore, will develop. Under the right conditions this will germinate to form a new mycelium of the fungus. The drawings only give an indication of what you might see for different genera, as they all have slightly different characteristics.

Using other baits, additional interesting fungi can be found.

Place a few small tomatoes or grapes into a small net bag, of the type in which peanuts for bird food are sometimes sold. Now add a stone to cause the bag to sink. Tie on a piece of string and drop the bag into a pond or stream, tying the other end of the string onto a peg and push this into the bank in some unobtrusive spot. These need a long incubation, say 3-5 weeks. Periodically, pull them out and check them. When fungi have developed there will be little white raised spots on the fruit.

Take off one of these spots, put it on a slide with a drop of water and, with a pair of needles or pins, pull it apart. Discard most of the material, but place a small amount under a coverslip and tap it with the end of a pencil. Then examine under the microscope. You should see *Blastocladia*: this is a fungus with no hyphae, but it looks like tiny tree trunks. There may be cigar-shaped, thin-walled zoosporangia and round, thick-walled zoosporangia (see Fig. 3).

Finally, some Hyphomycetes: if you see froth collecting at some point on a fast flowing stream, collect some in a jam jar. Let this settle. Then take a drop from the bottom of the jar, mount it on a slide, apply a cover slip and examine. You should see some spores with the four arms (tetraradiate), typical of hyphomycete fungi (see Fig.4).

Roger Evans

FUNGUS FOLKLORE & MYTHOLOGY: 2. THE FAIRY RING MUSHROOM

Nature has a long history of creating odd shapes for which humans misattribute reasons. In the fungal world, a front - runner for this title must surely be the Fairy Ring. These often appear on lawns or pastureland as a curious formation, where darker circles of grass stand out from the rest. There is often a circle of bare ground, just inside the rich outer ring, with a matching ring of mushrooms at the correct season.

At a time when elves and fairies were considered “real” entities it was only natural to assume that they must be involved in the formation of these rings. By far the most popular explanation was that of fairies dancing in a circle during the night (especially at full moon), causing the flattened inner ring by the patter of many little feet. The lush grass at the perimeter was thought to be a result of spells used to make the mushrooms, which served as seats for exhausted fairies to rest between dances.

How humans and livestock were thought to interact with these rings is also interesting. To have a ring in the field next to your house was thought to bring good fortune, but to let your animals eat the grass within the ring was asking for trouble.

Similarly, for humans stepping into a ring was full of foreboding - in particular, if it was with both feet and at night. This could result in a person being taken by the fairies to dance for the next seven years! Rescue was close to impossible unless another person outside the ring could grab your coat-tails as you danced by them.

Various methods to protect oneself from becoming an unwilling dancer existed at the time. These included:

- carry a piece of bread in your pocket;
- carry a silver coin in your pocket;
- wear a piece of clothing backwards;
- wear your clothes inside out;
- wear odd socks;
- say your name backwards to get unfairy-struck;
- never wear green in the woods (it is their colour);
- never follow music in the woods;
- never answer anyone calling you into the woods if you don’t know the voice;
- never talk to a fairy;
- never eat their food.

I can personally vouch for the protective effects of at least four of the above.

The wrath of the fairies is not to be taken lightly as the following tale recounts:

A large group of fairies were thought to reside at the Virtuous Well, also known as St. Anne’s Well, located near Trellech Village in Wales. One story is that a local farmer dug up a fairy ring around the well to prove to others that he did not believe in “such silly tales”.

However, the next day, when he attempted to draw water out of the well, it was dry. He was made to replace the turf around the well at once and the water returned a few days later.

On a more positive note, dew collected from the grass of the outer ring was thought to be highly beneficial to the complexion and was widely used as a facewash by spotty youths. A love potion for young girls could also be made from this dew, but no details are available as to how it was made, or used. Presumably, the lack of spots would have helped in any case.

Other causes attributed to the formation of the rings included:

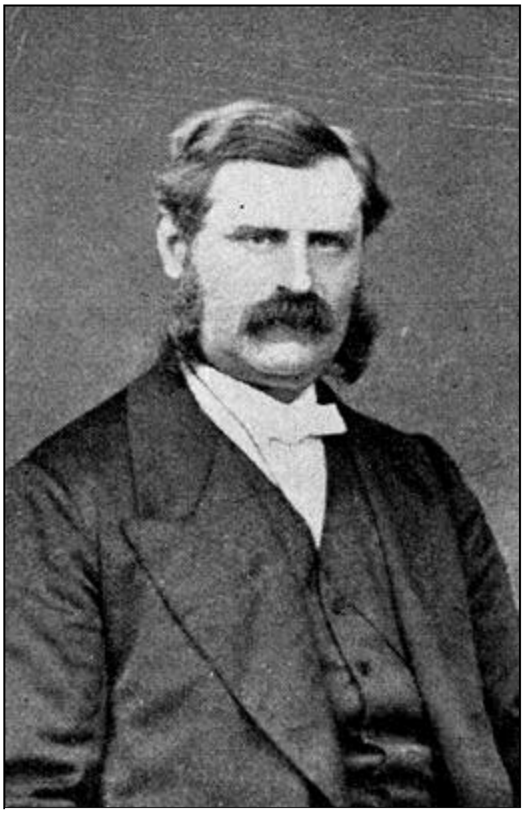
- resting dragons causing bare patches;
- marking the position of treasure (which could not be obtained without the aid of fairies);
- ants;
- moles;
- haystacks;
- cow urine;
- lightning hitting the ground – the electrical energy was believed to radiate outwards, scorching the soil and thus leaving a bare circle.

All of these causes are interesting in there own way, but lack the magical charm of the fairy stories.

Steve Rolph

A TALE OF SOME SHROPSHIRE MYCOLOGISTS AND OF WILLIAM HOUGHTON, CLASSICAL SCHOLAR, NATURALIST, MYCOLOGIST (1829-1895), IN PARTICULAR

Besides Charles Darwin (1809-1882) two other Shrewsbury men were significant naturalists in the nineteenth century. These were the Reverend William Allport Leighton (1805 -1889) and William Phillips (1822-1905). Leighton was a Shrewsbury inn-keeper's son and Phillips a Shrewsbury tailor.



Rev. William Houghton 1828-1895.
From Forrest 1899. Shrewsbury Museums Serice

One of the often understated facts about the lives of people who lived in the past is how much they were influenced in their accomplishments by others - often in fundamental ways, but about which there is little in the written records so vital to historians. This story is a classic case of such influence and the links are both interesting and surprising when discovered.

Leighton was at what we would now describe as primary school with Darwin. He particularly remembered Darwin bringing a flower to school (Darwin was 8 years old) and telling him how his mother had taught him that it was possible, by looking into the blossom, to work out the name of the flower. Leighton was later to produce the first flora of Shropshire in 1840, but mysteriously became interested in lichens, producing the very important 'Lichen Flora of Great Britain, Ireland and the Channel Islands' in 1871. Leighton was also a close friend of Phillips, who himself became interested in fungi "because of William Houghton" (see photo above). W. Phillips was to produce the first 'Manual of British Discomycetes', with illustrations in 1887. He was not a university man, but both Darwin and Leighton were greatly influenced by Professor Henslow at Cambridge University...

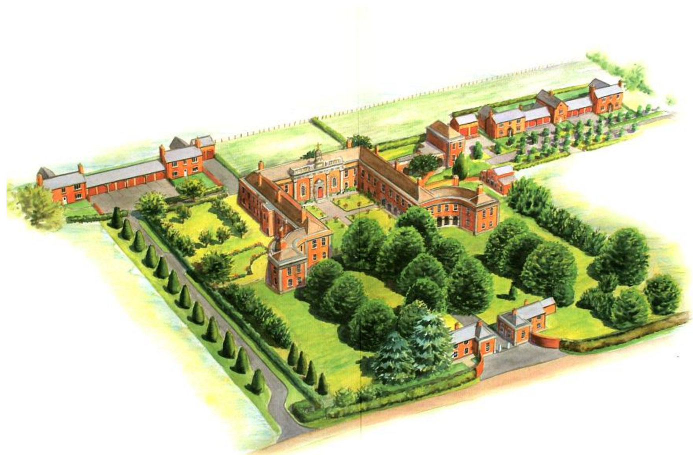
However, my story is about the Reverend William Houghton - who he was, what he did for natural history and, in particular, mycology. He lived from 1829 -1895, went to Brasenose College, Oxford, where it seems he was a very fit man, rowing for his College in 1849.

We need to turn to a triangular area of Shropshire, north of Telford - often somewhat bleak, flat and wet - bordered by Crudgington to the west and Newport to the east. Here are the Weald moors, known to few people and where today there are still comparatively few inhabitants. It is criss-crossed with natural and artificial watercourses (which habitats for fish are almost certainly significant to this account). The area was drained for farming by the Duke of Sutherland and later more so under the Commons Improvement Act of 1800.
In this triangle we come across a small hamlet, Preston-upon-the Weald Moors. It is now principally known for its spectacular (Grade 1) almshouses, called the Hospital, which were built in 1716 - 1725 under the will of Lady Catherine Herbert. It is of red brick and stone (see picture below) and is now converted into expensive flats. Nearby, almost crushed by huge farm buildings erected in recent years, is the parish church of St. Laurence, also built of red brick, in 1739 (see photo on next page).

William Houghton was the vicar here from 1860 to 1894 and a reminder of what he did there, as well as the things discussed in this article, can be seen in the Parish registers. His first entry is of officiating at a wedding in 1860 and the final one bearing his signature is for a funeral conducted by him 34 years later. He died in Tenby, aged 67, leaving £213 net.

Born in Liverpool in 1829, William Houghton graduated from Oxford in 1853. By 1858 he was the Headmaster of Solihull Grammar School and in 1859 he was elected Fellow of the Linnean Society of London. During his years at Preston-upon -the Weald Moors his prolific activities can perhaps be sorted under four headings. He:

1. wrote books for children;
2. produced scientific papers in a wide range of natural history topics - none of which were on flowering plants;
3. wrote about fish;
4. extracted important writing by the Greeks and Romans on fungi, translating the originals into English.



By courtesy of Shropshire Homes

Photograph by Graham Williams, Shropshire Family History Society

In a short account like the present one it is only possible to glimpse at what he achieved.

His two books for children were entitled, 'Country Walks of a Naturalist with his Children' and 'Seaside Walks of a Naturalist', the latter overlapping with more serious writing on fish, which was to be published later.

His scientific papers these were on many varied and separate topics - molluscs, protozoa, leeches, flatworms, birds and aphids - in 1885 he wrote a paper about the aphid affecting local mangold -wurzel crops, in which he describes a fungus
- almost certainly an *Entomophthora* - which he noted killed the aphids.

There are no papers here about fungi, but he reported his finds on fungal forays with the Woolhope Club and from local walks. At least three fungi were named after him by others - *Clitocybe houghtonii* [see also HFSG News Sheet No. 5, Spring 2003 – Ed.], *Pezicula houghtonii* and *Hygrophorus houghtonii* (now called *Hygrophorus laeta*).

Turning to fishes, he was second in a national essay competition, writing on the "Natural History of Commercial Sea-fishes of Great Britain and Ireland". He also wrote another competition essay entitled, "0n the Natural History and Cultivation of the Sole"(1883).

At this time he produced a huge two volume work, "British Freshwater Fishes". This was illustrated in colour by splendid chrome-lithographic plates of each species and pages from this remarkable book can be viewed, in colour, on the internet, at
www.darwincountry.org/explore/000913

We come to Houghton's most significant work last in this account. He is known internationally for his works on the earliest writings about fungi by the ancient Greeks and Romans. Much of what one reads about these early authors from around 300BC
was first written in English by Houghton. It is clear from his lengthy account called, "Notices of Fungi in Greek and Latin Authors" (1885) that he read these in the original Greek and Latin language.

It is difficult to précis this mass of information, but here we find some of the earliest writing about what a fungus is. These ancient writers were much concerned about which were the best fungi to eat and give graphic accounts of poisonous fungi. Names have, of course, changed, but here we find the first use of, for example, 'Agaricum' and 'Boletus'. Here also, amongst the poems and folklore, are some of the first suggestions of the medical uses of fungi.

His account was remarkable and is still the standard work on these early writings. In a similar vein, Houghton wrote papers about specific 'classical' topics, eg

- "The Unicorn of the Ancients" (1869);
- "The Rabbit as known to the Ancients" (1869);
- "Gleanings from the Natural History of the Ancients" (1880);
- "Fish Culture as Practised by the Ancients" (1883);
- "Birds of the Assyrian Monuments" (1883).

This intellectual giant beavering away in his Shropshire vicarage has left a legacy very important to our understanding of the history of mycology, not to mention his influence through Leighton and Phillips on our understanding of lichens and discomycete fungi.

I should like to thank Mark Lawley and Ted Blackwell for all their help with information on Houghton, given over a period of several years.

Tom Preece

AN UNCOMMON EARTHTONGUE

This *Cordyceps gracilis* was found above Llangattock, Powys on a footpath which traversed below the limestone "cliffs."

The stem was 85mm X 2-3mm slender at top slightly broadening towards the base, the cap almost chestnut in colour 9mm X 5mm. The asci are very long, on average 207μm by 5μm and with a thick apical tip. The ascospores are very thin.

There was no evidence of the Lepidoptera caterpillar at the base of the stem**.**

Roger Evans

HIGHLIGHTS OF A RUST RECORDER'S YEAR

2008 has been a very productive year with over 600 records to date - mainly from VCs 49 and 52, (Caernarfonshire and Anglesey). These include numerous new site records, records of new rusts and hosts and, importantly, there have been a few real highlights to both excite and please.

Uromyces sommerfeltii (left)

Uromyces chenopodii (centre); Puccinia schroeteriana (right0

In June I targeted salt marshes on Anglesey, looking for *Uromyces chenopodii* on Annual Seablite, *Suaeda maritima*. Searching hundreds of plants requires dedication, but I was rewarded with a few infected leaves from the Inland Sea near Holyhead. A reddish spot on the upper surface alerts the searcher to look closer and, on the lower surface of the fleshy leaves, were tiny, tangerine uredinia arranged in a circle. This rust is remarkable in being able to withstand the effects of salt water like its halophytic host and this feature also applies to *Uromyces salicorniae* on Glasswort, *Salicornia* sp. and *Uromyces sparsus* on Sea-spurrey, *Spergularia* sp., which I record at similar sites.

Also in June, I was out botanising on Creigiau Gleision, near Capel Curig. Our target species was the locally rare Mountain Avens, *Dryas octopetala* and other alpine plants. They grow in inaccessible spots out of reach of the sheep and nimble goats, requiring a head for heights and rough scrambling. We located the *Dryas,* but my attention was taken by a single, rusted Goldenrod plant, *Solidago virgaurea*, growing alongside a small population of uninfected plants. The recorded rust on this host is *Puccinia virgae-aureae* and there is a single VC49 record, (R.W.G. Dennis 1969). However, on examining the spores microscopically, I was surprised to see single-celled teliospores instead of the expected 2-celled spores of a *Puccinia* species. Nigel Stringer was contacted and he confirmed the identity of the rust as *Uromyces sommerfeltii*, a european species first found in the UK by Arthur Chater in Ceredigion, 2003. The rust has centres of population in Austria, Switzerland and in all Scandinavia and my find is thus the second British record.

In July I found another rust infected plant on the crags beneath the summit of Snowdon. Superficially the rust on the leaves looked very similar, but on this occasion it turned out to be *Puccinia virgae-aureae* and only the second VC49 record.

My most important find was discovered while searching for the larvae of a rare soldier fly at Cors Bodeilio, a fen site on Anglesey. While the photographers were busy I spotted a rust on leaves of Saw-wort, *Serratula tinctoria*. The species I have previously recorded on this host is *Puccinia hieracii* var. *hieracii*. This rust has uredinoid aecia, visible as cinnamon-brown pustules and not the aecial cups I had now found. Checking books at home, there was no reference to another rust and Nigel Stringer was again consulted. His research found a european rust, *Puccinia schroeteriana* Kleb 1895 and all the descriptions and microscopic parameters agree with my samples. *P. schroeteriana* alternates with Tawny Sedge, *Carex hostiana,* on the Continent and the urediniospore and teliospore stages will be found on the sedge, (Zwetko 1993). This plant grows alongside the Saw-wort at Cors Bodeilio and on subsequent visits in July and August I found infected sedge leaves.

In the UK *Puccinia caricina* sl is the recorded species on *C. hostiana,* due to the lack of information on host alternation and available specimens for study. (NS pers. comm.) It differs from *P. schroeteriana* in the number of pores in the urediniospores and the rust I collected appears to agree with the latter species. This important find is still subject to confirmation, but will be the first British record and may have confirmed the identity of the alternate *C. hostiana* host. To complete the collection I later recorded and photographed *Puccinia hieracii* on *Serratula* on Anglesey for comparison.

…..And, an added bonus for my repeat visits to Cors Bodeilio, was discovering a new site for *Puccinia angelicae* on wild angelica, *Angelica sylvestris* - only my second record of this rare rust in Wales.

My thanks go to Nigel Stringer for his help, enthusiasm and friendship.

References:

D.M. Henderson, BMS (2000). *A Checklist of the Rust Fungi of the British Isles*
D.M. Henderson, BMS (2004). *The Rust Fungi of the British Isles*
Wilson, M. & Henderson, D.M. (1966). *British Rust Fungi*. Cambridge University Press.
Zwetko, P., (1993). *Rostpilze (Uredinales) auf Carex im Ostalpenraum*

Text & photographs by Debbie Evans

FUNGI AND CREEPY-CRAWLIES: PART 1

Specialised fungi growing on insects and spiders are found occasionally, and there have been recent reports of Herefordshire instances of fungi parasitising arthropods. In autumn 2007 a mould *Gibellula aranearum* on spider cadavers was found by Jo Weightman; and the anamorph of *Cordyceps forquignonii* was reported on a dead Dipterous fly by John & Denise Bingham. In June 2008, Jo found the mould *Paecilomyces farinosus* on a pupa and in September the writer found an *Aspergillus* mould on a House Spider (*Tegenaria gigantea*). [Also, see Roger Evan's *Cordyceps gracilis* on page 9 – Ed]

Creatures classified in the phylum Arthropoda are what we often refer to as creepy-crawlies. These include such as ants, aphids, beetles, bugs, cockroaches, flies, lice, mites, harvestmen, spiders, woodlice, and even crayfish. The interactions between them and fungi range widely over species in both groups and involve a variety of associations. Many of these are not only surprising, but sometimes bordering on the bizarre: brief details of which are worthy of mention. What follows, therefore, is perhaps a sketchy rag-bag of facts from scattered references, but sufficient to reveal the widespread association of these groups. It may conceivably encourage further interest in some of the phenomena arising from fungi/arthropod interactions.

Although estimates of the number of fungi world-wide vary, Prof. David Hawksworth recently wrote that, "on balance the 1.5 million remains an accepted working hypothesis". Similarly, varying estimates apply to the number of arthropods - ranging from 800,000 to 3 million or more. Fungi and arthropods are two of the largest taxonomic groups and it is, therefore, hardly surprising that many instances of interactions and associations occur between them, some quite complex in their organization.

There are a variety of ways in which fungi and insects associate or interact. Many associations are to some degree parasitic, ranging from the merely harmless exploitation of the host's life cycle (which we may call quasi-parasitism), to disease and/or the death of the victim. These may be summarised under the following headings:

- fungus parasitic on insect (entomopathogenic fungi) - very often lethal;
- fungus exploiting insect behaviour quasi-parasitically;
- insect parasitic on fungus;
- insect exploiting fungus life cycle quasi-parasitically;
- the interaction leading to an incidental additional effect;
- a symbiotic/mutualistic relationship evolving, to mutual benefit.

In this short article it is possible to mention only brief details of a few examples of such interactions.

Paecilomyces farinosus on a pupa – photographed at Mains Wood, 23/10/02

<u>Fungus parasitic on insect</u>.

Lethal parasitism is dependent on the fungus being able to gain entry to the arthropod's body, which is encased in a tough exoskeleton composed of chitin and protein. Chitin is very resistant to break-down: in fact, the intact elytra (wing-cases) of beetles can be found preserved in glacial deposits from the last ice-age, 5000 or more years old and have been used in research into climate change during the Post-Glacial period. Although some arthropods are parasitised by ingesting fungal propagules which infect them from within by penetration through the gut wall, others are attacked externally by the germination of a fungus spore on the exoskeleton. In many cases a penetration peg forms which, by mechanical pressure in conjunction with 'softening-up' enzymes the fungus, is able to penetrate the cuticle. It then proliferates internally, consuming the insect and, in due course, breaks out to release spores. This penetration process is akin to that employed by some plant pathogens, when invading plant tissues.

The parasitism of a range of insects by several species of *Cordyceps* in Britain is perhaps best exemplified by *C. militaris* (Scarlet Caterpillarclub), on Lepidoptera larvae and pupae. Among other enzymes, *Cordyceps* produces the cuticle-degrading enzyme chitinase which breaks down chitin and, as described above, enables the germinating spore to penetrates the insect's exoskeleton.

Cordyceps militaris (as seen apparently emerging from the ground)

The insect dies as the fungus, forming yeast-like propagules, or hyphal bodies, increases within. These are circulated in the haemolymph (insect blood), to permeate its tissues, finally developing into a mycelial mass. The process causes the cadaver to become mummified into a pseudosclerotium within the exoskeleton. This is very resistant to decay due to the production of an antimicrobial substance, cordycepin, so that it does not rot before producing its reproductive structure, the familiar orange club-shaped perithecial stroma. The antibiotic properties of cordycepin may explain the use of *Cordyceps* in Chinese medicine: in fact, the immunosuppresive drug Cyclosporin was first isolated from the anamorph of *Cordyceps subsessilis*. Interestingly, the chitin-degrading ability of *Cordyceps* is not confined to insect parasitism. It can parasitise another fungus, the false truffle *Elaphomyces*, which is also reported to have chitin in its peridial make-up.

Cordyceps militaris (showing the disinterred pupa)

A similar dual capacity is exhibited by the Hyphomycete *Verticillium lecanii*, normally a parasite of aphids, scale insects and spiders. It is utilised as biocontrol of aphids in glasshouse cultivation, but reported also to parasitise powdery mildews and rust urediniospores of such as runner-bean rust *Uromyces appendiculatus* and *Dianthus* rust *U. dianthi*, and overseas, the economically important coffee rust *Hemileia vastatrix*. What may be deemed an uncanny versitility - the ability to parsitise such utterly different organisms as other fungi and insects - may not be as extraordinary as it seems. There are certain aspects of the biochemistry of both types of organism which are similar. Not only do fungi and insects have chitin (respectively, in hyphal walls and arthropod cuticle), but also major carbohydrates (trehalose and mannitol) and energy-storage compounds (lipids and glycogen). But it is not fully understood how fungi that secrete chitinolytic enzymes protect their own cell walls.

Another common insect parasite is the fly cholera mould, *Entomophthora*[1] (the name means 'insect destroyer'), sometimes seen on the cadavers of flies stuck to seldom-cleaned window panes. The mould can also be seen in autumn on infected dead flies clinging to the tops of plants, because the disease induces the dying fly to crawl upwards towards the light to a position favourable to the dispersal of spores. These fly victims can often be found in the proximity of attractant odours from such as carrion and stink-horns, or on grasses infected with the *Sphacelia* stage of ergot *Claviceps*.

Closely related to *Entomophthora*, the genus *Massospora* occurs in North America. This attacks the Seventeen-year Cicada, so called because the cicada nymphs spend sixteen years and nine months in the soil before emerging to fly as adult insects for only three months. The fungus invades the abdomen and converts part of the innards to a mass of powdery spores. As the disease develops, the still-living cicada sheds successive segments of its abdomen, thereby facilitating spore dispersal. With what seems remarkable *sang-froid,* infected cicadas continue to fly and crawl around with only the head and thorax - the supposedly vital organs having been consumed by the fungus and converted to spores.

Several fungi which kill silk-worm larvae are referred to collectively as muscardine disease and were known to the Japanese silk industry as early as the ninth century. Spores of one of these fungi, *Beauvaria bassiana*, can be cultured on an industrial scale on substrates such as bran, molasses, starch, or whey by-product of cheese manufacture. It is reported that China manufactures annually 10,000 tons of spore powder formulation for use against aphids and other insects in forests and agricultural land.

This same muscardine fungus is being researched at two British universities as a possible biocontrol of malaria and also as a more effective alternative to chemical pesticides, to which the insects can develop immunity. Research has indicated that malaria-infected mosquitoes appear to be far more vulnerable to entomopathogenic fungi which enter through their feet. It was found that surfaces impregnated with spores of *B. bassiana* kill about 90% of captive mosquitoes within two weeks of coming into contact and that only six hours of exposure was necessary. The fungus remained effective for at least 12 days. The fungus debilitates the insects for a period before they die, so that they are less able to fly to spread malaria. As the human-infecting malarial sporozoite requires about two weeks to develop within the mosquito to be infective, increased susceptibility and rapid kill by the fungus is an obvious advantage in disease control. Another muscardine fungus *Metarhizium anisopliae* is the principal component of a pesticide ("Green Muscle") developed in South Africa to kill locusts and has been shown experimentally to kill malaria-carrying mosquitoes within four days, whereas non-infected mosquitoes survived nine days.

Entomophthora sp.

The Class Arachnida of Arthropda includes spiders and harvestmen, which also fall victim to pathogenic fungi. Although the cuticle of spiders is essentially similar to that of insects, that of the opisthosoma (abdomen) is softer. It is this part which usually becomes mummified first and from which most of the spore-bearing mycelium emerges. Whilst harvestmen are parasitised by *Entomophthora phalangicida*, species of *Entomophthora* which parasitise a very wide range of insects do not seem to attack the true spiders.

Another Class of Arthropoda, Crustacea, includes crayfish. A fungus disease, 'Crayfish Plague', has led to a serious decline in the population of native British White-clawed Crayfish, *Austropotamobius pallipes* in many streams and rivers, especially in southern Britain. The disease is fatal to native crayfish and is caused by an Oomycete fungus, *Aphanomyces astaci*, carried in the exoskeleton of another species, the American Signal crayfish *Pacifastacus leniusculus,* which itself is immune. Oomycetes resemble filamentous fungi in their vegetative growth form (hyphae), but can form motile zoospores which disperse in water to spread the disease. The Signal Crayfish was introduced by commercial interests to be bred for food, because it is relatively fast growing and highly fecund. As with other non-native introductions (such as mink and grey squirrel), its escape (or deliberate release) into the environment from captive breeding has resulted in a serious decline in populations of the native species. Its import into Britain is now banned, as also its release and, legally, it may be kept only under licence.

A strange group of Ascomycetes, the Laboulbeniales, are highly specialised ectoparasites of arthropods and grow mostly superficially on the bodies of insects without causing much apparent injury. Not only are most forms host-specific, but some infect only individuals of one sex. The specialisation may be even more extreme in that some are restricted to growing at a precise spot on the insect's body, such as a segment of its leg or abdomen: *Herpomyces stylopage* is instanced as occurring only on the thin-walled hairs on a cockroach's antennae and *Laboulbenia gyrinidarum* commonly occurs on the elytra of Whirligig beetles (Gyrinidae). Bizarrely, *Hesperomyces virescens* is reported as being sexually transmitted between ladybirds.

Beekeepers have to contend with several fungi likely to attack either the bees themselves or pollen stored in the combs. A disease known as 'Chalk Brood' attacks both larvae and pupae and is caused by the fungus *Ascosphaeria apis,* which usually occurs in damp conditions. The larvae ingest the spores which germinate internally. The resulting mycelium gives the appearance of fluffy white pieces of cotton-wool and converts the insect to a hard mummy. As the disease progresses, this becomes covered with minute, black fruiting bodies, containing sticky spores which are dispersed by bees, thus spreading infection elsewhere.

Another Ascomycete, *Bettsia alvei*, grows on the pollen stored in the comb cells, not only depriving the larvae of food, but also producing lethal toxins. Several moulds such as *Aspergillus* and *Rhizopus* are known to have similar affects. The bee diseases *Nosema apis* and *N. ceranae*, caused by Microsporidia, (primitive intracellular organisms now classified under Fungi) develop in the gut of bees and are spread in the droppings. Although not rapidly fatal they are said to halve the life expectancy of a bee and to check the expansion of the colony.
Conversely, some hive fungi, mostly yeasts such as *Candida* and *Saccharomyces* appear to be beneficial, by being ingested by the larvae and helping to digest food and enhance larval nutrition.
If one may digress slightly to creepy-crawlies which, strictly speaking, are not arthropods, there are a number of predaceous fungi which use lassoes or adhesive traps to capture and consume nematodes (eelworms). Nematodes are small worms only a few millimetres in length, which are abundant in moist soil, rotting vegetation and animal dung. They may often be seen under the microscope when examining the tissues of over-ripe fungi and appear as thin eel-like bodies constantly switching to-and-fro, unless killed by stains such as lacto-phenol. Most feed on bacteria, but some are parasites of plant-crops, or even animals and humans.

Nematode-trapping fungi ensnare their prey by specialised devices. Amongst these are lasso-like loops which adhere irreversibly if a worm attempts to pass through or, in other fungi with even more advanced techniques, the loops are triggered to tighten rapidly if entered by a nematode. Other traps are formed from adhesive hyphae, hyphal nets, short branches, adhesive knobs, or adhesive conidia, depending on the fungus. The interesting fact is that adhesion does not depend on general stickiness, because the hyphae do not adhere to surrounding material. There is something in the chemistry of both eel-worm cuticle and hyphal wall which ensures rapid bonding on contact. Soon after capture the fungus penetrates rapidly by means of a narrow peg in conjunction with lysing enzymes, forming an infection bulb inside the host. From this hyphae grow out, to fill the body and consume its contents. After a day or so the hyphae grow out of the dead worm to produce more traps or spores.

Although most nematode-trappers are microfungi, two of the larger wood-destroying fungi with familiar names, the Oyster fungus, *Pleurotus ostreatus* and *Hohenbuehelia* (as its anamorph *Nematoctonus pachysporus*), have been discovered to trap nematodes, it is thought as a source of nitrogen due to the low nitrogen content of wood.

In the next issue, the concluding part of this will describe less baleful ways in which fungi exploit insects, quasi-parasitically. Also, reversing the roles, how insects parasitise, or exploit fungi, or form symbiotic associations and how some incidental effects arise from these insect/arthropod interactions.

Ted Blackwell

Text reference:
1 *Field Mycology* 8(4) Oct. 2007 pp115-6.

More detailed treatment can be found in the following:
Fungal Biology. Hudson, H.J. 1986. Edward Arnold.
Fungi, Spooner & Roberts. RBG Kew. 2005.
Introduction to Fungi. Webster, J. 1980. CUP.
Microbial Plant Pathology. Whitney, P.J. 1976. Hutchinson.
Modern Mycology. Deacon, J.W. 1997. Blackwell Science.