

Tree fungi, colonisation & decay



Volvariella bombycina



Mycelium



Kretzschmaria deusta decay



Cerioporus squamosus decay



Fomitopsis pinicola



Ceratocystis

Trees Management Officer - Hampstead Heath, North London Open Spaces

34 years looking at trees & fungi



Hampstead Heath

25,000 *urban* woodland trees with lots of fungi



Image by Matthew Maran

600+ species of fungi recorded at HH – Andy Overall

Three decades of watching the same wood volumes become colonised and go through fungal succession



1987



2017

Hampstead Heath trees, then & now.

1830



John Constable



1910



Likely to have been a significant increase in tree fungi species over the last 200 years due to the increase in trees

Fungi associating within trees



Nomenclature.....WHY !!!!!

Change in Taxonomic hierarchy as methods have improved which have provided taxo-mycologists with more information on species' evolutionary relationships

Old Names

Current Names

Collybia fusipes

Gymnopus fusipes

Inonotus radiata

Xanthoporia radiata

Oudemansiella mucida

Mucidula mucida

Piptoporus betulinus

Fomitopsis betulina

Piptoporus quercinus

Buglossoporus quercinus

Polyporus squamosus

Cerioporus squamosus

Ustulina deusta

Kretschmaria deusta

<http://www.speciesfungorum.org/>

Fungi are mostly made up of micro filaments of mycelium



Perennial brackets

Perennial fruit bodies persist over many years.

Each consecutive incremental layer is formed below the previous one.

This is where the pore layer is developed for the spore to drop out from.



Fomes fomentarius



Fomitopsis pinicola

Annual brackets



These blobs are the beginnings of this years fruiting of *Inonotus hispidus* on ash, next to the remains of last years fruiting scars.

Annual fruitbody development - *Laetiporus sulphureus* (chicken of the woods) on oak, taken over 30 days May/June



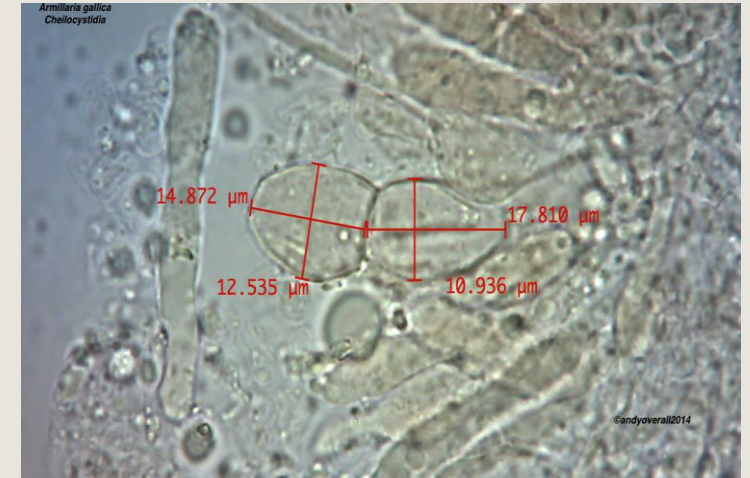
Identification - Microscopy



Field mycologist – Andy Overall



Ganoderma spore



Armillaria Cheilocystidia



Padua university Professori Montechio



Ceratocystis perithecia



Ceratocystis globose chlamydospores

Slice it open – see how it grows



Regularly receive emails from people asking for help in identification without having taken a wedge of flesh

Flesh & tube layer to aid identification



Ganoderma resinaceum



Rigidoporus ulmarius

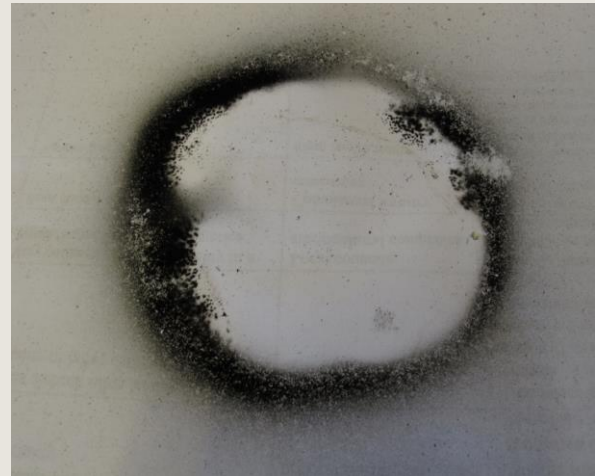


Fistulina hepatica



Ganoderma australe

Spore colour to aid identification



Fruit body pore layer



Phaeolus schweinitzii



Phellinus ignarius



Daedalea quercina



Fistulina hepatica

Fruit body Gills



Freely attached – *Amanita muscaria*



Decurrent – *Pleurotus dryinus*

Fruit body Gills



Species diversity within a Genus

Amanita



A. muscaria



A. fulva



A. pantherina



A. citrina



A. muscaria var



A. strobiliformis



A. phalloides



A. rubescens

Species diversity within a Genus

Ganoderma



G. applanatum



G. pfeifferi



G. australe



G. lucidum



G. resinaceum



G. carnosum

Species diversity within Genus

Coprinus



C. comatus



C. picaceus



C. atramentarius



C. disseminatus



C. logopus.



C. picaceus

Species diversity within a Genus

Hericium



H. erinaceus



H. cirrhatum



H. coralloides

Species diversity within Group

Puffbals



Three main types of tree associated fungi

Parasites

Fungi that attack weakened trees sustaining themselves via the breakdown of their host.

Saprophytes

Recycling fungi that break down the dysfunctional woody & leafy matter, helping to release nutrients back into soils.

Mycorrhiza

Fungi that create a symbiotic relationship via root contact, helping trees with water & nutrient uptake whilst getting carbohydrates in return.

Parasitic fungi



Armillaria mellea



Pholiota squarrosa



Fomitiporia punctata



Gymnopus (Collybia) fusipes

Saprophytes – decaying dead/dysfunctional wood volume



Armillaria tabescens



Flammulina velutipes



Geastrum spp



Cyathus striatus

Mycorrhizal fungi – symbiotic with tree roots



Ecto-mycorrhizal communities



Rare & threatened species of fungi



Red data book species such as *Podoscypha mulizonata*, *Piptoporus quercinus* & *Hericium errinaceus* each have biodiversity action plans assigned to highlight their vulnerability, with priority given to their conservation status.

Hunting down the rare Fung !



Record Details

Date: 11/7/2018

Collector: D. Humphries

Identifier: D. Humphries

Locality: Old Broom Nature Reserve

County: West Suffolk (VC:26)

Country: England

Associated Organism: Quercus sp.

Ecosystem: Nature Reserve

Grid Reference: TL80176745

Latitude/longitude: 52.275671 0.63943782

Notes: Approximately 100 lapsed oak pollards.

Origin of record: D. Humphries

LAFF record no.: 4650

Malformed unusual morphology



Anamorphic *Fistulina*



Geotropic *Ganoderma*



Double headed *Armillaria*

Fungal Strategy

Different types of colonisation strategies

Fungal Induced Dysfunction – eg *Armillaria* sp (honey fungus)

Pathogen that will attack a tree via rhizomorphs moving through the soil seeking biologically or structurally weak hosts. Mycelium will then fan out under the bark within the vascular system, shutting the tree down.



Black bootlace-like rhizomorphs
covered in melanine



Mycelium



Fruit body &
rhizomorph in soil

Sapwood Exposed

eg; *Fistulina hepatica* (beefsteak), *Polyporus squamosus* (dryads saddle)

Fungal species that invade the host tree via spore on exposed wood. (eg; lightning strikes, collision, old pruning wounds)



Sapwood Intact

eg; *Piptoporus betulinus* (birch polypore) *Heterobasidion annosum* (root rot)

Fungal species that are latent inside the host awaiting structural or biological weakness. (storm branch breakage or root plate rock)



Cut& breathe



Endophytic fungi can fruit quickly once a wood volume is opened to air

Wood decay & biomechanical adaptation



White decayed wood adapts its form by creating bulges in the trunk or buttresses
Brown decayed wood seldom or at all shows this type of adaptation to decay

Load failure from wind, decay and/or poor biomechanics



Wood decay, wind load & poor root growing environment can lead to tree failure



Trees live for centuries with fungal colonisations



Hatfield Park Ancient Oak with *Fistulina hepatica*

Tree decay & the basic types

White rot – degrades lignin

Eg; Ganoderma, Armillaria,

Simultaneous white rot - degrades cellulose & lignin

Selective delignification – degrades areas of lignin

Soft rot – degrading cellulose, later may degrade lignin

Eg; Kretzschmaria

Brown rot – degrades cellulose

Eg; Laetiporus

White rot = soft spongy collapse
fracture

White rot (degrades lignin)



Polyporus squamosus degrading Horse chestnut

Brown rot = brittle ceramic

Brown rot (degrades cellulose)



Laetiporus sulphureus degrading Oak

White rot



Brown rot – *Laetiporus sulphureus*, chicken of the woods



Soft rot – degrading
cellulose,

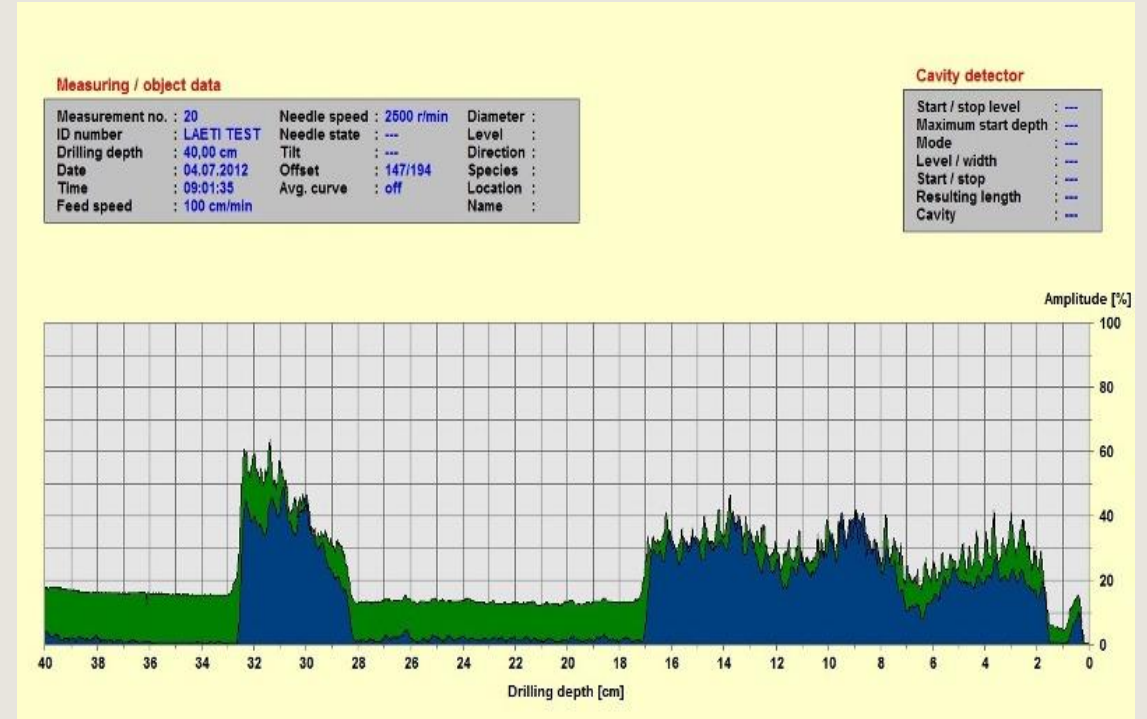


Kretzschmaria deusta colonising lime

Soft rot decay - Massaria disease of plane - *Splanchnonema platani*



Microdrill testing wood volume for resistance



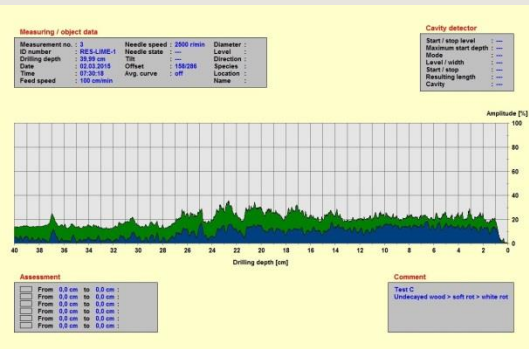
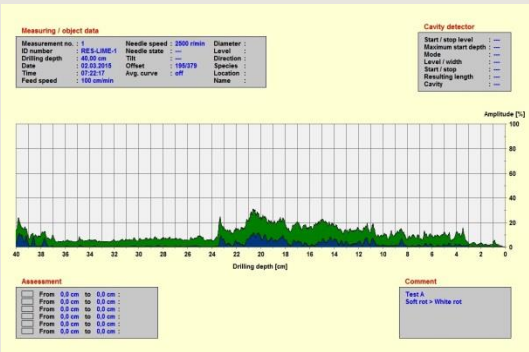
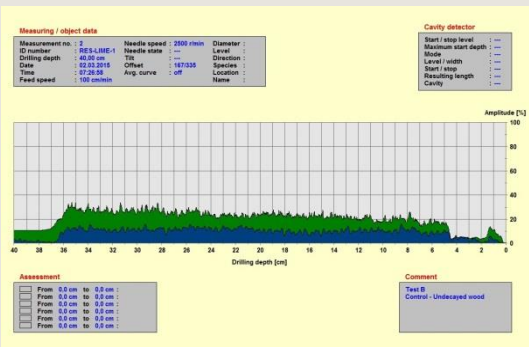
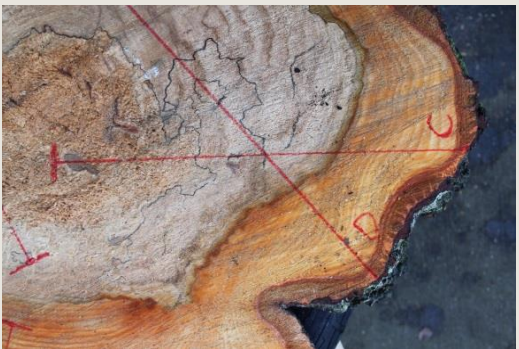
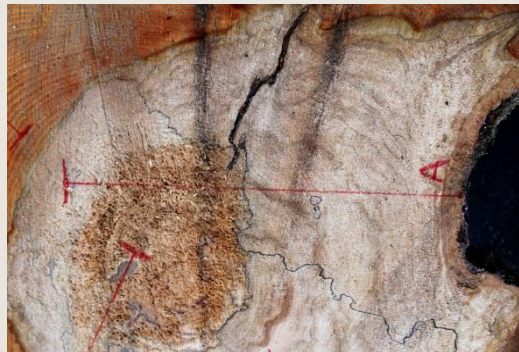
Brown rot decay – *Laetiporus sulphureus* aka chicken of the woods

Assessing decay & dysfunction

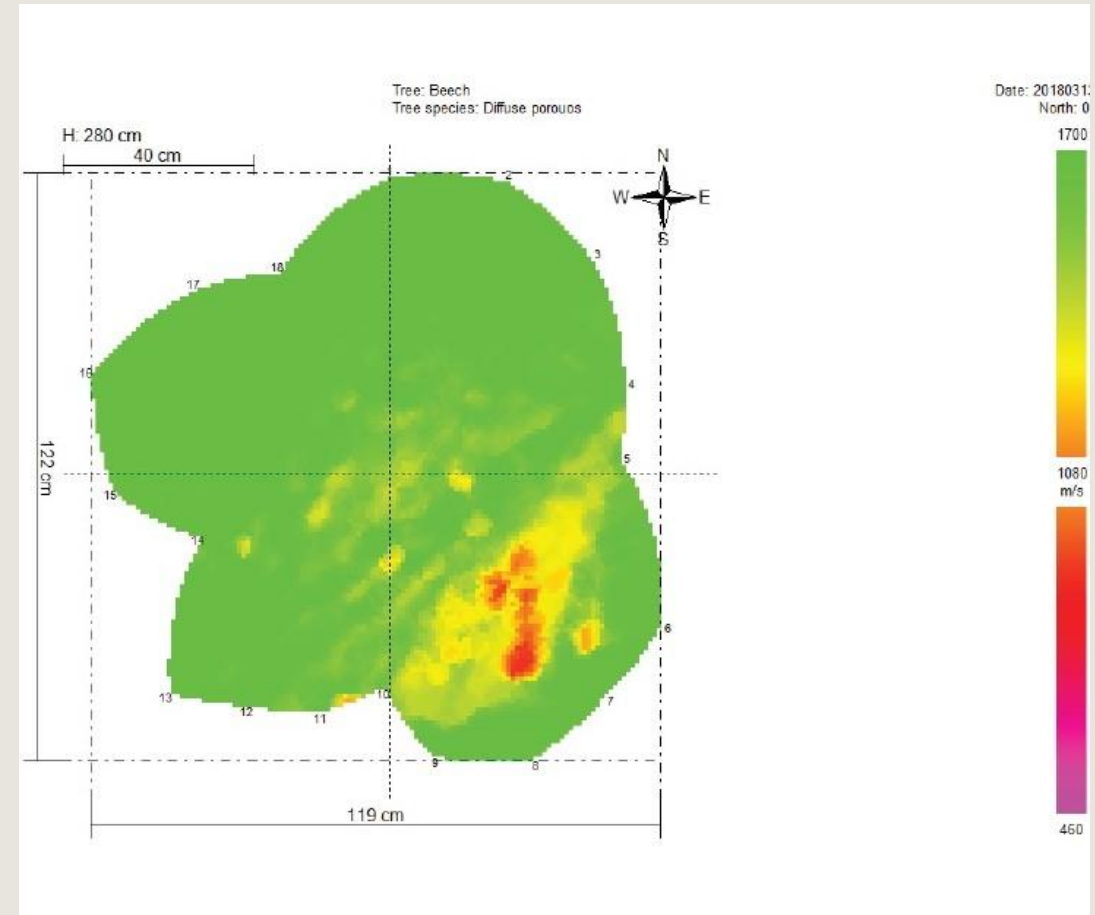


Various equipment available like micro-drills & tomography which can be used to determine the extent of decay in standing live & dead trees.

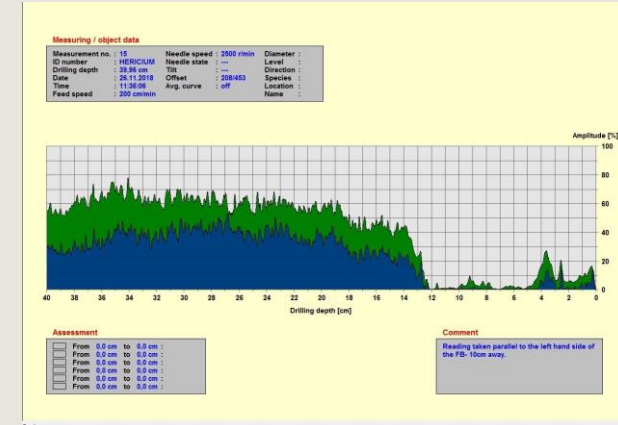
Kretzschmaria deusta, brittle cinder fungus – soft rot/facilitative rot, leading to intense white rot



Sonic tomography



Tracking decay over time



Involved in a small decay study at work with Cardiff University looking at oak heartwood colonies. A small separate part of the study has been looking at the spread of *Hericium erinaceus* within a fallen beech wood volume. I inoculated the beech in 2010 via mycelial plugs, One of the control areas fruit for the first time this year. Resistance readings from around the fruitbody are quite interesting showing very localised decay spread over that 8 year span.

Pseudosclerotial plates - Spalting



Walled off territories of individual and multiple fungal colonies





Fungi staining wood volume

The green elf cup – *Chlorociboria aeruginascens*



Dual species colonisation within same tree



Duel colonisation within the same tree

White rot of *Fomes fomentarius*

Degrades lignin
leaving the remaining wood spongy



Brown rot of *Piptoporus betulinus*

Degrades cellulose
leaving the remaining wood brittle

Trunk & Root decay (Fistulina hepatica & Collybia fuisipes)



Inonotus hispidus, shaggy bracket



Trunk & branch failure via simultaneous white rot

Meripilus giganteus, the giant polypore – root decay



White sponge like rot of the underside of lateral guy roots, can lead to complete root plate failure.

Some trees have been known to co-exist with this species for many years.

Meripilus giganteus – the giant polypore



Fistulina hepatica, beefsteak fungus



Trunk & branch failure via brown rot



Insects and Fungi



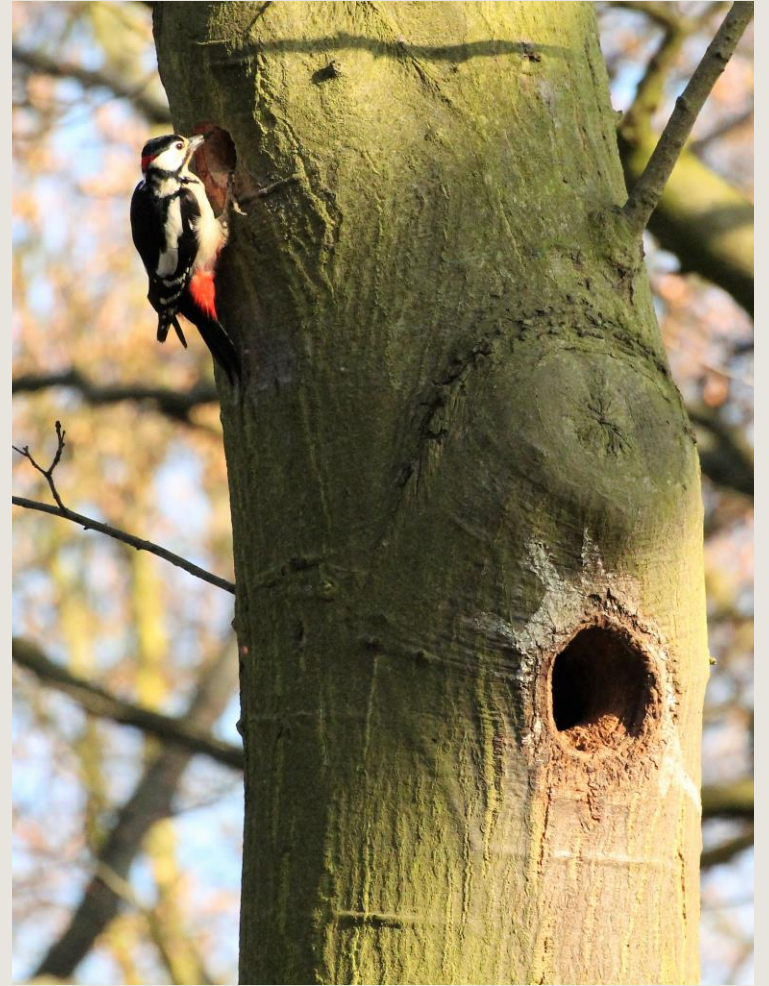
Decay & dysfunction provides habitat



Examples include...

- Bats (Noctules & Pipistrelles)
- Stag beetles
- Cardinal beetles
- Bees
- Fungi
- Lichen





Standing dead & decayed wood for habitat



About 80 created and maintained habitat sticks (Monoliths, Habiliths) at Hampstead Heath
Some allowed to fall apart naturally, some reduced cyclically to keep them standing longer.

Managing decayed trees for habitat

Balancing the needs of wildlife habitat within an urban well used site is a delicate balancing act where species choice for monoliths is critical.



Veteran tree management



The Hollow Beech
(storm damaged in '87)

Ganoderma spp, *Kretzschmaria
deusta* & *Mucidula mucida*
colonisations

Cyclical phased reduction

2009



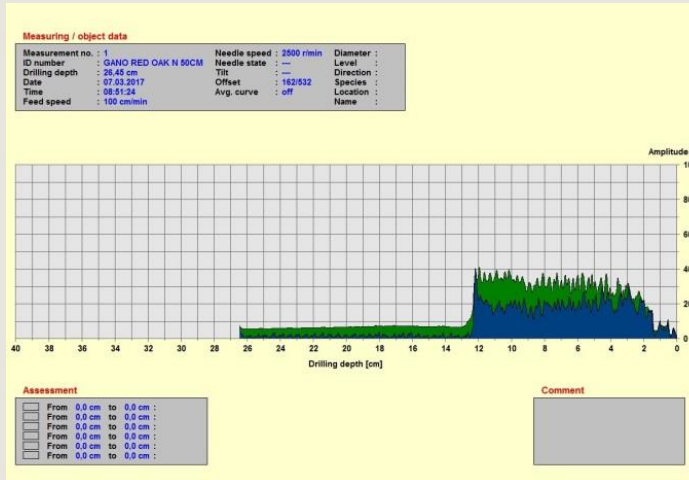
2014



Reduction of canopy to manage decayed trees



White rot decay
Ganoderma resinaceum
colonising red oak



Drop of amplitude shows where
the heart of the tree is decayed,
but the buttresses are sound.



Decay – a survival mechanism via biomechanical adaptation or a fast track to failure ?



Probably a bit of both

Lets keep that soil
& those roots healthy



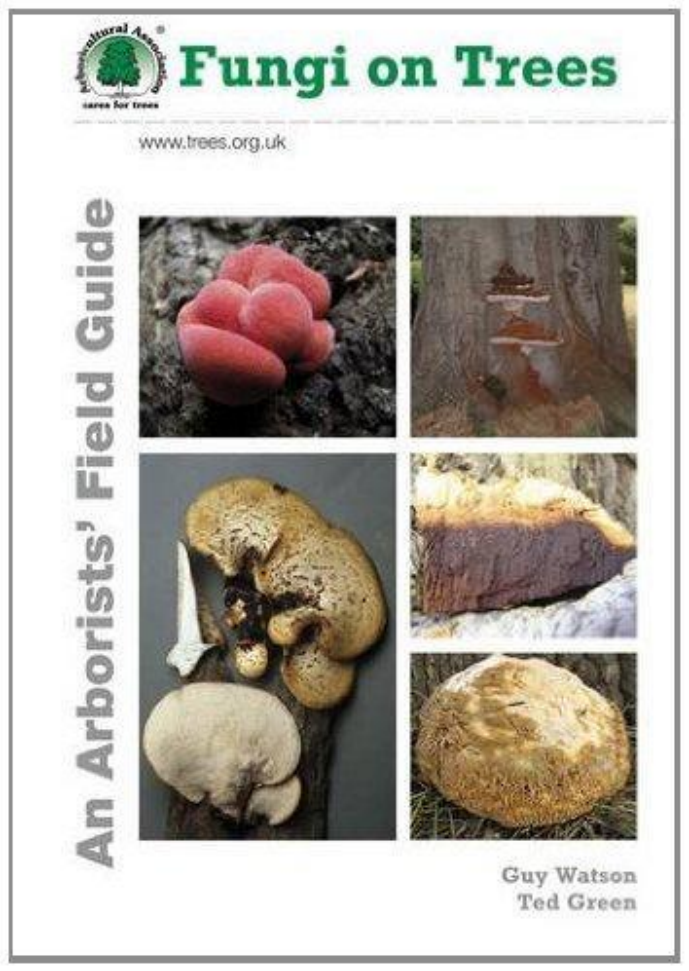
Comrade in mycological adventure – Murphy the fung mutt




A Guide to Fungi on Trees in Arboriculture

A New Arboricultural Association publication on the way 2019/20

Updating of the 2011 Fungi on Trees, An Arborists Field Guide
From 27 species to 100
From 182 images to 950



<i>Daldinia concentrica</i> (Bolton) Ces. & Not	Ascomycota	Xylariaceae	Perennial	White rot
Common name(s): King Alfred's cake; Cramp balls				



Often found on: Ash

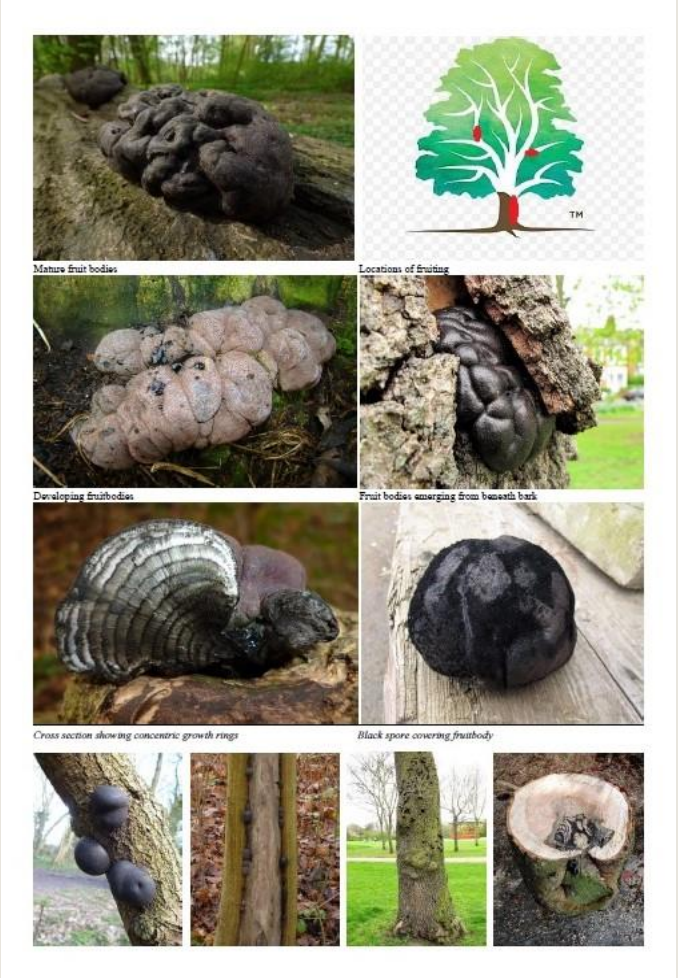
Sometimes found on: Beech, cherry, horse chestnut, sycamore

Location: Lower to upper stem, first & second order branches & also stumps and fallen branches

Description: Black, hard, perennial, charcoal like, ball shaped fruitbody. Usually found in groups. Cross section shows concentric internal growth rings with minute ascus (spore sac) just below the surface. Black spore.

Similar species: *Kretzschmaria deusta*, *Xylaria polymorpha*, *Bulgaria inquinans*.

Significance: White rotted wood usually found in vicinity of fruitbodies, considered to be weakly parasitic, continues to act saprophytically breaking down dysfunctional and dead wood volumes.



Fungi, just a load of old BOLLARDS !

