

# Fungi of the Knepp Castle Estate



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**January 2021**

All photographs inside this report were taken at Knepp by Richard Bullock.

## Background

The Estate itself, some 3500 acres in extent, has been in existence for centuries, and farmed since the early 18<sup>th</sup> Century. Intensive agriculture, with grubbing out of scrub and regular liberal application of modern chemical fertilizers, for soil 'improvement', pesticides and fungicides to enhance yields being practiced since the 1960s. A programme of re-wilding was introduced in 2002, aiming for a gradual return of the land as closely as feasible to the natural conditions which prevailed before the drastic modifications due to human intervention, and resulted in ecological impoverishment and loss of biodiversity. This process has been well documented, with ongoing studies of the wildlife and environment, and, even within 20 years, has seen successful in achieving an encouraging and marked upturn in biodiversity.

Fungi, as always, are key components in all of the various habitats present; they are enormously diverse and numerous, and fulfil essential roles in maintaining healthy and thriving ecosystems. Study of the fungi at Knepp was initiated as recently as 2016 and is in its early stages. It has been largely carried out and coordinated by the West Weald Fungus Recording Group (WWFRG).

## Recording history

There appear to be no early or historical records of fungi from Knepp. We are not aware of any fungus recording having taken place before 1999, when Ted Green and others found the rare oak-associates Robust Bracket (*Phellinus robustus*) and Oak polypore (*Piptoporus quercinus*), together with *Ganoderma resinaceum*, on an ancient oak, as well as another rarity, the root-associated *Podoscypha multizonata*. These records, together with the mycorrhizal bolete *Suillellus mendax*, newly described in 2013 and recorded by Ted Green some years later, are given in Tree (2018), which includes what seems to be the only published discussion of fungi at Knepp.



*West Weald Fungus Recording Group and Sussex Fungus Group, joint recording session, October 2019*

In October 2006, Peter Marren found a fine display of unimproved grassland indicator fungi on the Castle lawn, including seven waxcaps (*Hygrocybe* spp) and two club fungi. Only a handful of other

records exist before May 2014. On 26<sup>th</sup> October 2016, the WWFRG made its first visit to Knepp. Martin Allison, the Sussex County Recorder of macrofungi, was unable to make this date but made a solo visit two days earlier and passed his list to WWFRG.



*Hygrocybe calyptriformis*, a CHEGD grassland species found on the castle lawn

All of these first records were from the Repton park, in the 'Middle Block', to which WWFRG returned in October 2017 and June 2018, and again on a joint foray with Sussex Fungus Group in November 2019. A further (covid-limited) visit by members of WWFRG was made in October 2020. The group's first recording session on the Southern Block was in November 2018. We also joined a party from the British Plant Gall Society there in August 2019, and two members made a brief visit in October 2020. Additional species of fungi were recorded at every visit, the total recorded currently standing at 398 species. It should be noted that recording so far has been focused on larger basidiomycetes, and that records of other groups are comparatively few and are entirely lacking for some.

### **Results/Conclusions**

Considering the size of the Knepp Estate, the area covered on these trips was small, and the Northern Block is yet to be viewed. Nevertheless, some interesting records have been obtained and enough has been done to draw some conclusions about the fungal possibilities of the site. Where the fields of Knepp are assumed to have been, until fairly recently, improved grassland or arable, the prospect of good fungal diversity remains limited at present, but is improving. In contrast, the areas of woodland have probably been species-rich for many years. Where dairy cattle roamed there would always have been specialist dung-fungi present and those associated with dung-enriched soil, though their diversity would have been significantly impoverished due to the chemical feed. This is now no longer an influence and the recently introduced wild cattle and other herbivores on site, now feeding chemical-free, would be expected to support increasing numbers of such specialist

fungi. The ongoing study of these should be carried out if possible. 17 dung-associated fungi have so far been recorded here.

The Castle lawn gives a good indication of what might be expected when the grassland becomes chemical-free and short-grazed allowing CHEGD\* indicator species of unimproved grassland gradually to colonize or to resume fruiting and become widespread. Addition of nitrates spells disaster for waxcaps and many other grassland fungi, which almost immediately disappear. Even the commonest and least sensitive of these fungi will take at least ten years to recolonize previously 'improved' fields, and many will need well over 30 years. A good local example of this comes from Heathfield in Sussex where Peter Russell's study of St. Dunstan's Farm\*\* lists 30 CHEGD species, and some of the more interesting fields were under the plough 40 years earlier. Knepp now has 21 such species recorded and it will be interesting to see how this figure may increase over the coming years. Most of these fungi seem at present to be confined to the Castle lawn, a fine site which should receive further study, but the diversity of fungi present or fruiting at other grassland sites will gradually increase. More common and general grassland toadstools, such as field mushroom (*Agaricus campestris*) and parasol (*Macrolepiota procera*), were noted in 2017 where not previously seen. The grazing by different mammals at Knepp should produce varied lengths of sward that could be advantageous to different fungi.



*Panaeolus papilionaceus*, a common fungus of dung-enriched grassland

Short grass above the roots of trees that are hosting ectomycorrhizal fungi allows those species the chance to fruit successfully. This must be particularly true here of those fungi associated with the many old oaks in the hedgerows and in the parkland. Advancing scrub may remove this advantage in places, although any eventual open scrub woodland could be very good for fungi. Another area of interest concerns the anthills which have established since rewilding began and have been noted as

colonized already by various fungi, including lichens, though these have not been specifically identified.



*Mycena seynesii*, a rare species found here on cones of *Pinus radiata*

The fungi noted above, other than *S. mendax*, were recorded before the rewilding project began and, being then linked to trees suffering from pressures and damage inflicted by grazing and the intense agricultural regime, emphasizes the importance of ancient oaks with which so many fungi as well as other organisms are associated. These ancient trees require further study; they are mostly now much improved in condition and will support an increasing diversity of species, including lichenized fungi.

On other trees, several associated species of fungi have been already recorded, including some uncommon ones and one new British record, mostly living on dead wood but some with a degree of

parasitism. The importance of dead wood, of various sizes, cannot be over-emphasized, whether as attached twigs and branches on the trees and shrubs themselves or left to rot on the ground below; the same applies also to dead leaves and stems of all kinds. It is one of the major functions of fungi to break dead vegetation down, and there is already a great variety of species to be found at Knepp performing this function.

There is some threat to the survival of fungi where grazing animals gather in large numbers to shelter or feed, disturbing and trampling the ground. Compaction can damage fungal mycelium, including that of mycorrhizal species, hence potentially affecting tree condition. Aeration of the soil at such sites would be beneficial. Some larger fungi will, of course, be consumed by animals (including small mammals) as part of their diet, and fungal fruitbodies are also important as breeding sites or as food sources for many invertebrates so that these will benefit from any increase in fungal activity.

In addition to the larger fungi, which have been the focus of most recording to date, attention should be given to the vast numbers of microfungi that must exist on the Estate; these are currently (and may long remain) under-recorded for want of specialist recorders. Lichens, likewise, require the attention of specialists, although there are some records of them from 2009 and 2019.

Myxomycetes (slime moulds) are fungus-like and have historically been recorded by mycologists although they are now known to be of a different Kingdom (Protozoa). Just 2 species have yet been recorded, but many more will occur.

As things stand on 1<sup>st</sup> January 2021 the overall list of fungi on the Knepp Estate is of 398 species including lichens and myxomycetes. Those occurring include, very roughly:

Mycorrhizal with trees	43
In grass	40
On dead wood	145
On dead herbaceous matter or soil	60
On dung	17
Pathogens:	
Powdery mildews (Erysiphales)	9
Leaf spots	8
Rusts	15
Microfungi (all groups)	75

**ACTUAL TOTALS:**

Ascomycetes (excluding lichens)	93
Basidiomycetes	276
Lichens	26
Mucorales	1
Myxomycetes	2

It will be interesting to see if and how these ratios change in coming years, although this might depend on who is recording. As noted, all groups of fungi remain so far much under-recorded, especially amongst the so-called microfungi.

Some of the more notable species recorded so far are:

- *Candelabrum microsporum* One of the aero-aquatic hyphomycetes, widespread and probably common but infrequently recorded.
- *Exidia recisa* on *Salix* twigs and branches; a jelly fungus, uncommon in the south-east.
- *Hebeloma radicosum* An uncommon 'poison-pie' toadstool thought to be associated with mole latrines.
- *Hygrocybe calyptriformis* Perhaps the least common of the 14 waxcaps recorded so far.
- *Hymenogaster niveus* A truffle, mycorrhizal with various trees, on *Salix* at Knepp; seldom recorded.
- *Keissleriella holmiorum* 1st British record, on *Salix* branches.
- *Mycena seynesii* A rare 'bonnet' toadstool on fallen cones of *Pinus radiata*. Few previous UK records.
- *Phellinus populicola* A large bracket fungus on aspen, only recently recognized as a separate species.
- *Phellinus robustus* A large but rare bracket fungus on old oak trunks.
- *Podoscypha multizonata* A mildly parasitic bracket fungus at the base of old oaks (rarely other hosts).
- *Podosordaria pedunculata* on dung of cattle.
- *Russula veternosa* an uncommon 'brittle-gill' toadstool associated with *Fagus*.



*Phellinus robustus*, a rare bracket fungus on old oak trees

#### Further discussion

Some consideration might be given now to how we proceed with recording in the coming years. The total species actually present at Knepp will number in the thousands and, effectively, will never be

fully known. Recording can hence be ongoing into the foreseeable future. The various available habitats and microhabitats as well as the different host plants should all be investigated.

The lack of early records makes it difficult at this stage to reach conclusions as to the effects of rewilding in the 19 years since it was introduced, or to link the presence of rarities to this new management regime. For example, the microfungus *Keissleriella holmiorum*, known from Norway and parts of N. Europe, an interesting discovery at Knepp and the first British record, on *Salix* branches, is likely to have been present earlier and overlooked. However, the diversity of grassland fungi in the meadows (or at least their fruiting potential), as noted, has clearly increased and can be attributed to cessation of fertilizer application and grazing.

Overall, the rewilding project is potentially enormously beneficial to an increase in species diversity, including fungi, and at Knepp has been shown to be so for birds and some other wildlife groups.

\*CHEGD: grassland species of the Clavariaceae, *Hygrocybe*, Entolomataceae & Geoglossaceae families, and *Dermoloma*.

\*\* Russell, Peter, (undated) 'The History of St. Dunstan's Farm and its grassland fungi' (unpublished?)

### **Other References**

Tree, I. (2018). Wilding. *The return of nature to a British farm*. Picador.

**APPENDIX 1. CLASSIFIED LIST OF FUNGI RECORDED FROM KNEPP CASTLE ESTATE  
(Jan. 2021)**

**Basidiomycetes**

**AGARICALES**

Agaricus campestris  
Agaricus comtulus  
Agaricus impudicus  
Agaricus silvicola  
Agrocybe arvalis  
Agrocybe pediades  
Amanita ceceliae  
Amanita excelsa var. spissa  
Amanita phalloides  
Amanita rubescens  
Armillaria gallica  
Armillaria ostoyae  
Arrhenia retiruga  
Bolbitius titubans  
Calocybe gambosa  
Chlorophyllum rhacodes  
Clitocybe amarescens  
Clitocybe fragrans  
Clitocybe geotropa  
Clitocybe metachroa  
Clitocybe nebularis  
Clitocybe odora  
Clitocybe phaeophthalma  
Conocybe apala  
Conocybe semiglobata  
Coprinellus disseminatus  
Coprinellus domesticus  
Coprinellus micaceus  
Coprinopsis atramentaria  
Coprinopsis lagopus  
Coprinopsis nivea  
Coprinopsis picacea  
Coprinopsis pseudonivea  
Coprinopsis stercorea  
Cortinarius elatior  
Cortinarius trivialis  
Crepidotus applanatus  
Crepidotus cesatii  
Crepidotus mollis  
Crepidotus variabilis  
Entoloma juncinum  
Entoloma porphyrophaeum  
Entoloma sericeum  
Flammulina velutipes  
Galerina marginata  
Gymnopilus junonius  
Gymnopilus penetrans  
Gymnopus dryophilus  
Gymnopus fusipes  
Gymnopus obscuroides  
Gymnopus ocior  
Gymnopus peronatus  
Hebeloma radicosum  
Hygrocybe calyptriformis  
Hygrocybe cantharellus  
Hygrocybe chlorophana  
Hygrocybe coccinea  
Hygrocybe conica  
Hygrocybe glutinipes  
Hygrocybe insipida  
Hygrocybe intermedia  
Hygrocybe irrigata  
Hygrocybe pratensis  
Hygrocybe psittacina  
Hygrocybe punicea  
Hygrocybe quieta  
Hygrocybe virginea  
Hygrophoropsis aurantiaca  
Hypholoma fasciculare  
Hypholoma lateritium  
Inocybe adaequata  
Inocybe fraudans  
Inocybe geophylla  
Inocybe lilacina  
Inocybe rimosa  
Inocybe sindonia  
Laccaria amethystina  
Laccaria laccata  
Laccaria proxima  
Lacrymaria lacrymabunda  
Lepista flaccida  
Lepista nuda  
Leratiomyces ceres  
Lyophyllum decastes  
Macrolepiota konradii  
Macrolepiota mastoidea  
Macrolepiota procera  
Marasmiellus ramealis  
Marasmiellus vaiillantii  
Marasmius rotula  
Marasmius setosus  
Melanoleuca poliroleuca  
Mycena adscendens  
Mycena aetites  
Mycena arcangeliana  
Mycena galericulata  
Mycena haematopus  
Mycena hiemalis  
Mycena inclinata  
Mycena leptcephala  
Mycena maculata  
Mycena olida  
Mycena pelianthina  
Mycena polygramma  
Mycena pseudocorticola  
Mycena pura  
Mycena rosea  
Mycena seynesii  
Mycena speirea  
Mycena stylobates

Mycena vtilis  
Panaeolina foenicicii  
Panaeolus fimicola  
Panaeolus olivaceus  
Panaeolus papilionaceus  
Panellus stipticus  
Parasola auricoma  
Parasola leiocephala  
Parasola misera  
Parasola plicatilis  
Pholiota alnicola  
Pholiota gummosa  
Plicatura crispa  
Pluteus cervinus  
Pluteus ephebeus  
Pluteus salicinus  
Pluteus thomsonii  
Psathyrella candolleana  
Psathyrella corrugis  
Psathyrella multipedata  
Psathyrella obtusata  
Psathyrella piluliformis  
Psathyrella pseudogracilis  
Pseudoclitocybe cyathiformis  
Psilocybe semilanceata  
Rhodocollybia butyracea  
Rhodotus palmatus  
Stropharia aeruginosa  
Stropharia inuncta  
Stropharia semiglobata  
Tricholoma cingulatum  
Tricholoma saponaceum  
Tricholoma sulphureum  
Tubaria furfuracea  
Volvariella gloiocephala  
Xerula radicata

#### **BOLETALES (boletes & allies)**

Caloboletus radicans  
Hortiboletus engelii  
Hortiboletus rubellus  
Leccinum duriusculum  
Neoboletus praestigiator  
Paxillus involutus  
Suillellus mendax  
Suillus bovinus  
Xerocomellus cisalpinus  
Xerocomellus porosporus  
Xerocomellus pruinatus  
Xerocomus subtomentosus

#### **RUSSULALES (milk caps & brittle gills)**

Lactarius blennius  
Lactarius controversus  
Lactarius deliciosus  
Lactarius quietus  
Lactarius serifluus  
Lactarius subdulcis

Russula amoenolens  
Russula atropurpurea  
Russula densifolia  
Russula fragilis  
Russula graveolens  
Russula insignis  
Russula nigricans  
Russula pseudointegra  
Russula risigallina  
Russula vesca  
Russula veteriosa

#### **OTHER BASIDIOMYCETES**

Auricularia auricula-judae  
Auricularia mesenterica  
Bjerkandera adusta  
Botryobasidium conspersum  
Botryobasidium subcoronatum  
Byssomerulius corium  
Calocera cornea  
Calocera viscosa  
Calvatia gigantea  
Chondrostereum purpureum  
Clavaria fragilis  
Clavulina coralloides  
Clavulina rugosa  
Clavulinopsis corniculata  
Clavulinopsis fusiformis  
Clavulinopsis helvola  
Cylindrobasidium laeve  
Dacrymyces stillatus  
Daedaleopsis confragosa  
Dendrothele acerina  
Eichleriella deglubens  
Exidia glandulosa  
Exidia nucleata  
Exidia plana  
Exidia recisa  
Fistulina hepatica  
Fuscoporia ferrea  
Ganoderma applanatum  
Ganoderma australe  
Ganoderma lucidum  
Ganoderma resinaceum  
Gloeoporus dichrous  
Hapalopilus nidulans  
Hymenochaete cinnamomea (cf)  
Hymenogaster niveus  
Hymenoscyphus herbarum  
Hyphodontia sambuci  
Inonotus dryadeus  
Inonotus hispidus  
Junghuhnia nitida  
Laetiporus sulphureus  
Lenzites betulina  
Lycoperdon perlatum  
Lycoperdon pyriforme  
Macrotyphula juncea

Mensularia radiata  
Meripilus giganteus  
Neolentinus sp. (2012; K)  
Peniophora incarnata  
Peniophora limitata  
Peniophora lycii  
Peniophora quercina  
Phaeolus schweinitzii  
Phallus impudicus  
Phellinus pomaceus  
Phellinus populicola  
Phellinus robustus  
Phylloporia ribis  
Phlebia radiata  
Phlebia rufa  
Phlebia tremellosa  
Pleurotus ostreatus  
Podoscypha multizonata  
Polyporus brumalis  
Polyporus durus  
Polyporus tuberaster  
Postia caesia  
Postia subcaesia  
Schizopora paradoxa  
Scleroderma areolatum  
Scleroderma citrinum  
Scleroderma verrucosum  
Steccherinum ochraceum  
Stereum gausapatum  
Stereum hirsutum  
Stereum rameale  
Stereum rugosum  
Stereum subtomentosum  
Trametes gibbosa  
Trametes pubescens  
Trametes versicolor  
Tremella foliacea  
Tremella mesenterica  
Trichaptum abietinum  
Typhula setipes

#### **UREDINALES (RUST FUNGI)**

Melampsora epitea  
Melampsora larici-populina  
Melampsora populnea  
Phragmidium bulbosum  
Phragmidium violaceum  
Puccinia calcitrapae  
Puccinia galli-verni  
Puccinia glechomatis  
Puccinia lapsanae  
Puccinia menthae  
Puccinia phragmitis  
Puccinia polygoni-amphibii  
Tranzschelia discolor  
Uromyces dactylidis  
Uromyces rumicis

#### **ASCOMYCETES**

##### **'Discomycetes'**

##### **Operculates**

##### **PEZIZALES**

Ascobolus immersus  
Chelymenia granulata  
Humaria hemispherica  
Iodophanus carneus  
Peziza sp 1  
Peziza sp 2  
Saccobolus versicolor

##### **Inoperculates**

##### **HELOTIALES & others**

Ascocoryne albida  
Ascocoryne sarcoides  
Ascodichaena rugosa  
Bisporella sulfurina  
Botrytis cinerea  
Bulgaria inquinans  
Chlorociboria aeruginascens  
Dasyscyphella nivea  
Hyaloscypha aureliella  
Hyaloscyphus daedaleae  
Lachnum brevipilosum  
Mollisia cinerea  
Mollisia olivascens  
Monilinia fructigena (Monilia state)  
Neodasyscyphus cerina  
Orbilina comma  
Orbilina eucalypti  
Phacidium multivalve  
Rutstroemia firma  
Taphrina tosquinetii

##### **'PYRENOMYCETES'**

(= unitunicate taxa; including anamorphs)  
(various groups; Xylariales separated)

Candelabrum microsporium  
Cercospora depazeoides  
Chaetosphaerella phaeostroma  
Cladosporium uredinicola  
Colletotrichum liliacearum  
Coniothyrium conoideum  
Cytospora occulta (K)  
Dendryphion comosum  
Diatrype bullata  
Diatrype stigma  
Diatrypella quercina  
Diplodia sp. (K)  
Eudarlucia caricis  
Fusidium griseum  
Hainesia rubi  
Hapalocystis bicaudata  
Hypomyces chrysospermus

Hysterium pulicare (K)  
Nectria cinnabarina  
Periconia cookei  
Phyllosticta typhina  
Plagiostoma salicella  
Podosordaria pedunculata  
Podospora curvicolla  
Podospora decipiens  
Podospora myriospora  
Podospora pleiospora  
Podospora setosa  
Pyrenochaeta ilicis  
Ramularia centaureae  
Ramularia glechomatis  
Ramularia sphaeroides  
Ramularia urticae  
Rhopoglyphus filicinus  
Schizothecium conicum  
Septoria inconspicua  
Septoria urticae  
Stagonospora vexata  
Torula herbarum  
Venturia rumicis

#### **XYLARIALES**

Annulohypoxyton multiforme  
Daldinia concentrica  
Hypoxyton fuscum  
Hypoxyton howeanum  
Hypoxyton minutellum  
Hypoxyton petriniae  
Xylaria hypoxyton  
Xylaria polymorpha

#### **LOCULOASCOMYCETES**

(bitunicate taxa)

Botryosphaeria dothidea  
Gloniopsis praelonga  
Keissleriella holmiorum  
Leptosphaeria doliolum  
Microthyrium sp.  
Paraphaeosphaeria rusci  
Sporormiella minima

#### **ERYSIPHALES (Powdery mildews)**

Erysiphe adunca

Erysiphe alphitoides  
Erysiphe heraclei  
Erysiphe urticae  
Golovinomyces depressus  
Golovinomyces verbasci  
Neoerysiphe galeopsidis  
Podosphaera plantaginis  
Sawadaea bicornis

#### **LICHENISED SPP**

Amandinea punctata  
Arthonia radiata  
Caloplaca saxicola  
Candelaria concolor  
Candelariella vitellina  
Diploica canescens  
Evernia prunastri  
Fuscidea lightfootii  
Hypogymnia tubulosa  
Lecanora chlarotera  
Lecanora expallans  
Lecidella elaeochroma  
Opegrapha atra  
Opegrapha niveoatra  
Opegrapha varia  
Pertusaria albescens  
Pertusaria pertusa  
Physcia tenella  
Physconia grisea  
Punctelia ulophylla  
Ramalina farinacea  
Ramalina pollinaria  
Sarcopyrenia gibba  
Schismatomma decolorans  
Trapeliopsis flexuosa  
Xanthoria parietina

#### **MYXOMYCETES (slime moulds)**

Mucilago crustacea  
Physarum album

#### **MUCORALES**

Pilobolus crystallinus