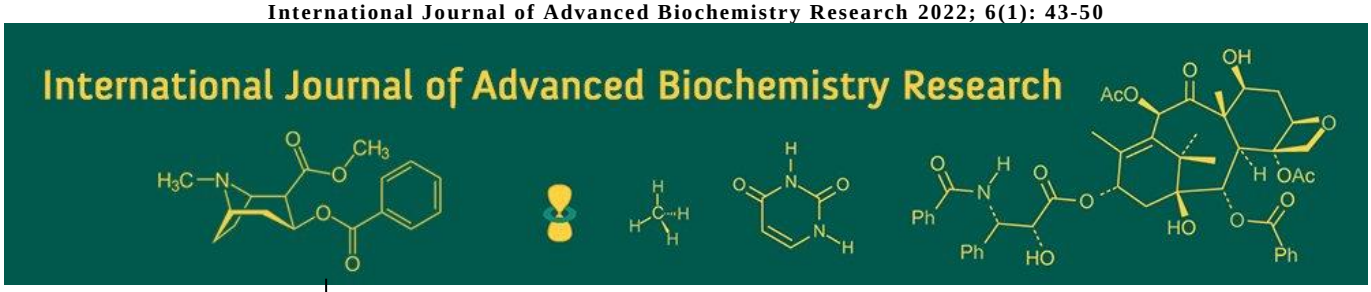

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The wild non-edible mushrooms, what should we know so far?

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Abstract
The world of mushrooms is rich in species of high interest due to their nutritional and pharmaceutical values. However, this world includes also non-edible species, which are not consumed due to being poisonous, of awful smell, or causing some serious gastrointestinal symptoms. Apart from being of no nutritional value, the study of their chemical composition revealed the presence of some biologically active compounds that can be used for medicinal and biological control purposes. Hence, we are focusing on this review on the morphology, and classification of some non-edible mushroom species, including *Rhodotus palmatus*, *Amethyst deceiver*, *Amanita muscaria*, *Macrolepiota procera*, *Scutellinia scutellata*, and the genera *Panus*, *Crepidotus*, *Mycena*, together with puffballs mushrooms. Also, we introduced examples of biological activities reported for some of these species, and compounds responsible for such activities.

Keywords: Non-edible mushroom, *Rhodotus palmatus*, *Amethyst deceiver*, *Clathrus* sp., *Scutellinia scutellata*, Puffballs, *Lepiota*, Hairy *Mycena, Amanita muscaria, Crepidotus, Panus fasciatus*

Introduction
Mushrooms are those macrofungi that are known for centuries for their nutritional and medicinal benefits. Thanks to the richness of mushrooms in bioactive compounds that belong to different chemical classes such as phenols, terpenes, proteins, fatty acids, flavonoids, polysaccharides, polyketides, alkaloids, steroids, and other compounds. Mushrooms are reported among the two fungal phyla, Ascomycota and Basidiomycota, and each group ate characterized by having edible members, as well as non-edible (poisonous) members. The majority of mushrooms are saprophytes, but some are insect parasites, which extend the environmental application of mushrooms as agents that clean environment and recycle essential elements among food chain [1-10]. Also, as clean and efficient biocontrol agents that help in getting rid of many harmful insects. On the other hand, many studies have described the activities of the fruiting bodies, crude extracts, and purified compounds originated from mushrooms [11-20]. These activities include antimicrobial, antiviral, anticancer, antioxidant, antitumor, anti-inflammatory, immunosuppressant, hypocholesterolemic, and hypoglycemic effects. Although over 14,000 species of these wonderful group of microbes were discovered and studied, new species are continuously discovered all over the world. It should be noted that different species under the same genus may show different biological potentials [21-25]. This can be attributed to the change in environmental and growing conditions which is critically affecting the chemical profile of different species. Mushrooms are unable to synthesize organic matter and are devoid of chlorophyll, which prevent them from performing photosynthesis. So are called heterotrophic beings, i.e., having no ability to produce their own food. Like all fungi, mushrooms feed by absorption. Has a number of filaments of cells, called hyphae, which may be branched and have varying lengths. The assembly of hyphal is the mycelia, which plays important roles as support and absorption of nutrients [26-32]. In the cosmetics industry, various substances extracted from mushrooms have been used, such as ceramides, lentinan, schizophyllan, and L-ergothioneine fatty acids omega 3, 6 and 9, carotenoids, resveratrol, azelaic acid among others. In addition, some mushroom species are producers of enzymes. Among these enzymes are hydrolases, esterases and phenol oxidases among others [6, 15].
Moreover, scientists have succeeded in culturing many species for the large-scale industrial production of their bioactive chemical constituents.

Understanding the importance of mushrooms and their originated compounds encourages for increasing the efforts to discover new species, and study currently identified ones. Furthermore, repurpose mushrooms known for exerting specific activities for supporting currently used drugs or being used solely to face newly spreading diseases such as COVID-19. Apart from the identified edible mushrooms, there are plenty of mushroom genera that are non-edible or even poisonous. These mushrooms are also generous sources of bioactive compounds that have pharmaceutical and industrial applications. Also, some of these mushrooms can contribute in biocontrol of different insects. In this review, we will focus on some of the famous non-edible or poisonous fungal species, including *Rhodotus palmatus*, *Amethyst deceiver*, *Amanita muscaria*, *Macrolepiota procera*, *Scutellinia scutellata*, and the genera *Panus*, *Crepidotus*, *Mycena*, together with puffballs mushrooms.

Rhodotus palmatus

Rhodotus palmatus belonging to Phylum: Basidiomycota; Class: Agaricomycetes; Order: Agaricales; Family: Physalacriaceae. Description and Ecology: Saprobic; growing alone, scattered, or in troops or loose clusters on the wet, well-decayed wood of hardwoods; late spring through fall; originally described from France; widely distributed in North America east of the Great Plains; also distributed in Europe and Asia. Cap: 3–8 cm across; convex when young, becoming broadly convex or nearly flat; sticky when fresh; bald; netted with a reticulate pattern of whitish ridges and veins/or without veins and ridges; pinkish orange to pale peach. Gills: Attached to the stem; close; short-gills frequent; whitish when young, becoming pale peach to pink with maturity. Stem: 10–40 mm long; 3–10 mm thick; often off-center; equal; whitish to pinkish or pale brownish; bald; basal mycelium white. Flesh: Whitish; unchanging when sliced; rubbery and gelatinous. Odor and Taste: Not distinctive. Spore Print: Whitish in a thin print; pinkish to pale yellow in a thick print. Microscopic Features: Spores 5–7.5 x 4–7.5 µm; sub-globosa to broadly ellipsoid; spiny with rod-like spines 0.5–1 µm long; in amyloid. Basidia 30–37.5 x 6–7.5 µm; sub-clavate; 4-sterigmate. Cheilocystidia 30–55 x 2.5–5 µm; fusiform to narrowly lageniform; smooth; thin-walled; hyaline in KOH. Pleurocystidia not found (Figure, 1). Pileipellis an easily disarticulating hymeniform layer of clavate elements 28–38 x 7.5–12.5 µm, smooth, interspersed with cystidioid elements 25–75 x 5–7.5 µm, fusiform to lageniform or irregular, smooth [33].

Fig 1: *Rhodotus palmatus.* Cited in https://imgur.com/a/Dii3H#y2L9SmA

Many biologically active compounds were reported from this species such as the meroterpenoid, rhodatin, which showed high anti-hepatitis C virus activity [34]. Also, the sesquiterpenoids rhodocoranes A–E which exert cytotoxicity and selective antifungal activity [34]. Moreover, the sesquiterpenoids and norsesquiterpenoids, rhodocoranes F–L that showed mild antimycotic and cytotoxic activities [35].

***Laccaria amethystina* (Amethyst deceiver)**

Laccaria amethystina, commonly known as the *Amethyst deceiver*. *Amethyst deceiver* belonging to Phylum: Basidiomycota; Class: Agaricomycetes; Order: Agaricales; Family: Hydnangiaceae. *Laccaria amethystina* is a small, brightly colored mushroom that grows in deciduous and coniferous forests. The mushroom itself is edible, but can absorb arsenic from the soil. Description and ecology: Mycorrhizal with hardwoods (especially partial to oaks and beech); growing alone, scattered, or gregariously; late spring and summer; widely distributed east of The Rocky Mountains. Cap: 0.5-3.5 cm; broadly convex to flat; often with a central depression; the margin even or inrolled, not lined, or slightly lined at maturity; finely hairy-scaly, or nearly bald; bright greyish purple, fading to buff; changing color markedly as it dries out. Gills: Attached to the stem, or rarely running down it; distant or nearly so; thick; waxy; dark purple or colored like the cap. Stem: 1-7 cm long; 1-7 mm thick; equal or slightly swollen at the base; finely to coarsely hairy or scaly; colored like the cap; with lilac to whitish basal mycelium (Figure, 2). Flesh: Insubstantial; colored like the cap or paler. Odor and Taste: Not distinctive. Spore Print: White. Microscopic Features: Spores 7-10 µ; globose; ornamented with spines 1.5-3 µ long and over 1 µ wide at their bases; in amyloid. Basidia 4-spored, rarely 2-spored. Cheilocystidia narrowly cylindric, sub-clavate, or somewhat irregular; 25-65+ x 4-12 µ. Pileipellis a cutis of elements 6-20 µ wide, with upright individual elements or bundles of upright elements; terminal cells sub-clavate to capitate [34].

Fig 2: *Amethyst deceiver.* Cited in https://imgur.com/a/Dii3H#y2L9SmA.

Panus

Panus genus belonging to; Phylum: Basidiomycota; Class: Agaricomycetes; Order: Polyporales; Family: Polyporaceae. *Panus* is a small genus of tough wood-rotting fungi whose fruit bodies are usually purple tinged when young and fresh; they grow rather like oyster mushrooms or Split Gill fungi, with a very short eccentric stem, wavy margins, and shallowish gills that fork. Distribution: *Panus* sp. occurs on dead deciduous hardwood in southern Europe. The few records from Britain. Taxonomic history: Despite having gills, fungi in the genus *Panus* are now thought to be much

more closely related to the Polypores than to the Agaricales. Cap: Usually semi-circular or oyster-shaped when growing on standing wood, but as shown in the picture above rosette forms, sometimes occur when fruiting on dead wood lying on the ground. Caps are up to 10 cm across, developing wavy margins; tough; densely fuzzy; reddish to purplish-brown when young, fading to tan with age. Stem Nearly always eccentrically attached; very stubby and often invisible because it is embedded within the substrate; paler than the cap; usually fuzzily textured (Figure, 3). Gills Pale mauve or pale purple when young and fresh, turning paler and later browning with age; decurrent to the stem. Spores Ellipsoidal, smooth, 4.5-6.5 x 2.5-4 µm; in amyloid. Spore print White or very pale yellow. Odour/taste: Not distinctive. Habitat & Ecological role: Restricted to dead hardwood. Season: Summer through to winter and often into spring in mild parts of southern Europe. This genus has species not generally considered edible, and contains toxins [36]. Different beneficial components are originated from this mushroom genus. For example, the feruloyl esterase purified from fruiting bodies of *Panus giganteus*, which is reported as a potential dietary supplement [37]. Additionally, meroterpenoids isolated from *Panus lecomtei* exhibited varied antibacterial activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Bacillus Calmette–Guérin*, *Pseudomonas aeruginosa* and *Escherichia coli* [38].

Fig 3: *Panus fasciatus.* Cited in https://imgur.com/a/Dii3H#y2L9SmA

Crepidotus

This genus belonging to Phylum: Basidiomycota; Class: Agaricomycetes; Order: Agaricales; Family: Inocybaceae. Distribution: Common in woodlands throughout Britain and Ireland, this mushroom occurs across mainland Europe and is also recorded in many other parts of the world including North America. The cap is initially white, turning creamy-ochre with age. The fruit body is nearly always laterally attached to its substrate-usually small twigs-via its cap, rather than with a stipe. Typically 0.5 to 2 cm in diameter and often slightly lobed. Gills The gills, which radiate from the point of attachment, are moderately crowded. White at first, they gradually turn yellow-brown or buff. Stem Almost invariably this little woodland mushroom has no stipe (stem) at all (Figure, 4). Spores Ellipsoidal, ornamented with minute spiny warts, 5-7 x 3-3.5 um. Spore print Pinkish buff. Cheilocystidia (gill edge cystidia) are clavate, sometimes branched. Odour/taste: Not distinctive. Habitat & Ecological role: Saprobic, on twigs in deciduous and mixed woodland and at the bases of hedgerows. Season: August to December in Britain and Ireland [39].

Fig 4: *Crepidotus* sp. Cited in https://imgur.com/a/Dii3H#y2L9SmA

Amanita muscaria

Phylum: Basidiomycota; Class: Agaricomycetes; Order: Agaricales; Family: Amanitaceae. The Fly Agaric, *Amanita muscaria*, is a hallucinogen and must be considered poisonous. These attractive fungi often appear in groups and are a common sight in all kinds of woodlands. Distribution: Usually recurring in the same place for several years, *Amanita muscaria* is found frequently throughout the northern hemisphere, including Britain and Ireland, mainland Europe, Asia, the USA and Canada. The common name Fly Agaric is a reference to the tradition of using this mushroom as an insecticide. In some European countries caps of Amanita muscaria are crumbled up and placed in saucers of milk to attract house flies. The flies drink the milk, which contains ibotenic acid that not only attracts flies but also poisons them. Cap: The cap of *Amanita muscaria* ranges from 10 to 20 cm diameter at maturity; red or occasionally orange (and very rarely a white form is seen: it does not have red spots, although some picture-book Fly Agarics are depicted in this way). Caps usually flatten or even become slightly concave when fully developed, but occasionally the Fly Agaric remains broadly convex. Amanita muscaria-cap without veil fragments Caps of the Fly Agaric usually retain irregular, white fragments of the universal veil, but in wet weather they can wash off even while the caps are young and domed-as see on the left. In all but the driest of weather, Amanita muscaria caps flatten at maturity. When damaged, the flesh just below the pellicle (the skin of the cap) of a Fly Agaric is initially white but soon turns yellow on exposure to air. Gills: *Amanita muscaria* has white, free, crowded gills that turn pale yellow as the fruit body matures. Stem: Fly Agaric stems are 10 to 25 cm long and 1.5 to 2 cm in diameter; white and ragged with a grooved, hanging white ring. The swollen stem base retains the white mains of the sack-like evolva, which eventually fragments into rings of scales around the base of mature specimens. Spores of *Amanita muscaria*, the Fly Agaric Spores: Ellipsoidal; 8.2-13 x 6.5-9 µm; in amyloid (Figure, 5). Spore print White. Odour/taste: Not distinctive. Habitat & Ecological: role *Amanita muscaria* on the seashore, Kent In common with most *Amanita* species, and with all common amanitas that occur in Britain, *Amanita muscaria* is ectomycorrhizal. The Fly Agaric forms Mycorrhizal associations with a range of hardwood and softwood trees, notably birches, pines and spruces. Season: August to November in Britain and Ireland [40].

Fig 5: *Amanita muscaria.* Cited in https://imgur.com/a/Dii3H#y2L9SmA

Being a famous hallucinogenic mushroom, *A. muscaria* can be employed for developing anesthesia and sedation drugs [41]. On the other hand, toxins of this mushroom are successful in trapping and killing effects on insects or agricultural pests [40, 42].

Hairy *Mycena*

Phylum: Basidiomycota; Class: Agaricomycetes; Order: Agaricales; Family: Mycenaceae. *Mycena* is a large genus of small saprotrophic mushrooms that are rarely more than a few centimetres in width. They are characterized by a white spore print, a small conical or bell-shaped cap, and a thin fragile stem. Most are gray or brown, but a few species have brighter color. Most have a translucent and striate cap, which rarely has an incurved margin. *Mycena* are hard to identify to species and some are distinguishable only by microscopic features such as the shape of the cystidia. The most amazing features of this mushroom in some species have spiny or hairy shape this duo to parasitic filamentous fungi which called *Spinellus fusiger*. *Spinellus fusiger*, commonly known as the bonnet mold, is a species of fungus in the Zygomycota phylum. It is a pin mold that is characterized by erect sporangiophores that are simple in structure, brown or yellowish-brown in color, and with branched aerial filaments that bear the zygospores. It grows as a parasitic mold on mushrooms, including several species from the genera *Mycena*, including *M. haematopus*, *M. pura*, *M. epipterygia*, *M. leptocephala*, and other various *Mycena* species.

Some species are edible, while others contain toxins, but the edibility of most is not known. Mycenoid species: those that used to belong to the genus "*Mycena*." Most of the species are extremely small mushrooms, rarely exceeding a few centimetres in diameter and often only reaching diameters of a few millimetres (Figure, 6). They are frequently overlooked, unless they happen to be growing in large clusters. The tell-tale characteristics of this group include a white spore print, a small conical or bell-shaped cap, and a thin stem that is not tough or wiry. Many species grow in clusters on decaying stumps and log [43]. Spores: Ellipsoidal to sub-cylindrical, smooth, 7.5-13 x 4-6 µm; in amyloid. Spore print: White. Odour/taste: Odour absent or slightly nitrous; taste not distinctive. Habitat & Ecological role: Solitary or in small groups, usually attached to dead hardwood on the forest floor. Season: June to October in Britain and Ireland.

Fig 6: *Mycena*, different species. Cited in https://imgur.com/a/Dii3H#y2L9SmA and https://en.wikipedia.org/wiki/Spinellus_fusiger

The antimicrobial activity of *Mycena rosea* was previously reported against S. aureus and MRSA [44, 45]. On the other hand, the pyrroloquinoline alkaloids, *Mycena flavins* A isolated from *M. haematopus* fruiting bodies showed moderate antibacterial activity against *Azoarcus tolulyticus*, Also, the pyrroloquinoline alkaloid, haematopodin B, is known for having an activity similar to that of the antibiotic gentamicin [46].

***Macrolepiota procera* (Parasol)**

Macrolepiota which called Parasol belonging to Phylum: Basidiomycota; Class: Agaricomycetes; Order: Agaricales; Family: Agaricaceae. *Macrolepiota procera*, the Parasol Mushroom, is a choice edible species found on roadside verges, in neglected pastureland and on grassy seaside cliffs in summer and autumn. Distribution Frequent in southern Britain and Ireland, Parasols are less common in northern England and Scotland except for sheltered coastal locations. This species occurs also in most parts of mainland Europe and in the USA. Cap: Initially spherical and pale brown with a darker brown area near the crown that breaks into scales, the cap of *Macrolepiota procera* expends until it is flat with a small central bump, known as an umbo. The cap flesh is white and does not change significantly when cut. The cap diameter at maturity ranges between 10 and 25 cm. The broad, crowded gills of the Parasol Mushroom are white or pale cream and free, terminating some distance from the stipe. Stem: A large double-edged ring persists around the

stem of *Macrolepiota procera* but often becomes movable and falls to the base. The stem is smooth and white or cream but decorated with small brown scales that often give it a banded, snakeskin appearance (Figure, 7). Inside the stem the tough white fibrous flesh is loosely packed, and sometimes the stem is hollow. Bulbous at the base, the stems of *Macrolepiota procera* tapers inwards slightly towards the apex; the diameter ranges from 1 to 1.5 cm (to 2.5 cm across the bulbous base), and the stem height can be up to 30 cm. Spores: Ellipsoidal, smooth, thick-walled; 12-18 x 8-12 µm; with a small germ pore. Spore print: White or very pale cream. Odour/taste: Odour not distinctive; taste sweet. Habitat & Ecological role: Parasol mushrooms are saprobic. They are most common in woodland clearings and in grassy areas next to woodland, growing alone or in small scattered groups; also occasionally in permanent pasture and in stable sand dunes as well as on disturbed ground such as in gardens and allotments [47].

Macrolepiota procera extract showed *in vitro* antioxidant activity with IC_{50} that reached 311.40 µg/mL) Additionally, extract of this mushroom exerted cytotoxic activity against human epithelial carcinoma HeLa cells, human lung carcinoma A549 cells, and human colon carcinoma LS174 cells [48]. Additionally, the extract of *Macrolepiota procera* showed an antiproliferative effect in a time- and dose-dependent manner [49].

Fig 7: *Macrolepiota procera.* Cited in https://imgur.com/a/Dii3H#y2L9SmA

Puffballs

Puffballs mushroom belonging to Phylum: Basidiomycota; Class: Agaricomycetes; Order: Agaricales; Family: Agaricaceae. Puffballs are fungi, so named because clouds of brown dust-like spores are emitted when the mature fruit-body bursts or is impacted. Puffballs include many genera like *Calvatia*, *Calbovista* and *Lycoperdon.* True puffballs do not have a visible stalk or stem (Figure, 8). The term "puffball," mean more or less any mushroom that looks like a ball when mature. Typically the interior of a puffball is composed of spore-producing flesh that turns into spore dust as the mushroom matures. When the puffball matures it splits open, or a perforation develops on surface of the ball, through which the spores escape—when raindrops land on the puffball, via air currents, or by some other means. Puffballs range widely in size and appearance—from tiny species that grow in clusters on wood, to large, terrestrial species growing in fairy rings in meadows. A few species, like *Calvatia gigantea*, are enormous, reaching diameters of 50 cm! I am including the "earthstars" with the puffballs since they consist, at maturity, of a puffball sitting atop a star-shaped arrangement of fleshy arms. If your puffball is growing underground or partially underground, it may well be a truffle or false truffle [50, 51].

Fig 8: Puffballs. Cited in https://imgur.com/a/Dii3H#y2L9SmA

A peptide isolated from fruiting bodies of the puffball mushroom *Calvatia caelata* showed *N*-glycosidase activity and translation inhibiting activity in the cell-free rabbit reticulocyte lysate system. Moreover, It inhibited proliferation of spleen cells with an IC_{50} of about 100 NM, and reduced viability of breast cancer cells to half [52]. Ng *et al.*, [53], have identified this peptide as calcaelin.

Scutellinia scutellata

This genus belonging to Phylum: Ascomycota; Class: Pezizomycetes; Order: Pezizales; Family: Pyronemataceae. *Scutellinia scutellata* likes damp places: as long as there is plenty of moisture and some well-rotted timber to eat. Up to 10mm across, but more commonly 3 to 5 mm, the cups of Common Eyelash are shiny on the upper surface and vary in colour from orange through to a very deep red inside the cup. A fringe of dark brown eyelash-like hairs surround the rim of the cup. The shallow cups, which become almost flat when fully mature, are initially round, but often develop irregular margins as they push up against their neighbours. The pale orange downy outer surface is infertile; the Ascospores are produced on the shiny inner surface of the cup, which is typically 2 to 4 mm tall and is attached to the substrate by mycelial threads and without a visible stipe. The ascospores are produced on the shiny inner surface of the cup, which is typically 2 to 4 mm tall and is attached to the substrate by mycelial threads and without a visible stipe. Marginal hairs of *Scutellinia scutellata* 350-1800 x 20-50 µm, septate, dark brown, pointed. Marginal hairs 350-1800 x 20-50 µm, septate, dark brown, pointed. A mature ascus of *Scutellinia scutellata* with its eight spores Asci Hyaline, 250-300 x 18-25 um; uniseriate, each ascus having eight spores. Asci tips do not turn blue in Melzer's reagent. Paraphyses Septate; pale orange, cylindrical with clavate tips 10-12 µm across. *Scutellinia scutellata* Spores: Ellipsoidal, smooth initially, eventually developing tiny warts and some connecting ridges to 1 µm in height, typically 10-12 x 18-19 µm; hyaline. Not distinctive (Figure, 9). Habitat & Ecological role: Saprobic, on humous-rich damp soil, damp long-dead wood and other well-rotted vegetation; also occasionally on the dung of horses, cows and other ruminants. Season: June to late November in Britain and Ireland [54].

Fig 9: *Scutellinia scutellata.* Cited in https://imgur.com/a/Dii3H#y2L9SmA

***Clathrus* sp.**

This genus belonging to Phylum: Basidiomycota; Class: Agaricomycetes; Order: Phallales; Family: Phallaceae. The most common species is *Clathrus ruber*. *Clathrus ruber* is a remarkable species, almost certainly introduced rather than native to northern Europe. When seen for the first time it is often assumed to be something other than a fungus. Like the common stinkhorn and the dog stinkhorn, this 'cage stinkhorn' emerges from a white ball or 'egg'. Many reports saying that eating Red Cage eggs can cause serious gastric upsets. The picture above shows both a mature and a newly-emerged fruit body, the latter exhumed to show the rhizomorphs at the base of the 'egg'. Distribution Rare in mainland Britain, but fairly common in the Channel Islands, this saprobic fungus is generally referred to as the Red Cage or as the Lattice Fungus. *Clathrus ruber* is common in central and southern Europe. *Clathrus ruber* is also recorded from Asia and North America. The generic name *Clathrus* means 'a cage', while ruber means red, a reference to the colour of most of the fungi in this genus of stinkhorn-like fungi. Description Initially appearing as a half-buried whitish ball or 'egg', the cage-like form of this fungus becomes visible once the outer membrane of the egg bursts - pictured on the left. Within a few minutes, the fruit-body of the Red Cage Fungus expands to become a large, globe-shaped or ovoid structure whose surface consists of a lattice in the form of a rounded or oval cage-like mesh. The bright red colour makes this striking species very easy to identify; however, it is a relatively rare find in Britain and occurs mainly in the south of England and on the Isle of Wight and in the Channel Isles. Fruit bodies erupt and then collapse in little more than 24 hours, and within two or three days all signs of the fruit body have disappeared. Dimensions Typically 5 to 15 cm across and most often roughly spherical, but some forms (or are they a different species?) have very narrow, almost wire-like lattice frameworks while other related species are vertically aligned ellipsoids. This mushroom has no stem. The inside of the cage is coated with a dark green smelly gleba that attracts flies, and as the gleba sticks to the legs of the flies it gets carried to other locations where a new Red Cage colony could result (Figure, 10). Spores Elongated ellipsoidal, smooth, 4–6 x 1.5–2.5 µm. Spore print Olive-brown. Odour/taste Strong, unpleasant odour reminiscent of rotting meat; no distinctive taste. Habitat & Ecological role: Saprobic, mainly found in parks and gardens, *Clathrus ruber* often fruits in small groups on/or besides decomposing vegetable matter and in particular compost heaps. Increasingly, this species is being found growing on bark mulch in parks and gardens. Season: June to September in southern Britain, but all year round in the south of France and from October to May in the more southerly parts of Europe [55-57].

Fig 10: *Clathrus* different species. Cited in https://imgur.com/a/Dii3H#y2L9Sm

Conclusion

Due to the appearance of new diseases, and the spreading of lethal ones. Scientists keep investigating all possible natural sources in an attempt to find efficient compounds capable of healing diseases and decreasing mortality rates. Apart from being of no nutritional value, non-edible and poisonous mushrooms worth studying as rich sources of compounds that could be of medical or biological control applications. Repurposing such species can contribute to finding new cures or supporting used drugs in our battle against currently spreading diseases.

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