MYCOSPHERE 15(1): 6347–6438 (2024) www.mycosphere.org ISSN 2077 7019
Doi 10.5943/mycosphere/15/1/27

ARTICLE

Unlocking nature's pharmacy: diversity of medicinal properties and mycochemicals in the family Hymenochaetaceae (Agaricomycetes, Basidiomycota)

Ghobad-Nejhad M[1*], Zhou LW[2], Tomšovský M[3], Angelini P[4], Cusumano G[4], Angeles Flores G[4,5], Venanzoni R[4], Wang XW[2,10], Chaharmiri-Dokhaharani S[6], Moridi Farimani M[7], Pärtel K[8], Dai YC[9], and Wu F[9*]

[1] *Department of Biotechnology, Iranian Research Organization for Science and Technology (IROST), P. O. Box 3353-5111, Tehran, Iran*
[2] *State Key Laboratory of Mycology, Institute of Microbiology, Chinese Academy of Sciences, Beijing 100101, China*
[3] *Department of Forest Protection and Wildlife Management, Faculty of Forestry and Wood Technology, Mendel University in Brno, Zemědělská 1, Brno 61300, Czechia*
[4] *Department of Chemistry, Biology and Biotechnology, University of Perugia, 06122 Perugia, Italy*
[5] *Botanic Garden Giardino dei Semplici, Department of Pharmacy, Gabriele d'Annunzio University, 66100 Chieti, Italy*
[6] *Center of Excellence in Fungal Research, Mae Fah Luang University, Chiang Rai 57100, Thailand*
[7] *Department of Phytochemistry, Medicinal Plants and Drugs Research Institute, Shahid Beheshti University, Evin, Tehran, Iran*
[8] *Institute of Agriculture and Environmental Sciences, Estonian University of Life Sciences, Kreutzwaldi 5, Tartu 51006, Estonia*
[9] *State Key Laboratory of Efficient Production of Forest Resources, School of Ecology and Nature Conservation, Beijing Forestry University, Beijing 100083, China*[10] *University of Chinese Academy of Sciences, Beijing 100049, China*

Citation – Ghobad-Nejhad M, Zhou LW, Tomšovský M, Angelini P, Cusumano G, Angeles Flores G, Venanzoni R, Wang XW, Chaharmiri-Dokhaharani S, Moridi Farimani M, Pärtel K, Dai YC, Wu F 2024 – Unlocking nature's pharmacy: diversity of medicinal properties and mycochemicals in the family Hymenochaetaceae (Agaricomycetes, Basidiomycota). Mycosphere 15(1), 6347–6438, Doi 10.5943/mycosphere/15/1/27

Abstract

Hymenochaetaceae is a large and noteworthy family of macrobasidiomycetes predominantly growing on woody plants. Several Hymenochaetaceae members have a long history of recognition in traditional medicine and modern pharmacological studies have demonstrated their therapeutic properties. This review comprehensively surveys the studies on biological activities and mycochemical compounds reported from the Hymenochaetaceae species so far. There are 124 potential species from 27 genera in Hymenochaetaceae with at least one bioactive metabolite and/or biological property. A diverse range of metabolites were found (ca. 500 compounds) classified mainly into terpenoids, styrylpyrones, steroids, phenolics, polysaccharides, and other compounds. Numerous novel sesquiterpenoids, triterpenoids, steroids, and styrylpyrones have been isolated from the family. Medicinal properties cover a range of about 100 types of bioactivities, more predominantly antioxidant, antitumor, antidiabetic, immunomodulatory, anti-inflammatory, antibacterial, and antifungal effects. The role of Hymenochaetaceae members in aesthetic medicine is also discussed. Molecular phylogenetic reconstructions reveal that the medicinal species are distributed in 27 monophyletic clades, and 20 medicinal species are types of their respective genera (generic types). So far most of medicinal Hymenochaetaceae species are shown to be distributed in Asia, particularly in China. Considering the drawbacks imposed by improper characterization of

Submitted: 24 May 2024; **Accepted:** 28 August 2024; **Published:** 4 December 2024
*__Corresponding Authors:__ Masoomeh Ghobad-Nejhad – e-mail – ghobadnejhad@gmail.com,
Fang Wu – e-mail – fangwubjfu2014@bjfu.edu.cn
Accepted by: Jian-Kui Liu

Hymenochaetaceae isolates in biomedical studies, general recommendations are given with the aim of encouraging greater focus on accurately identifying the medicinal fungal species.

Keywords – Bioactive – *Inonotus* – medicinal mushrooms – *Phellinus* – taxonomy – wood-inhabiting basidiomycetes

INTRODUCTION

Medicinal mushrooms are prolific producers of natural products and have been extensively studied for their health-promoting properties. Several species have been an integral part of traditional medicine systems across different cultures and regions and have been implemented as a remarkable source in design and development of traditional and modern medications. Taxonomically, the bulk of medicinal mushrooms belong to the Agaricomycetes, comprising a few hundred species (Łysakowska et al. 2023) out of ca. 150K fungal species formally identified globally (Antonelli et al. 2020).

Hymenochaetaceae (Hymenochaetales, Agaricomycetes) is a large family of macrobasidiomycetes and one of the speciose groups of wood-inhabiting fungi (Fig. 1). They are characteristic in their usually bulky fruiting bodies with various shades of brown color. The family currently comprises 35 genera and ca. 900 species distributed worldwide (Wu et al. 2022, Lima et al. 2022, Wang et al. 2023a, Hou et al. 2023, Wu et al. 2024). Species in Hymenochaetaceae are characterized by annual to perennial, woody or fibrous, resupinate, effused-reflexed to pileate fruiting bodies (basidiomata), mostly broadly attached to their substrate, rarely bearing a stipe. The hymenophore is typically poroid or corticioid, occasionally hydnoid. The basidiomata are usually known to exhibit a typical darkening in potassium hydroxide (KOH) called a xanthochroic reaction. The hyphal system is monomitic to dimitic, and generative hyphae lack clamp connections. Setal elements are often present in hymenium or trama (Bernicchia & Gorjón 2020). Species have parasitic, saprotrophic, or ectomycorrhizal lifestyles.

Several members of the family Hymenochaetaceae are economically important. Genera such as *Coniferiporia*, *Onnia*, and *Pyrrhoderma* are significant forest pathogens causing heart, butt and root rot in wood (Yuan et al. 2023). Hymenochaetaceae taxa generally cause a white rot, very often with apparent selective delignification (white pocket rot – *Porodeadealea*, laminated rot – *Coniferiporia*), though the white rot of *Inonotus hispidus* show also soft rot patterns (Schwarze 2007). A remarkable economic aspect of the family is the association of several species with esca-related wood rot of grapevine and other crop trees particularly caused by *Fomitiporia pseudopunctata* (Cloete et al. 2015).

The genera *Inonotus* and *Phellinus*, the most noteworthy members of the Hymenochaetaceae family, have been a remarkable source of numerous bioactive compounds and pharmaceutical research (Dong et al. 2019, He et al. 2021, Zhang et al. 2022, Cheng et al. 2023, Le et al. 2024). This can be ascribed to their historical medicinal applications and believed health-promoting properties, wide geographic distribution, visible and usually large fruiting bodies, and fairly easy culturing. The attractiveness of species for therapeutic properties also depends on the size and shape of the fruiting body, i.e., species with large, pileate basidiomata (*Phellinus, Inonotus, Sanghuangporus*) have been more likely to be the subject of health property experiments than those with resupinate or effused-reflexed fruiting bodies such as *Hymenochaete, Hydnoporia,* and *Mensularia*. Various Hymenochaetaceae members have been recognized to produce numerous bioactive metabolites, some being unique or rare in the realm of fungi (Sandargo et al. 2019, Liu et al. 2024).

Despite abundant literature on biological properties and metabolites of the eminent genera and individual species of the Hymenochaetaceae family, a comprehensive account is lacking covering the entire family. Moreover, the diversity of medicinal species in a modern systematic view is yet unknown. This review brings state of the art on medicinal properties and compounds of Hymenochaetaceae species worldwide. We also questioned what is the phylogenetic relationships of the medicinal species of the family, and how is their worldwide geographic distribution.

Figure 1 – Basidiomata in selected medicinal Hymenochaetaceae species. a *Fuscoporia torulosa*. b *Hymenochaete rubiginosa*. c *Inocutis rheades*. d *Inonotus hispidus*. e *Inonotus obliquus*. f *Mensularia radiata*. g *Phellinus igniarius*. h *Phellinus tremulae*. i *Porodaedalea pini*. j *Pyrrhoderma noxium*. k *Sanghuangporus baumii*. l *Sanghuangporus sanghuang*. Photos: h by Michal Tomšovský, others by Yu-Cheng Dai.

Methodology

In the present review, we adopt the concept of Hymenochaetaceae following Wu et al. (2022). Bulk of information was retrieved from databases such as Google Scholar and Web of Science with search terms including the taxon name combined with technical keywords such as 'bioactivity', 'chemical compound', 'metabolite', 'medicinal', and alike. The chemical compounds (Table 1, Supplementary Table 1) were classified consulting published literature, expert knowledge, and chemical databases (e.g., PubChem, ChemSpider, NIST) and illustrated mainly via NPATLAS (van Santen et al. 2022). The phylogenetic reconstructions (Table 2) were performed using the Maximum Likelihood (ML) analysis implemented in raxmlGUI v.8.2.12 (Stamatakis 2014) with the calculation of bootstrap (BS) replicates under the auto FC option (Pattengale et al.

2010). Distribution data were consulted from Gómez-Espinoza et al. (2023), Riquelme & Rajchenberg (2021), Wu et al. (2019), Ryvarden & Melo (2017), Prasher (2015), Ranadive (2013), Ghobad-Nejhad & Hallenberg (2012), Ranadive et al. (2011), Ghobad-Nejhad (2011), collections at TAAM herbarium (acronymed at Index Herbariorum, Thiers 2024), and our field observations. We tentatively considered a species as medicinal if it has at least one reported bioactive property and/or bioactive compound.

Traditional medicine and ethnopharmacology

Various Hymenochaetaceae members are recognized in traditional medicine and ethnopharmacology in different parts of the world. Here, we briefly present data on exemplar species on a genus basis.

Fomitiporia punctata has been recognized as a medicine in some folklore recipes to treat malicious tumors since the last century (Ying et al. 1987). *Fomitiporia robusta* has been used for its traditional aging of wine and brandy named 'rakiya' in Bulgaria (Stoyneva-Gärtner et al. 2018) to treat various diseases based on the aged beverages that receive the tannins from soaked pieces of dried basidiomata.

Inonotus hispidus has been used as a diuretic, astringent, antiseptic agent, and has been reported to treat dyspepsia, cancer, diabetes, diarrhea, general detoxification, diseases of the heart, liver, stomach, abdominal pain, tuberculosis, and inflammation in Chinese traditional medicine (Angelini et al. 2019). *Inonotus obliquus* has been traditionally used to treat viral and parasitic infections, gastrointestinal diseases and shown to improve immunity and to be hypoglycemic (Gründemann et al. 2020, Szychowski et al. 2021). In Russia, *I. obliquus* has been utilized in various medicinal preparations for centuries without displaying any toxicity (Shashkina et al. 2006, Kim et al. 2006). The asexual stage known as 'Chaga' (Tchaga) has traditionally been used in Russia, Poland, and the Baltic states for the treatment of various diseases e.g., tuberculosis, gastrointestinal disorders, cardiovascular diseases, diabetes, and skin problems (Shashkina et al. 2006). Probably the oldest document confirming the use of Chaga for medicinal purposes in Europe is the work by Hippocrates 'Corpus Hippocraticum' (Szychowski et al. 2021). The Chaga drink is popular among people living in woodlands who use this for stimulant effects (Shashkina et al. 2006). In Russia, cancer incidence is said to be lower in regions where Chaga is regularly consumed (Shashkina et al. 2006). Links to positive effect of Chaga in cancer treatment occur also in popular literature in Aleksander Solzhenitsyn's Cancer Ward (Szychowski et al. 2021). Khanty people from Western Siberia used tea from *I. obliquus* for general detoxification and against tuberculosis and heart, liver and stomach diseases. The "soap water" including Chaga was applied for ritual washing and other hygienic purposes, and the smoked pieces of the fungus were believed to prevent diseases (Saar 1991).

Phellinus igniarius has been reported to be widely used in traditional medicine (Hobbs 2002, Meunink 2015, Azeem et al. 2018, He et al. 2021, Khojimatov et al. 2023), though the identity of the historically used species is often questionable. The extract of *P. igniarius* has been reported as a traditional Chinese medicine for the treatment of festering, abdominalgia, bloody gonorrhea, and diarrhea (He et al. 2021); the fungus tea is known to be a commonly used antioxidant to prevent cancer (Meunink 2015, Khojimatov et al. 2023). *Phellinus nigricans*, common in the boreal Northern Hemisphere, has been burnt and used as a chewing tobacco ingredient by the Khanty people. A mixture of the burnt fungal fruiting body and tobacco was applied against toothache and to prevent tooth problems (Saar 1991). Very similar recipe is used in western Alaska (USA) by Inupiaq and Yup'ik people (Blanchette et al. 2002). The ash from basidiomata increases the pH of mixture of burnt fruiting body and tobacco. The higher pH increases the rapid absorption of high levels of nicotine and leads to common nicotine addictions and associated diseases among the indigenous people. Although Blanchette et al. (2002) named the fungus as *P. igniarius*, the species is more probably *P. nigricans* occurring in Alaska due to its growth on birch and very dark, heavily cracked surface of basidiomata (Brazee 2015). *Phellinus pomaceus* has been traditionally used for medicinal purposes in East Asian countries (Khojimatov et al. 2023), but this may have been misidentified with other *Phellinus* spp. in the area. The species is used in some parts of northwest Iran as wound healing for livestock animals (MG pers. comm.).

Sanghuangporus species have a long history of application in the traditional Chinese medicine (Wu et al. 2012, Shen et al. 2021). The 2000 years old Chinese medicine book 'Shen Nong Materia Medica' already reported ear of *Morus* trees as Sang'er (He et al. 2021, Zhou et al 2022). The name 'Sanghuang' appeared 1400 years ago in another traditional Chinese medicine book, 'The Characters of Drugs'. Since that time, 'Sanghuang' has been widely applied in literature of traditional Chinese medicine. 'Sanghuang' is considered a supplementary food in cancer treatments (Han et al. 2016). The basidiomata of *Sanghuangporus* spp. are commonly collected by people in East and South East Asia for direct consumption or processing. The powder or chips of basidiomata as supplements are the main method of consumption, but products including fungal extracts (tea, alcoholic drinks, candies, or cosmetics) are also available in the market. Zhang et al. (2021) reported *S. lonicerinus* as commonly used for medical purposes by Tujia people in Hubei province of China.

Non-specific '*Phellinus*' has also been reported in traditional medicine. For instance, the Aborigines in Australia used aqueous extracts prepared from charred basidiomata of '*Phellinus*' to treat coughs, sore throats, fever, and diarrhea (Kalotas 1996). Moreover, '*Phellinus*' and '*Inonotus*' are ethnomycologically well reputed in East Asia and China for health and immune system improvement and treatment of various diseases including diabetes, tuberculosis, cancer, and cardiovascular and gastrointestinal diseases (de Silva et al. 2012, Wu et al. 2019). As will be pointed out in the following, the precise identity of the taxa used in traditional medicine is a matter of debate.

Mycochemistry

Owing to their rich application history and wide recognition in traditional medicine, Hymenochaetaceae taxa, more notably *Phellinus* and *Inonotus* species, have been subject to intense mycochemical (more commonly as 'phytochemical') research (see e.g., Dong et al. 2019, He et al. 2021, Zhang et al. 2022, Cheng et al. 2023, and references therein). Using various extraction and purification methods, numerous macro- and small-molecule compounds have been isolated in the course of bioassay-guided fractionation and chemical investigations, including hetero- and homopolysaccharides, steroids and sterols, phenolics, styrylpyrones (-pyranones), sesquiterpenoids, di- and triterpenoids, limonoids, alkanes, chlorine- and nitrogen-containing metabolites, furans, alkaloids, and some other complex metabolites.

While some isolated chemical compounds in Hymenochaetaceae may have been previously known in other fungal groups, especially in Ascomycota, or in plant kingdom, the others may have been entirely new, characterized firstly in fruiting bodies or fermented mycelia of Hymenochaetaceae and introduced as new to science. Examples of novel compounds are given for some species in the following (Fig. 2).

The new lanostane-type triterpenoids, gilvsins A–D, were discovered from *Fuscoporia gilva* by Liu et al. (2009). A new triterpene called fuscoporic acid was recently introduced from *Fuscoporia torulosa* by Béni et al. (2021). The novel lanostane-type triterpenoids named as phellibarins A–D were first introduced from *Fuscoporia rhabarbarina* (Feng et al. 2016).

Hispolon, the now well-known styrylpyrone, was first introduced from *Inonotus hispidus* through bioactivity-guided fractionation targeted at finding metabolites with interesting immunomodulatory and antiviral activities (Ali et al. 1996). The new hispolon derivatives inonophenols A–C, and the new lanostane triterpenoid inonoterpene A, were recently introduced from this species (Kou et al. 2021). The cyclohexenone derivative (4S,5S)-4-hydroxy-3,5-dimethoxycyclohex-2-enone (HDE) with antitumor activities was isolated for the first time from *I. hispidus* (Yang et al. 2019).

Ying et al. (2014) discovered the new lanostane-type triterpenoids called inotolactones A and B, and the new drimane-type sesquiterpenoid, inotolactone C from *Inonotus obliquus*, all with α-glucosidase inhibitory. Four new drimane sesquiterpene lactones, inonolactones E–H, were recently isolated from *I. obliquus* (Zou et al. 2020). The two new flavan derivative enantiomers 1a and 1b isolated from *I. obliquus* were said to be "the first pair of enantiomers in nature with tetrahydrofuran-flavan skeleton" (Zou et al. 2020). From *I. rickii*, Chen et al. (2014) discovered the novel bisabolene-type sesquiterpenoids, inonotic acid A, 3-O-formyl inonotic acid A, and inonotic acid B, as well as the new drimane-type sesquiterpenoid 3α,6β-dihydroxycinnamolide.

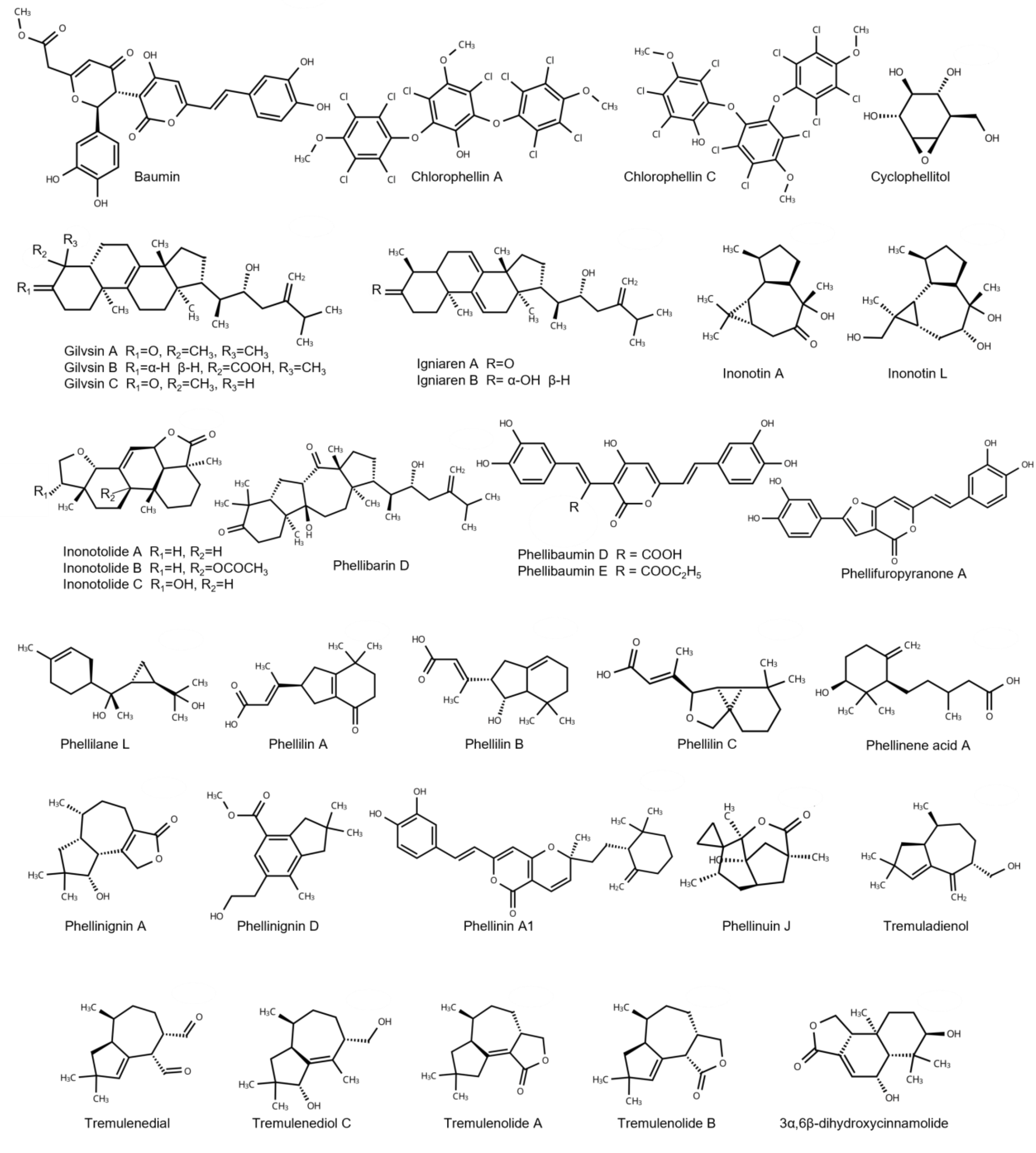

Figure 2 – Chemical structure of selected novel compounds discovered in Hymenochaetaceae.

From *Inonotus* sp. isolates BCC 22670 and BCC 23706, the new cyclofarnesane-type sesquiterpenoid inonofarnesane, aromadendrane-type sesquiterpenoid called inonotins A–L (Isaka et al. 2015), and alliacane-type sesquiterpenoids inonoalliacanes A–I (Isaka et al. 2017) were introduced; the inonotins were shown to be different from common aromadendranes of higher plants (Isaka et al. 2015).

The novel isopimarane-type diterpenoid lactones named as inonotolides A–C were first discovered in *Neomensularia kanehirae* (Ding et al. 2018). The chloroaromatic compound drosophilin A methyl ether (DAME) was first found in *Phellinus fastuosus* (Singh & Rangaswami 1966).

Examples of new compounds introduced from *Phellinus igniarius* are: the new sesquiterpenoid eudesm-1β,6α,11-triol (Song et al. 2014) which exhibited antiviral effects on influenza virus; the new tirucallane triterpenoid igniarine (Thanh et al. 2018); the new steroids 3α,17α,19,20-tetrahydroxy-4α-methylpregn-8-ene and 3α,12α,17α,20-tetrahydroxy-4α-methylpregn-8-ene (Yin et al. 2015); the new tremulane-type sesquiterpenoids phellinignins A–C and illudane-type sesquiterpenoid phellinignin D (Wu et al. 2020); the new homopregnene steroid 3,17,20-trihydroxy-4-methylpregn-8-en-7-one and three heptanorergosterane derivatives steroids called phellinignincisterols A–C (Wu et al. 2010); the new abietane diterpenoid 12-hydroxy-7-oxo-5,8,11,13-tetraene-18,6-abietanolide (Wang et al. 2006); the new tremulane sesquiterpenoids (−)-(2S,3S,6S,7S,9R)-tremul-1(10)-ene-11,12,14-triol, (−)-(2S,3S,6S,7S,9S)-tremul-1(10)-ene-11,12,15-triol, and (+)-(1R,6S,7S)-tremul-2-ene-12(11)-lactone which showed significant vascular-relaxing effects (He et al. 2021).

From *Phellinus pomaceus*, the new illudin-type sesquiterpenoid called phellinuin J (He et al. 2015) and from *Phellinus tremulae*, the new tremulane-type sesquiterpenoids tremulenolides A and B, tremulenedial, tremulenedial dibenzyl acetal, tremulenediols A–C, and tremuladienol were introduced (Ayer & Cruz 1993). From *Phellinus* sp., Atsumi et al. (1990) discovered a cyclitol compound called cyclophellitol with β-glucosidase inhibitory activity.

The new chlorine-containing compounds chlorophellins A–C (Lee et al. 2008) and the new spiroindene pigment phelliribsin A (Kubo et al. 2014) were introduced from *Phylloporia ribis*. The new ceramides N-(2'-hydroxynonacosanoyl)-D-erythro-1,3,4-trihydroxy-2-aminooctadecane and N-(2'-hydroxytriacontanoyl)-D-erythro-l,3,4-trihydroxy-2-aminooctadecane were discovered from *Porodaedalea pini* by Lourenço et al. (1996). The new phenolics methyl (E)-3-(4-methoxycarbonylphenoxy)-acrylate and methyl 3-(4-methoxycarbonylphenoxy)-propionate were introduced from *Porodaedalea chrysoloma* by Sárközy et al. (2020).

From *Sanghuangporus baumii*, the new davallialactone derivative styrylpyrone named as baumin with strong antioxidant activity (Lee et al. 2010) and the new hispidin derivatives phellibaumins A–E with NF-κB inhibitory activity (Wu et al. 2011) were isolated. The new benzyl dihydroflavones phelligrins A and B, methylphelligrins A and B, and epi-methylphelligrins A and B were discovered from this species (Wu et al. 2011). From *S. vaninii*, two new abscisic acid derivative sesquiterpenes named phellinene acids A and B were introduced by Zheng et al. (2012).

Phellilane L was a new cyclopropane-containing sesquiterpenoid derived from *Tropicoporus linteus* (Ota et al. 2017). Some other new compounds from this species include: the new phellilin-type sesquiterpenoids called phellilins A–C with weak elastase inhibitory effects (Huang et al. 2013); the two furans phellinusfurans A and B showing considerable anti-complement activity, and a furanone called phellinone displaying antimicrobial properties (He et al. 2021); the new hispidin-derivative phellinstatin which displayed considerable enoyl-acyl carrier protein (ACP) reductase inhibitory effects against methicillin-resistant *Staphylococcus aureus* (MRSA) (Cho et al. 2011); the new furopyranone called phellifuropyranone A (Kojima et al. 2008); and the two nitrogen-containing compounds (indole derivatives) named as 7-methoxyindole-3-carboxylic acid methyl ester and 1-methyindole-3-carboxaldehyde (Samchai et al. 2011).

Examples of Hymenochaetaceae compounds structurally new to the fungal kingdom are aethiopinolones A–E isolated from *Fomitiporia aethiopica* (Chepkirui et al. 2018a). Also noteworthy is the discovery of compounds from newly described species. *Phylloporia boldo* described by Rajchenberg et al. (2019) from Chile was soon shown to produce various halogenated hydroquinones (Riquelme et al. 2020). Thirteen new sesquiterpenoids as well as (6R,7S,10R)-7,10-epoxy-7,11-dimethyldodec-1-ene-6,11-diol and elgonenes A−L were recently discovered from a new, yet undescribed species of *Sanghuangporus* (Cheng et al. 2019).

In this study, we summarized the information on the Hymenochaetaceae species with their known chemical compounds (Table 1). The occurrence of each compound in Hymenochaetaceae is also listed in Supplementary Table 1. The most prevalent compound groups in Hymenochaetaceae are briefly discussed.

Table 1 Hymenochaetaceae species with their known chemical compounds and medicinal properties. Authority of fungal names follow Index Fungorum (www.indexfungorum.org). For selected species, the noteworthy synonyms are mentioned. Species with an asterisk (*) are generic types.

Species	Distribution	Compounds[b]	Bioactivity	References
Coltricia perennis (L.) Murrill*	temperate and boreal zones of the Northern Hemisphere	(polyphenols, polysaccharides, terpenoids)	anticancer, antibacterial	Adongbede & Aduralere (2019), Ghosh (2014)
Coniferiporia weirii (Murrill) L.W. Zhou & Y.C. Dai	North America (following *Thuja*), Asia?	(triterpenes)	-	Kahlos et al. (1989a)
Cylindrosporus flavidus (Berk.) L.W. Zhou* = *Onnia flavida* (Berk.) Y.C. Dai	Asia	-	antitumor	Wu et al. (2019)
Flaviporellus splitgerberi (Mont.) Murrill* = *Inonotus splitgerberi* (Mont.) Ryvarden	tropical America	(alkaloids, triterpenes, steroids, coumarins, reducing sugars, phenols)	antioxidant	Campi et al. (2019)
Fomitiporella badia (Cooke) Teixeira	Pantropical	-	antioxidant, antifungal, antidiabetic, antimicrobial	Azeem et al. (2018), Ranadive et al. (2013)
Fomitiporia aethiopica Decock, Bitew & G. Castillo	Africa	aethiopinolones A–E	cytotoxic effects against various human cancer cell lines	Chepkirui et al. (2018a)
Fomitiporia alpina B.K. Cui & Hong Chen	Southwest China, Central Asia?	-	antitumor	Wu et al. (2019)
Fomitiporia bannaensis Y.C. Dai	Southeast Asia	-	treating coronary artery disease	Wu et al. (2019)
Fomitiporia erecta (A. David, Dequatre & Fiasson) Fiasson	Mediterranean area	hispidin, hypholomin B	antitumor	Wu et al. (2019), Fiasson (1982)
Fomitiporia gaoligongensis B.K. Cui & Hong Chen	Southwest China, Central Asia?	-	antitumor	Wu et al. (2019)
Fomitiporia hainaniana B.K. Cui & Hong Chen	South China	-	treating coronary artery disease	Wu et al. (2019)
Fomitiporia hartigii (Allesch. & Schnabl) Fiasson & Niemelä	Europe, Asia	hispidin, hypholomin B, 3,14'-bishispidinyl	antioxidant, xanthine oxidase inhibitory, antitumor, antibacterial	Wu et al. (2019), Azeem et al. (2018), Kovács et al. (2017), Fiasson (1982)
Fomitiporia hippophaëicola (H. Jahn) Fiasson & Niemelä	Europe, East to Central Asia	benzoate, salicylate, 2-furoate, 3-furoate, protocatechuic acid // (total phenol, flavonoid, carbohydrate,	antioxidant, antibacterial	Sunthudlakhar et al. (2019), Azeem et al. (2018), Watling & Harper (1998)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		triterpene contents)		
Fomitiporia norbulingka B.K. Cui & Hong Chen	West China, Central Asia?	-	antitumor	Wu et al. (2019)
Fomitiporia pentaphylacis L.W. Zhou	South China	-	antitumor	Wu et al. (2019)
Fomitiporia pseudopunctata (A. David, Dequatre & Fiasson) Fiasson = *Fomitiporia mediterranea* M. Fisch.	South Europe, West Asia, East Africa	hispidin, hypholomin B, frustulosin, 4-hydroxybenzaldehyde, dihydroactinolide, 6-formyl-2,2-methyl-4-chromanone	treating coronary artery disease	Wu et al. (2019), Fischer & Thines (2017), Fiasson (1982)
Fomitiporia punctata (P. Karst.) Murrill	Europe, Asia	hispidin, hypholomin B	antioxidant, xanthine oxidase inhibitory, treating coronary artery disease, antitumor, antiviral, preventing and treating cardiovascular diseases	Wu et al. (2019), Kovács et al. (2017), Dai et al. (2010), Fiasson (1982)
Fomitiporia punicata Y.C. Dai, B.K. Cui & Decock	North China, Central Asia?	-	antitumor	Wu et al. (2019)
Fomitiporia rhamnoides T.Z. Liu & F. Wu	North China, Central Asia	-	antitumor	Wu et al. (2019)
Fomitiporia robusta (P. Karst.) Fiasson & Niemelä	Europe, West Asia	hispidin, hypholomin B, 3,14'-bishispidinyl, melanin, tryptamine, L-tryptophan // (phenolic acids)	antibacterial, antioxidant, xanthine oxidase inhibitory, antitumor, cytotoxic, genoprotective, immunostimulatory, anti-inflammatory	Badalyan & Gharibyan (2020), Wu et al. (2019), Kovács et al. (2017), Fiasson (1982)
Fomitiporia subhippophaeicola B.K. Cui & Hong Chen	West China, Central Asia	-	antitumor	Wu et al. (2019)
Fomitiporia subrobusta B.K. Cui & Hong Chen	Southwest China	-	antitumor	Wu et al. (2019)
Fomitiporia subtropica B.K. Cui & Hong Chen	South China	-	treating coronary artery disease	Wu et al. (2019)
Fomitiporia tenuitubus L.W. Zhou	South China	-	antitumor	Wu et al. (2019)
Fomitiporia texana (Murrill) Nuss	Southwest USA	-	antitumor	Wu et al. (2019)
Fomitiporia torreyae Y.C. Dai & B.K. Cui	East Asia	-	treating coronary artery disease	Wu et al. (2019)
Fulvifomes aureobrunneus (J.E. Wright & Blumenf.) Y.C. Dai & F. Wu	Argentina	(sesquiterpenes)	antibacterial, antifungal, antimicrobial	Azeem et al. (2018), Ranadive et al. (2013)
Fulvifomes coffeatoporus (Kotl.	USA	-	antimicrobial	Ranadive et al. (2013)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
& Pouzar) Y.C. Dai & F. Wu				
Fulvifomes crocatus (Fr.) Y.C. Dai & F. Wu	Mexico	(sesquiterpenes)	antibacterial, antifungal, antioxidant	Azeem et al. (2018)
Fulvifomes fastuosus (Lév.) Bondartseva & S. Herrera	Singapore, (most probably in tropical Asia)	drosophilin A, drosophilin A methyl ether	antimicrobial	Wu et al. (2019), Ranadive et al. (2013), Singh & Rangaswami (1966)
Fulvifomes grenadensis (Murrill) Murrill	Neotropics and Africa	-	antimicrobial	Ranadive et al. (2013)
Fulvifomes lloydii (Cleland) Y.C. Dai & X.H. Ji	Australia, New Zealand, Southeast Asia	(sesquiterpenes)	antibacterial, antifungal	Azeem et al. (2018)
Fulvifomes luteoumbrinus (Romell) Y.C. Dai & Vlasák	Brazil to South USA	-	antimicrobial	Ranadive et al. (2013)
Fulvifomes mcgregorii (Bres.) Y.C. Dai	Southeast Asia	-	antitumor, improving immunity	Wu et al. (2019)
Fulvifomes merrillii (Murrill) Baltazar & Gibertoni	Philippines, (most probably in Southeast Asia)	hispidin, hispolon, inotilone	α-glucosidase inhibitory, aldose reductase inhibitory, antioxidant, hepatoprotective, antibacterial, antidiabetic, antifungal, anticancer	He et al. (2021), Dong et al. (2019), Azeem et al. (2018)
Fulvifomes minutiporus (Bond. & Herrera) Y.C. Dai & F. Wu	Cuba	-	antimicrobial	Ranadive et al. (2013)
Fulvifomes rimosus (Berk.) Fiasson & Niemelä	Mediterranean and Black Sea areas, Africa, Asia, Australia	hispidin, hypholomin B, 3,14'-bishispidinyl // (polysaccharides)	invigorating qi, replenishing the blood, improving immunity, antitumor, antioxidant, anti-inflammatory, hepatoprotective, antibacterial, antifungal, immunomodulatory, antineoplastic, antiparasitic, anti-obesity, hypolipidemic	Wu et al. (2019), Azeem et al. (2018), Ganesan & Xu (2018), Rony et al. (2014), Silva et al. (2009), Fiasson (1982)
Fulvifomes robiniae (Murrill) Murrill*	USA, Asia?	benzoate, salicylate, drosophilin A methyl ether	-	Watling & Harper (1998), Butruille & Dominguez (1972)
Fulvifomes swieteniae Murrill	Central America and Florida of USA	-	antibacterial, antimicrobial	Azeem et al. (2018), Ranadive et al. (2013)
Fulvifomes xylocarpicola T. Hatt., Sakay. & E.B.G. Jones	Thailand	fulvifomins A–C, 6-deoxydetigloyl-swietenine acetate, methyl angolensate	antimalarial, antitubercular	Isaka et al. (2021)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
Fuscoporia contigua (Pers.) G. Cunn.	Northern Hemisphere	hispidin, hypholomin B	antioxidant	Azeem et al. (2018), Fiasson (1982)
Fuscoporia ferrea (Pers.) G. Cunn.	Northern Hemisphere	hispidin, hypholomin B	-	Fiasson (1982)
Fuscoporia ferruginosa (Schrad.) Murrill*	cosmopolitan	hispidin, hypholomin B, gallic acid, caffeic acid, syringic acid, muscimol, phelligrin A, 3,4-dihydroxybenzaldehyde, baumin, phellinulins M and K, phelligridins C and J, 2(S)-hydroxyalbicanol-11-acetate, inoterpene B // (total polysaccharides)	antibacterial, antioxidant	Chaharmiri-Dokhaharani et al. (2021), Fiasson (1982)
Fuscoporia gilva (Schwein.) T. Wagner & M. Fisch. = *Phellinus gilvus* (Schwein.) Pat.	America, Asia	ebricoic acid, trametenolic acid, gilvsins A–D, 24-methylenelanost-8-ene-3β,22-diol, 3,4-dihydroxyb, enzalacetone, hydroxycinnamic acid, phellibaumin D, interfungin B, phelligridimer A, inoscavin A, protocatechuic acid, protocatechualdehyde // (polysaccharides, phenylpropanoids; total phenol, flavonoid, carbohydrate, and triterpene contents)	reinforcing the spleen, eliminating dampness, promoting digestion, antitumor, improving immunity, vasodilating, antibacterial, hepatoprotective, antioxidant, antifungal, anti-inflammatory, treating rheumatism, anticancer, ACE[c] inhibitory	Zhang et al. (2022), He et al. (2021), Huo et al. (2020), Sunthudlakhar et al. (2019), Wu et al. (2019), Azeem et al. (2018), Hai Bang et al. (2014), Chang et al. (2011), Dai et al. (2010), Liu et al. (2009)
Fuscoporia griseopora (Reid) Y.C. Dai & F. Wu	Costa Rica	-	antimicrobial	Ranadive et al. (2013)
Fuscoporia rhabarbarina (Berk.) Groposo, Log.-Leite & Góes-Neto	South America, subtropical and tropical Asia	phellibarins A–D, ergosterol peroxide, 5α,6α,8α,9α-diepoxyergost-22-en-3β,7α-diol, 14α-hydroxyergosta-4,7,9(11),22-tetraen-3,6-dione, ergosta-4,7,22-trien-3,6-dione, (22E,24R)-ergosta-7,22-dien-3β,5α,6β-triol	antitumor, anti-inflammatory, antioxidant	He et al. (2021), Azeem et al. (2018), Chen & Liu (2017)
Fuscoporia torulosa (Pers.) T. Wagner & M. Fisch	Europe, Asia	fuscoporic acid, inoscavin A, Z-inoscavin A, 3,4-dihydroxy benzaldehyde, osmundacetone,	cytotoxic, synergistic, antioxidant, antibacterial, anticholinesterase, tyrosinase inhibitory,	Dimitrova-Shumkovska et al. (2022), Béni et al. (2021), Deveci et al. (2019a), Covino et al. (2019), Wu et al. (2019),

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		senexdiolic acid, ergosta-7,22-diene-3-one, natalic acid, torulosic acid, albertic acid, pomacerone, 5α,8α-epidioxyergosta-6,22-dien-3β-il-palmitate, ergosta-4,6,8(14),22-tetraen-3-one, ergosterol peroxide, oleanolic acid, oleanonic acid, 28-norolean-12-en-3β-ol, javeroic acid, β-sitosterol, 2,3-dihydroxy cinnamic acid, 3,4-dihydroxy benzaldehyde, 4-(3,4-dihydroxyphenyl)but-3-en-2-one, hispidin, hypholomin B, 3,14'-bishispidinyl, anthocyanin, 3,5-dichloro-p-anisyl alcohol // (tannins, proanthocyanidins, flavonoids)	xanthine oxidase inhibitory, antifungal, detoxification, treating anemia	Azeem et al. (2018), Khadhri et al. (2017), Kovács et al. (2017), Swarts et al. (1997), González et al. (1994), Fiasson (1982)
Fuscoporia viticola (Schwein.) Murrill	Northern Hemisphere	hispidin, hypholomin B	-	Fiasson (1982)
Hydnoporia corrugata (Fr.) K.H. Larss. & Spirin = *Hymenochaete corrugata* (Fr.) Lév.	Northern Hemisphere	chloromethane	-	Watling & Harper (1998)
Hymenochaete cruenta (Pers.: Fr.) Donk = *Hymenochaete mougeotii* (Fr.) Cooke	Europe, Asia	hymenoquinone, hispidin	-	Fiasson (1982)
Hymenochaete luteobadia (Fr.) Höhn. & Litsch.	tropical America and Africa	hispidin	-	Fiasson (1982)
Hymenochaete microcycla (Zipp. ex Lév.) Spirin & Miettinen = *Hymenochaete porioides* T. Wagner & M. Fisch.	tropical Asia and America, Oceania	-	antitumor	Wu et al. (2019)
Hymenochaete pinnatifida Burt	North America	hymenoquinone, hispidin	-	Fiasson (1982)
Hymenochaete rheicolor (Mont.) Lév. = *Hymenochaete sallei* Berk. & M.A.	North and South America, Asia	hispidin	immunomodulatory, antineoplastic, antiparasitic	Silva et al. (2009), Fiasson (1982)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
Curtis				
Hymenochaete rubiginosa (Dicks.) Lév.*	Northern Hemisphere, Oceania	hispidin, protocatechuic acid, fumaric acid, gallic acid, caffeic acid, vanillin, p-coumaric acid, rosmarinic acid	antioxidant, anticholinesterase, antibacterial, antifungal	İnci et al. (2022), Çayan et al. (2021b), Fiasson (1982)
Hymenochaete setipora (Berk.) S.H. He & Y.C. Dai	Indonesia, Australia	homovanillic acid, protocatechualdehyde, protocatechuic acid, vanillin, chlorogenic acid, gallic acid, 3,4-dihydroxybenzoic acid, p-coumaric acid, vanillic acid, veratric acid, abscisic acid, rutin	antibacterial, antioxidant	Tamrakar et al. (2017, 2016)
Hymenochaete xerantica (Berk.) S.H. He & Y.C. Dai = *Inonotus xeranticus* (Berk.) Imazeki & Aoshima	Asia	hispidin, 3,14'-bishispidinyl, hypholomin B, 1,1-distyrylpyrylethan, phelligridins D and F, inoscavins A–E, methylinoscavins A–D, interfungins A–C, davallialactone, methyldavallialactone	antioxidant	Lee & Yun (2011), Dai et al. (2010)
Hymenochaete sp.	-	-	antibacterial	Nurdiansyah et al. (2021)
Inocutis dryophila (Berk.) Fiasson & Niemelä	Northern Hemisphere	hispidin, hypholomin B	-	Fiasson (1982)
Inocutis levis (P. Karst.) Y.C. Dai	Central and West Asia, North Africa, South Europe (Italy)	ascorbic acid, catechin, caffeic acid, resorcinol, syringic acid, vanillic acid, p-coumaric acid, salicylic acid, quercetin, galactan, demethylincisterol A3, cerevisterol, ergosterol peroxide, ergosterol, hydroxy octadecadienoic acid, octadecanoic acid (stearic acid), linoleic acid, 9-octadecenoic acid Z (oleic acid), chlorogenic acid, gallic acid, veratric acid, chavicol, cinnamic acid, 3-hexyloxy-4-hydroxybenzaldehyde, 4-hydroxybenzaldehyde, hispidin,	antitumor, antidiabetic, antibacterial, antioxidant, improving insulin resistance and glucose tolerance, potential to control hypertriglyceridemia	Moghaddam et al. (2024), Chaharmiri-Dokhaharani et al. (2024, 2020), Wu et al. (2019), Ehsanifard et al. (2019, 2017), Vinogradov & Wasser (2005)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		inonotins C and H, inotilone, phaeolschidin E, phellinulins B and M, phelligridin A, 1-phenylhept-3-en-4-one, 1-phenylheptane-1,5-dione, ribisin B, N-(4-chlorophenyl)-N-(phenylmethyl)-benzenemethanamine, 1-methyl-1-ethylcyclohexane, 2-methyl-3-decen-5-one, ethyl linoleate, 1-ethyl-2-methylcyclohexane, ethyl oleate, ergosta-7,22-dien-3-ol, ergosta-5,7,22-trien-3-ol, hexadecanoic acid, hexadecanoic acid ethyl ester, hexadecanoic acid methyl ester, 8,11-octadecadienoic acid methyl ester, 9-octadecenoic acid (Z)- methyl ester, (Z,Z)-9,12-octadecadienoic acid, octadecanoic acid methyl ester		
Inocutis rheades (Pers.) Fiasson & Niemelä *	Northern Hemisphere	hispidin, hypholomin B, chloromethane, inotodiol, lanosterol, ergosterol peroxide, lupeol, betulin, betulinic acid, betulone, betulonic aldehyde, betulinic aldehyde	haemostasis, analgesic, treating hemorrhoids, antitumor, antioxidant, α-glucosidase inhibitory	Borovskii et al. (2022), Wu et al. (2019), Olennikov et al. (2017), Watling & Harper (1998), Fiasson (1982)
Inocutis tamaricis (Pat.) Fiasson & Niemelä	South Europe, North Africa, Asia	hispidin, hypholomin B, Fr-I, Fr-II	haemostasis, analgesic, treating hemorrhoids, antioxidant, antitumor	Wu et al. (2019), Zheng et al. (2014), Fiasson (1982)
Inonotus andersonii (Ellis & Everh.) Černý	North America, 'Armenia'[a]	chloromethane, hispidin	antibacterial, antioxidant, ACE[c] inhibitory	Sujarit et al. (2021), Hai Bang et al. (2014), Watling & Harper (1998)
Inonotus clemensiae Murrill	tropical Asia	hispidin	antibacterial, antioxidant	Sujarit et al. (2021), Tamrakar et al. (2017, 2016)
Inonotus cuticularis (Bull.) P. Karst	Northern Hemisphere	chloromethane, hispidin, caffeic acid, ellagic acid, gallic acid, p-coumaric	haemostasis, antitumor, antibacterial, antifungal,	Chaharmiri-Dokhaharani et al. (2024), Wu et al. (2019),

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		acid, salicylic acid, vanillic acid, veratric acid, baumin, cinnamic acid, daedalin A, 3,4-dihydroxybenzalacetone, inonotins C and H, inotilone, inonotusic acid, inonotsudiol A, phellifuropyranone A, phellinulin B, phelligridin D, 1-phenylhept-3-en-4-one, 4-methyl-1-decene, 2-methyl-3-decen-5-one, docosane, dodecane, eicosane, 1-ethyl-1-methylcyclohexane, ergosta-5,7,22-trien-3-ol, 2-furanglycolic acid, heneicosane, heptadecane, hexacosane, hexadecane, hexadecanoic acid methyl ester, linoleic acid, 7-methoxy-2-methylisoquinoline-3,5,8-trione, nonadecane, octadecane, 3-ethyl-5-(2-ethylbutyl)-octadecane, 8,11-octadecadienoic acid methyl ester, 9-octadecenoic acid (Z)- methyl ester, (Z)-9,17-octadecadienal, octadecanoic acid methyl ester, pentacosane, tricosane, tridecane, tetradecane, tetracosane, undecane	antioxidant	Tamrakar et al. (2017), Watling & Harper (1998)
Inonotus hispidus (Bull.) P. Karst*	Northern Hemisphere	myricetin, (4S,5S)-4-hydroxy-3,5-dimethoxycyclohex-2-enone, 3,14'-bishispidinyl, hypholomin B, oxalic acid, formic acid, acetic acid, butyric acid, vanillic acid, paraoxybenzoic acid, obliquequinic acid,	antitumor, haemostasis, promoting (improving) digestion, activating the circulation to remove blood stasis, antibacterial, antioxidant, anti-hyperglycemic, immunomodulatory,	Liu et al. (2024), Bao et al. (2023), Khojimatov et al. (2023), Wu et al. (2019), Angelini et al. (2019), Yang et al. (2019), Olennikov et al. (2014), Lee & Yun (2011), Watling & Harper (1998), Fiasson (1982)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		inonotic acid, hydroxyphenolcarboxylic acids, ergosterol, lanesterol, inotodinol, humins, resins, inonophenols A−C, inonoterpene A, 4-(3′,4′-dihydroxyphenyl)-2-butanone, (E)-4-(3′,4′-dihydroxyphenyl)but-3-en-2-one, hispolon, hispidin, xylaritriol, 3β-hydroxylanosta-8,24-dien-21-al, 24-methylenelanost-8-en-3β-ol, cerevisterol, ergosterol peroxide, (22E,24R)-ergosta-7,22-diene-3β,5α,6β,9α-tetrol, 3β-O-glucopyranosylergosta-5,7,22-triene, chloromethane, hispindic acids A and B, inonotusins A and B, dodecanoic acid, tetradecanoic acid, pentadecanoic acid, hexadecanoic acid, heptadecanoic acid, octadecanoic acid, eicosanoic acid, heneicosanoic acid, docosanoic acid, tricosanoic acid, tetracosanoic acid, C16:1 ω5, C16:1 ω7, C18:1 ω9, C20:1 ω11, C22:1 ω11, C18:2 ω6, β-glucans, quinines of oxyphenolcarboxylic acids, pterins, lignin, fiber, N-butylbenzenesulfonamide, lauramidopropyl betaine, 3,5-di-tert-butyl-4-hydroxybenzaldehyde, uplandicine, coumestrol, psoralen	treatment of candidiasis, antiviral, hypolipidemic, anti-inflammatory, antiproliferative, antifungal, immunostimulatory, neurotrophic, neuroprotective, sedative effects	
Inonotus nidus-pici Pilát	Europe, Iran	citropremide, 3,4-dihydroxybenzalacet	antimicrobial, antioxidant,	Garádi et al. (2021), Fiasson (1982)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		one, lanosterol, ergost-6,8,22-trien-3β-ol, ergosterol peroxide, hispidin, hypholomin B, lanostane	antiproliferative	
Inonotus obliquus (Fr.) Pilát	Northern Hemisphere	4-hydroxy-3,5-dimethoxy benzoic acid 2-hydroxy-1-hydroxymethyl ethyl ester, trametenolic acid, inonolactones E–H, inonotsuoxides A and B, inonotsutriols A–C, ergosterol, (3β,22R,23E)-lanosta-8,23-diene-3,22,25-triol, (3β,22R,23E)-lanosta-7,9(11),23-triene-3,22,25-triol, inoterpenes A–F, inonotsulides A–C, (3β,22R,25E)-lanosta-8,23-diene-triol, (3β,22R,25E)-lanosta-7:9(11),23-triene-triol, inonotusic acid, inonotsudiol A, inonotsuoxodiol A spiroinonotsuoxodiol, ergosterol peroxide, inonotusols A–G, inonoblins B and C, 3β-hydroxylanosta-8,24-dien-21-al, lanosterol-3β-hydroxylanosta-8,24-diene, inotodiol, β-hydroxylanosta-8,24-dien-21-oic acid, 3β,22,25-trihydroxylanosta-8,23-diene, 3β,22-dihydroxylanosta-8,24-dien-7-one, 3β-hydroxylanosta-8,24-diene-21,23-lactone, 21,24-cyclopentalanost-8-ene-3β,21,25-triol, lanost-8-ene-3β,22,25-triol, inonotsutriols D and E, chagabusone, betulin, lupeol, lupenon, fuscoporianol A–C,	neuroprotective, improving immunity, antitumor, anticancer, antimicrobial, antioxidant, antiproliferative, anti-inflammatory, antidiabetic, hypoglycemic, cytotoxic and/or apoptotic, α-glucosidase inhibitory	Khojimatov et al. (2023), Ern et al. (2023), Zou et al. (2020), Duru et al. (2019), Wu et al. (2019), Chen & Liu (2017), Zhao et al. (2015), Balandaykin & Zmitrovich (2015), Ying et al. (2014), Nguyen et al. (2013), Lee & Yun (2011), Handa et al. (2010), Nakata et al. (2009), Kim et al. (2008a), Nakajima et al. (2007), He et al. (2001), Shin et al. (2000), Watling & Harper (1998)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		ergosterol, sitosterol, stigmasterol, chloromethane, ergothionein, inotolactones A and B, inotolactone C, 3β-hydroxy-25,26,27-trinorlanosta-8,22E-dien-24-oic acid, inonotusanes A–C, 17-hydroxy-ent-atisan-19-oic acid, phelligridins D, E, G, and I, anthocyanin, β-glucan, lectins, melanin, hemicellulose, cellulose, oxalic acid, gallic acid, protocatechuic acid, p-hydroxybenzoic acid, homogentisic acid, ferulic acid, quercetin, naringin, resveratrol, kaempferol		
Inonotus rickii (Pat.) D.A. Reid	tropical America, Asia, South Europe	inonotic acid A, 3-O-formyl inonotic acid A, 3α,6α-hydroxycinnamolide, 3α,6β-dihydroxycinnamolide // (exopolysaccharides)	cytotoxic, increasing motor activity of smooth muscles and stimulating synapses, activity on human colon cancer cells, neurotrophic, antioxidant	Huang & Valiante (2022), Ranadive et al. (2021), Bai et al. (2020), Duru & Çayan (2015), Chen et al. (2014)
Inonotus sideroides (Lév.) Ryvarden = *Coltricia sideroides* (Lév.) Teng	China	brasilanes A–C, colisiderin A, 7(E),9(E)-undecandiene-2,4,5-triol	cytotoxic	Hu et al. (2015)
Inonotus sp. (mainly the isolates BCC 22670 and BCC 23706)	-	inonoalliacanes A–I, inonofarnesane, inonotins A–L, isohispidin	antibacterial, antiviral	Dai et al. (2021), Isaka et al. (2017, 2015), Lee & Yun (2011)
Meganotus everhartii (Ellis & Galloway) Y.C. Dai, F. Wu, L.W. Zhou, Vlasák & B.K. Cui* = *Phellinus everhartii* (Ellis & Galloway) A. Ames	North America	protocatechuic acid // (total phenol, flavonoid, carbohydrate, and triterpene contents)	antioxidant, antibacterial	Sunthudlakhar et al. (2019)
Mensularia nodulosa (Fr.) T. Wagner & M. Fisch	Europe, West Asia	hispidin, hypholomin B	-	Fiasson (1982)
Mensularia radiata (Sowerby) Lázaro Ibiza*	Northern Hemisphere	hispidin, hypholomin B, gallic acid, p-hydroxybenzoic acid, catechin hydrate,	antitumor, antioxidant, anticholinesterase, antidiabetic	Çayan et al. (2021a), Titilawo et al. (2020), Girometta et al. (2020),

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		6,7-dihydroxycoumarin, p-coumaric acid, coumarin, trans-2-hydroxycinnamic acid, ellagic acid, rosmarinic acid, trans-cinnamic acid, 17-(2-hydroxy-1,5-dimethyl-hex-4-enyl)-4,4,10,13,14-pentamethyl-2,3,4,5,6,7,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta[a]phenanthrene, ergosterol, tetradecanoic acid, pentadecanoic acid, hexadecanoic acid, heptadecanoic acid, octadecanoic acid, eicosanoic acid, heneicosanoic acid, docosanoic acid, tricosanoic acid, (also C16:1 ω5, C16:1 ω7, C18:1 ω9, C20:1 ω11, C22:1 ω11, C18:2 ω6), cholesterol, β-sitosterol, sitostanol, stigmasterol, ergosta-7,22-dien-3β-ol, fungisterol, ergosterol peroxide, hemoproteid peroxidase, α-glucans, β-glucans, vitamins A and C		Wu et al. (2019), Olennikov et al. (2014), Kahlos et al. (1989b), Kahlos & Hiltunen (1988), Fiasson (1982), Lobarzewski (1977)
Neomensularia kanehirae (Yasuda) F. Wu, L.W. Zhou & Y.C. Dai = *Inonotus sinensis* Teng	East Asia	inonotolides A–C	-	Ding et al. (2019, 2018)
Nothophellinus andinopatagonicus (J.E. Wright & J.R. Deschamps) Rajchenb. & Pildain*	Argentina, Chile	β-glucans	antifungal, cytotoxic, anticarcinogenic	Albornoz et al. (2022), Aqueveque et al. (2010)
Ochrosporellus taiwanensis (Sheng H. Wu et al.) Y.C. Dai & F. Wu	East China	(polysaccharides)	treating acute leukemia	Chao et al. (2018)
Onnia leporina (Fr.) H. Jahn	temperate and boreal zones of Northern Hemisphere	chloromethane	-	Watling & Harper (1998)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
Onnia tomentosa (Fr.) P. Karst*	Northern Hemisphere	hispidin, hypholomin B	antimicrobial	Ranadive et al. (2013), Fiasson (1982)
Onnia triquetra (Pers.) Imazeki	Europe, North America	hispidin, hypholomin B	-	Fiasson (1982)
Onnia vallata (Berk.) Y.C. Dai & Niemelä	Asia	-	antitumor	Wu et al. (2019)
Phellinidium ferrugineofuscum (P. Karst.) Fiasson & Niemelä*	boreal zone of Northern Hemisphere	hispidin, 3,14'-bishispidinyl	-	Fiasson (1982)
Phellinopsis conchata (Pers.) Y.C. Dai* = *Phellinus conchatus* (Pers.) Quél.	Northern Hemisphere	hispidin, hypholomin B	antioxidant, xanthine oxidase inhibitory, promoting blood circulation, detoxification, improving immunity, antitumor, antibacterial, ACE[c] inhibitory	Wu et al. (2019), Kovács et al. (2017), Tamrakar et al. (2017), Hai Bang et al. (2014), Fiasson (1982)
Phellinus ellipsoideus (B.K. Cui & Y.C. Dai) B.K. Cui, Y.C. Dai & Decock	South China	fomitiporiaester A, protocatechuic acid, (E)-4-(3,4-dihydroxyphenyl)but-3-en-2-one, inoscavins A, C, and E, phelligridin K, inonoblin B, protocatechualdehyde, hispidin, hispolon	antioxidant, antitumor	Wu et al. (2019), Li et al. (2017)
Phellinus igniarius (L.) Quél* = *Phellinus trivialis* (Bres.) Kreisel	Europe, Asia	PIP-1, PIP60-1, PSeP, PPI, PISP1, hispidin, 3,14'-bishispidinyl, benzoate, salicylate, 12-hydroxy-7-oxo-5,8,11,13-tetraene-18,6-abietanolide, 3-hydroxy-2-methyl-4-pyrone, 2,5-bis(4,7-dihydroxy-8-methyl-2-oxo-2H-chromen-3-yl)cyclohexa-2,5-diene-1,4-dione, inonoblin C, tryptamine, L-tryptophan, ellagic acid, eburicoic acid, cycloeucalenol, lupeol, botulin, 23-hydroxybetulinic acid, 3β-acetyloleanolic acid, naringenin, sakuranetin, aromadendrin, folerogenin, scopoletin, syringic acid, protocatechin,	antioxidant, xanthine oxidase inhibitory, haemostasis, antitumor, antibacterial, anti-fatigue, anti-inflammatory, immunomodulatory, hepatoprotective, lowering blood glucose (hypoglycemic), low-density lipoprotein (LDL) antioxidant, antimicrobial, anticancer, antiviral, antidiabetic, reduces hyperglycemia and normalizes insulin levels, anti-arthritis, stimulate the synthesis of y-interferon, strengthening immunity, vasodilating, cytotoxic, promoting blood circulation, reinforcing the	Le et al. (2024), Khojimatov et al. (2023), Zhang et al. (2022), Li et al. (2022), Çayan et al. (2021b), Dai et al. (2021), He et al. (2021), Sujarit et al. (2021), Wu et al. (2019), Azeem et al. (2018), Chen & Liu (2017), Kovács et al. (2017), Yin et al. (2014), Dai et al. (2010), Wu et al. (2010), Wang et al. (2006), Mo et al. (2004), Watling & Harper (1998), Fiasson (1982)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		caffeic acid, isoergosterone, phelligrins A and B, 'phelilgreen B', eriodictyol, methylfeligrins A and B, epi-methylfeligrins A and B, 7,3'-dihydroxy-5'-methoxyisoflavone, taxifolin, phellinsin A, phelligridins A, B, C, D, E, G, H, I, and J, phellinusfurans A and B, inotilone, 2,5-dihydroxymethylfuran, 2-hydroxymethyl-5-methoxymethylfuran, 5-hydroxymethyl-2-furaldehyde, hispolon, phellinignins A–C, phellinignin D, 11,12-epoxy-12β-hydroxy-1-tremulen-5-one, conocenols A and B, davallialactone, phelligridimer A, nepetidin, gilvsins A and C, sulfurenic acid, betulic acid, igniarens A–D, 5α,8α-epidioxy-22E-ergosta-6,22-dien-3β-ol, (+)-(2S,3R,6S,7S)-tremul-1(10)-ene-2,12-diol, 12-hydroxy-α-cadinol, (−)-(2S,3S,6S,7S,9R)-tremul-1(10)-ene-11,12,14-triol, (−)-(2S,3S,6S,7S,9S)-tremul-1(10)-ene-11,12,15-triol, (+)-(3S,6R,7R)-tremulene-6,11,12-triol, (+)-(3S,6S,7S,10S)-tremulene-10,11,12-triol, (+)-(3S,6R,7R,10S)-tremulene-6,10,12-triol, (−)-(2R,3S,6S,7S,9R)-	spleen, anticholinesterase, inhibiting the nuclear factor-κB (NF-κB), cardioprotective, vascular-relaxing, elastase inhibitory, antiplasmodial, anti-gout	

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		tremul-1(10)-ene-11,12,14-triol, (−)-(2S,3S,4S,6S,7S)-tremul-1(10)-ene-4,11,12-triol, (−)-(2S,3R,6S,7S)-tremul-1(10)-ene-2,12-diol, 11,12-dihydroxy-7β-peroxy-hydroxyl-tremul-1(10)-ene, 12,15-dihydroxy-tremulene, 3α,6α-dihydroxyspiroax-4-ene, (+)-(1R,6S,7S)-tremul-2-ene-12(11)-lactone, 3S,4S,9R,10S-11,12,14-trihydroxydrimene, 3S,9R,10S-3-hydroxy-11,12-O-isopropyldrimene, 3S,9R,10S-3,11,12-trihydroxydrimene, eudesm-1β,6α,11-triol, 12-hydroxy-a-cadinol, 3α,12-dihydroxy-δ-cadinol, 2-furoate, cinnamate, fumaric acid, p-coumaric acid, ferulic acid, trans-cinnamic acid, meshimakobnol A and B, inoscavin A, 7,8-dihydroxycoumarin, 3,4-dihydroxybenzalacetone, inoscavin C, osmundacetone, igniarine, tremulenediols A–C, phellinols A, B, G, and F, naphthalenes A and B, ergosterol, ergosterol peroxide, 5α-ergosta-7,22-dien-3-one, 3,17,20-trihydroxy-4-methylpregn-8-en-7-one, phellinignincisterols A–C, 5α,6β-dihydroxy-daucosterol, ergosta-4,6,8(14),22-tetraen-3-one, 3α,17α,19,20-		

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		tetrahydroxy-4α-methylpregn-8-ene, 3α,12α,17α,20-tetrahydroxy-4α-methylpregn-8-ene, daucosterin, 8,9-epoxyergosta-5,22-dien-3β,15-diol, 6β,12-dihydroxy-tremulene, 10β,12-dihydroxy-tremulene, 6β,11,12-trihydroxy-tremul-1(10)-ene		
Phellinus laevigatus (P. Karst.) Bourdot & Galzin	Europe, Asia	hispidin, 3,14'-bishispidinyl, benzoate	antitumor, improving immunity	Dai et al. (2010), Watling & Harper (1998), Fiasson (1982)
Phellinus lundellii Niemelä	Northern Hemisphere	hispidin, 3,14'-bishispidinyl, benzoate, salicylate, 2-furoate	antitumor, improving immunity	Wu et al. (2019), Watling & Harper (1998), Fiasson (1982)
Phellinus monticola L.W. Zhou & Y.C. Dai	West China, Central Asia	-	haemostasis, antitumor	Wu et al. (2019)
Phellinus mori Y.C. Dai & B.K. Cui	North China	PM-EPS1, PM-EPS3	antioxidant	Wu et al. (2019), Cao et al. (2013)
Phellinus nigricans (Fr.) P. Karst	boreal zone of Northern Hemisphere	benzoate, salicylate, protocatechuic acid // (total phenolic, flavonoid, carbohydrate, and triterpene contents)	antioxidant, antibacterial, antiproliferative, immunostimulatory, anti-inflammatory	Zeb & Lee (2021), Sunthudlakhar et al. (2019), Watling & Harper (1998)
Phellinus nilgheriensis (Mont.) G. Cunn.	India, tropical Asia	inoscavin A, meshimakobnol A	-	Le et al. (2024)
Phellinus orientoasiaticus L.W. Zhou & Y.C. Dai	West China, Central Asia	(cyclohumulanoid sesquiterpenes, total polysaccharides, flavonoids, and triterpenoids)	antitumor, antioxidant, improving immunity	Zhang et al. (2024), Pham et al. (2022), Wu et al. (2019)
Phellinus padicola L.W. Zhou & Y.C. Dai	West China	-	antitumor, haemostasis	Wu et al. (2019)
Phellinus parmastoi L.W. Zhou & Y.C. Dai	China, Central Asia	-	antitumor, improving immunity	Wu et al. (2019)
Phellinus piceicola B.K. Cui & Y.C. Dai	West China	-	antitumor, haemostasis	Wu et al. (2019)
Phellinus pomaceus (Pers.) Maire = *Phellinus tuberculosus* Niemelä	Europe, Asia	β-boswellic acid, friedelin, taraxerol, ursolic acid, senexdiolic acid, hispidin, inotilone, phellifuropyranone A, phelligridins C, D, and H, flavogallonic acid dilactone, phaeolschidins A–C, embinin,	antioxidant, xanthine oxidase inhibitory, antibacterial, no cytotoxic effects on normal human fibroblast cells, antitumor, improving immunity	Le et al. (2024), Khojimatov et al. (2023), Dai et al. (2021), Chaharmiri-Dokhaharani et al. (2021), He et al. (2021), Azeem et al. (2018), Chen & Liu (2017), Kovács et al. (2017), He et al. (2015, 2014),

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		methylinoscavin D, chloromethane, methyl chloride, javeroic acid, phellinic acid, pomacerone, tryptamine, L-tryptophan, serotonin, 3,4-dihydroxyphenylacetic acid, protocatechuic acid, 3,14'-bishispidinyl, gallic acid, caffeic acid, syringic acid, veratric acid, ellagic acid, benzoate, salicylate, 2-furoate, phellinuins A–G, phellinuin J, inoscavin A, meshimakobnol A // (steroids, polysaccharides)		Dai et al. (2010), Watling & Harper (1998), Fiasson (1982), White (1982)
Phellinus populicola Niemelä	Europe	benzoate	-	Watling & Harper (1998)
Phellinus pseudolaevigatus Parmasto = cf. *Phellinus orienticus* Parmasto	East Russia	benzoate, salicylate	-	Watling & Harper (1998)
Phellinus setulosus (Lloyd) Imazeki	topical Asia	-	antitumor, improving immunity	Dai et al. (2010)
Phellinus tremulae (Bondartsev) Bondartsev & P.N. Borisov	temperate zone of Northern Hemisphere	tremulenolides A and B, tremulenedial, tremulenedial dibenzyl acetal, tremulenediols A–C, tremuladienol, tremulanes, hispidin, 3,14'-bishispidinyl, 2-carbomethoxyoxepin, 1-carbomethoxybenzene 1,2-oxide, benzoate, salicylate, methyl salicylate, 7-phenylheptan-3-ones, 1-phenylheptane-1,5-dione	antioxidant, xanthine oxidase inhibitory, antitumor, improving immunity	Dai et al. (2021), He et al. (2021), Azeem et al. (2018), Kovács et al. (2017), Dai et al. (2010), Ayer et al. (1999), Watling & Harper (1998), Ayer & Cruz (1995, 1993), Ballini & Bosica (1994), Fiasson (1982), Serck-Hanssen & Wikström (1978)
Phellinus yucatanensis (Murrill) Imazeki	?	drosophilin A methyl ether	-	Hsu et al. (1971)
Phellinus sp.	-	SHIP-1 and 2, interfungins A–C, phellinins A–C, phellinins A1 and A2, phellinol,	immunomodulatory, antioxidant, anti-inflammatory, β-glucosidase inhibitory, HIV-1	Zhang et al. (2022), He et al. (2021), Lee & Yun (2011)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		senexonol, trametenolic acid B, ergosta-4,6,8(14),22-tetraen-3-one, cyclophellitol, hispidin, hispolon, 4-hydroxybenzylideneacetone	integrase inhibitory, antiviral	
Phellopilus nigrolimitatus (Romell) Niemelä, T. Wagner & M. Fisch.* = *Phellinus nigrolimitatus* (Romell) Bourdot & Galzin	temperate and boreal zones of Northern Hemisphere	hispidin, 3,14'-bishispidinyl	antibacterial, antioxidant, xanthine oxidase inhibitory	Kovács et al. (2017), Fiasson (1982)
Phylloporia boldo Rajchenb. & Pildain	Andean-Patagonian area	drosophilin A, drosophilin A methyl ether, chloroneb	-	Riquelme et al. (2020)
Phylloporia fontanesiae L.W. Zhou & Y.C. Dai	subtropical China	-	anti-inflammatory	Cheng et al. (2023)
Phylloporia lonicerae W.M. Qin, Xue W. Wang, T. Sawahata & L.W. Zhou	East Asia	-	antitumor, anti-inflammatory	Cheng et al. (2023), Wu et al. (2019)
Phylloporia ribis (Schumach.) Ryvarden	Northern Hemisphere	PRP, PRG, PISP1, hispidin, hypholomin B, phelliribsin A, chlorophellin A–C, drosophilin A, benzoate, salicylate, 2-furoate, ribisins A–D, ribisins E–G, phelligridimer A, 3,5-dichloro-p-anisyl alcohol	antitumor, immunomodulatory, neurotrophic, PPAR-γ agonistic, antidiabetic, anti-Alzheimer, antibiotic, neuroprotective	Zhang et al. (2022), He et al. (2021), Azeem et al. (2018), Dai et al. (2010), Watling & Harper (1998), Swarts et al. (1997), Fiasson (1982)
Phylloporia sp.	-	stigmasterol, β-sitosterol, ergosterol, ergosterol-5,8-peroxide, cerevisterol, protocatechuic acid, azelaic acid, palmitic acid, chrysophanic acid, succinic acid, oleic acid, 2-hydroxytetracosanoic acid, docosanoic acid, tricosanoic acid, petroselinic acid, phelliribsin A, phelligridin F, inoscavin B, drosophilin A, chlorophellins A–C, apigenin, naringenin, betulinic acid, hexanal, 2-	antitumor, immunomodulatory, antioxidant, neuroprotective, antidiabetic, antimicrobial, anti-inflammatory	Cheng et al. (2023)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		methylbutanal, 3-methylbutanal, niacin, glucan		
Porodaedalea alpicola S.J. Dai, F. Wu & Y.C. Dai	South Asia	-	antitumor, improving immunity	Wu et al. (2019)
Porodaedalea chinensis S.J. Dai & F. Wu	Southwest China	-	antitumor, improving immunity	Wu et al. (2019)
Porodaedalea chrysoloma (Fr.) Fiasson & Niemelä	Europe, West Asia	methyl (E)-3-(4-methoxycarbonylphenoxy)-acrylate, methyl 3-(4-methoxycarbonylphenoxy)-propionate, ergone, 3β-hydroxyergosta-7,22-diene, ergosterol, hispidin, hypholomin B, 3,14'-bishispidinyl	antioxidant, antibacterial, xanthine oxidase inhibitory, antitumor	Sárközy et al. (2020), Kovács et al. (2017), Dai et al. (2010), Fiasson (1982)
Porodaedalea himalayensis (Y.C. Dai) Y.C. Dai	Southwest China, Central Asia	-	antitumor, improving immunity	Wu et al. (2019)
Porodaedalea laricis (Jacz. ex Pilát) Niemelä = *Phellinus laricis* (Jacz. ex Pilát) Pilát	Europe, Asia	-	antitumor, improving immunity	Wu et al. (2019)
Porodaedalea pini (Brot.) Murrill*	Europe, West Asia	hispidin, hypholomin B, 3,14'-bishispidinyl, 8,14-labdadien-13-ol, dehydroabietic acid, pinillidine, PPE, PPW-1, EP-AV1, EP-AV2, episteryl acetate, (+)-pinoresinol, episterol, ergosterol peroxide, N-(2'-hydroxynonacosanoyl)-D-erythro-1,3,4-trihydroxy-2-aminooctadecane, N-(2'-hydroxytriacontanoyl)-D-erythro-l,3,4-trihydroxy-2-aminooctadecane, 2,4,6-triphenylhex-l-ene, 2-farnesyl-5-methylbenzoquinone, 8-methyl-13-phenyltrideca-4,6,8,10,12-pentaene-3-one, 4-vinylphenol, 4-vinylresorcinol, 4-hydroxystyrene, pentaenone, catechin,	immunomodulatory, anti-inflammatory, xanthine oxidase inhibitory, antiviral, antioxidant, antitumor, improving immunity, antifungal, nitric oxide (NO) production inhibitory, anti blue stain and wood decay fungi, hypoglycemic, cardioprotective	Le et al. (2024), Zhang et al. (2022), He et al. (2021), Azeem et al. (2018), Zhu et al. (2017), Olennikov et al. (2014), Dai et al. (2010), Ayer et al. (1999), Lourenço et al. (1996), Fiasson (1982)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		inoscavin A, meshimakobnol A, dodecanoic acid, tetradecanoic acid, pentadecanoic acid, hexadecanoic acid, heptadecanoic acid, octadecanoic acid, eicosanoic acid, docosanoic acid, tricosanoic acid, tetracosanoic acid, C16:1 ω7, C18:1 ω9, C18:2 ω6 // (alkaloids)		
Porodaedalea yamanoi (Imazeki) Y.C. Dai	Northeast Asia	-	antitumor, improving immunity	Wu et al. (2019)
Pseudoinonotus dryadeus (Pers.) T. Wagner & M. Fisch. *	Northern Hemisphere	cerevisterol, sphingosine, diacylglycerophospholipids	antioxidant, antibacterial, skin protective	Zeb & Lee (2021), Cateni et al. (2015), Harms et al. (2014)
Pyrrhoderma adamantinum (Berk.) Imazeki* = *Phellinus adamantinus* (Berk.) Ryvarden	Southeast Asia	-	treating gastropathy, antibacterial, antioxidant, antimicrobial	Wu et al. (2019), Tamrakar et al. (2017, 2016), Ranadive et al. (2013)
Pyrrhoderma lamaoense (Murrill) L.W. Zhou & Y.C. Dai	Southeast Asia	-	antitumor	Wu et al. (2019)
Pyrrhoderma noxium (Corner) L.W. Zhou & Y.C. Dai = *Phellinidium noxium* (Corner) Bondartseva & S. Herrera, *Pyrrhoderma sublamaensis* (Lloyd) Y.C. Dai & F. Wu	Southeast Asia	2-(3,4-dihydroxy-2-methoxyphenyl)-1,3-benzodioxole-5-carbaldehyde, 4-(3,4-hydroxyphenyl)-3-buten-2-one, 3,4-dihydroxybenzalacetone, 2-(3,4-hydroxy-2-methoxyphenyl)-1,3-benzodioxole-5-carbaldehyde // (total phenol, flavonoid, carbohydrate, and triterpene contents)	antibacterial, antioxidant, antimicrobial	Zhang et al. (2022), He et al. (2021), Sunthudlakhar et al. (2019)
Pyrrhoderma sp.	-	gallic acid, catechin, chlorogenic acid, caffeic acid, luteolin	antibacterial, antioxidant	Munir et al. (2022)
Sanghuangporus alpinus (Y.C. Dai & X.M. Tian) L.W. Zhou & Y.C. Dai	Southwest China, Central Asia	ascorbic acid // (polysaccharide, polyphenol, flavonoid, triterpenoid contents)	antitumor, lowering serum lipids, treating pneumonia, antioxidant	Wang et al. (2023b), Wu et al. (2019)
Sanghuangporus baumii (Pilát) L.W. Zhou & Y.C. Dai	East Asia	ergosterol, ergosterol peroxide, ergosta-7,22-dien-3β-yl pentadecanoate, 24-ethylcholesta-5,22-	antitumor, lowering serum lipids, treating pneumonia, ameliorating endothelial and	Le et al. (2024), Zan et al. (2023), Wang et al. (2023b), Angelini et al. (2022), Zhang et al. (2022), He et al.

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		dien-3β-ol, ergosta-7,22-dien-6β-ethoxy-3β,5α-diol, ergosta-7-en-6β-ethoxy-3β,5α-diol, interfungin A, baicalein, ganoderic acid DM, ergosta-7,22-dien-3β-yl-pentadecanoate, ergosta-7,22-dien-3β-ol, ergosta-6,2-dien-3β,5α,8α-triol, ganoderiol B, acetylodollactone, cycloatran-24-ene-1α,2α,3β-triol, baumin, inoscavin A, methylphelligrin A and B, phellibaumins A–E, davallialactone, phelligrins A and B, naringenin, rhamnetin, folerogenin, dihydrorhamnetin, genkwanin, sakuranetin, epi-methylphelligrin A and B aromadendrin, eriodictyol, β-glucan, PBF-I, PBF3, PBF6, SHPS-1, PPB-2, EPS-D, EPS-C, 4-(4-hydroxyphenyl)-3-buten-2-one, 4-(3,4-dihydroxyphenyl)-3-buten-2-one, 3,4-dihydroxy benzaldehyde, phelligridin D, osmundacetone, hispidin, 2,5-bis(4,7-dihydroxy-8-methyl-2-oxo-2H-chromen-3-yl)cyclohexa-2,5-diene-1,4-dione, hypholomin B, 2,3-bis(4,7-dihydroxy-8-methyl-2-oxo-2H-chromen-3-yl)cyclohexa-2,5-diene-1,4-dione, 3β-hydroxycinnamolide, 9,11-dehydroergosterol peroxide, meshimakobnol A, ascorbic acid, isophelligridimer A,	vascular dysfunction, antioxidant, antiproliferative, anti-aging, anti-inflammatory, immunostimulatory, effect on in vitro fertilization of pigs, antidiabetic, antibacterial, antifungal, alleviating septic shock, preventing and treating autoimmune joint inflammation, anti-obesity, hepatoprotective, hypoglycemic, antidiabetic, immunomodulatory, tyrosinase inhibitory	(2021), Wu et al. (2019), Azeem et al. (2018), Ganesan & Xu (2018), Wu et al. (2011), Dai et al. (2010)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		coumaric acid, 7-acetoxycoumarin-3-carboxylic acid, phaeolschidin E, isophelligridins C and D, hypholomine A, phelligridins C, H, I, and J, hispolon, inoscavin E, phelligridimer A, phaeolschidin A, pinillidine, phellinstatin, heneicosanoic acid, docosanoic acid, linoleic acid, palmitic acid, oleic acid, nonadecanoic acid, arachidic acid, hydroxy-docosanoic acid, hydroxy-tricosanoic acid, hydroxy-tetracosanoic acid, hydroxy-pentacosanoic acid, hydroxy-hexacosanoic acid		
Sanghuangporus lonicericola (Parmasto) L.W. Zhou & Y.C. Dai	East Asia	SePSP, ascorbic acid // (polyphenol, flavonoid, triterpenoid contents)	antitumor, improving immunity, antioxidant, anti-inflammatory	Wang et al. (2023b), Zhang et al. (2022), Wu et al. (2019)
Sanghuangporus lonicerinus (Bondartsev) Sheng H. Wu, L.W. Zhou & Y.C. Dai	Central and West Asia	hispolon, hispidin, methylhispolon	antitumor, anticancer, estrogenic	He et al. (2021), Dong et al. (2019), Wang et al. (2019)
Sanghuangporus quercicola Lin Zhu & B.K. Cui	China	ascorbic acid // (polysaccharide, polyphenol, flavonoid, triterpenoid contents)	antitumor, lowering serum lipids, treating pneumonia, antioxidant	Wang et al. (2023b), Wu et al. (2019)
Sanghuangporus sanghuang (Sheng H. Wu, T. Hatt. & Y.C. Dai) Sheng H. Wu, L.W. Zhou & Y.C. Dai*	East Asia	SHP-2, SSPS1, SSIPS1, SS-1, SSEPS2, chlorogenic acid, icarisid II, isorhamnetin, quercetin, quercitrin, rutin, ascorbic acid, hispidin // (sesquiterpenoids, triterpenoid)	antimicrobial, antioxidant, antitumor, anti-inflammatory, antiproliferative, hypoglycemic, immunomodulatory	Zhang et al. (2023, 2022), Wang et al. (2023b), He et al. (2021), Jiang et al. (2021), Sujarit et al. (2021), Li et al. (2020), Wu et al. (2019)
Sanghuangporus vaninii (Ljub.) L.W. Zhou & Y.C. Dai	East Asia	PV-B, PV-W, EPS, inonolane A, phellibaumin E, 4-(4-hydroxyphenyl)-3-butene-2-one, 3-	antioxidant, antiproliferative, antitumor, improving immunity, anti-gout (uric acid-lowering),	Ma et al. (2024), Li et al. (2023a), Zhang et al. (2023, 2022), Wang et al. (2023b), Guo et al. (2021),

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		hydroxyfriedel-3-en-2-one, friedelin, inotilone, phellinene acids A and B, (±)-(2E,4E)-γ-ionylideneacetic acid, (±)-(2E,4E)-3′-hydroxy-γ-ionylideneacetic acid, (±)-(2S,4E)-4′-hydroxy-γ-ionylideneacetic acid, ergostane-4,6,8,22-tetrad-ene-3-one, ascorbic acid	hypouricemic, anti-inflammatory, anti-melanogenic, anti-wrinkle, immunomodulatory, antiviral (SARS-CoV-2 inhibitory)	Im et al. (2019), Li et al. (2019), Wu et al. (2019), Yang et al. (2013), Chen & Liu (2017), Dai et al. (2010)
Sanghuangporus weigelae (T. Hatt. & Sheng H. Wu) Sheng H. Wu, L.W. Zhou & Y.C. Dai	China, Japan, Korea	ascorbic acid // (polysaccharide, polyphenol, flavonoid, triterpenoid contents)	antitumor, lowering serum lipids, treating pneumonia, antioxidant	Wang et al. (2023b), Wu et al. (2019)
Sanghuangporus zonatus (Y.C. Dai & X.M. Tian) L.W. Zhou & Y.C. Dai	tropical China, Sri Lanka	ascorbic acid // (polysaccharide, polyphenol, flavonoid, triterpenoid contents)	antitumor, lowering serum lipids, treating pneumonia	Wang et al. (2023b), Wu et al. (2019)
Sanghuangporus sp. (isolates MUCL 55592, MUCL56354)	(Kenya, East Africa)	phelligridin L, 3,14'-bishispidinyl, hispidin, ionylideneacetic acid, 1S-(2E)-5-[(1R)-2,2-dimethyl-6-methylidenecyclohexyl]-3-methylpent-2-enoic acid, phellidines D and E, (6R,7S,10R)-7,10-epoxy-7,11-dimethyldodec-1-ene-6,11-diol, elgonenes C, D, G/H, I, J, K, and L, elgonenes A−L, p-coumaric acid	nematicidal, antimicrobial. antitumor	He et al. (2021), Cheng et al. (2019), Chepkirui et al. (2018b)
Tropicoporus linteus (Berk. & M.A. Curtis) L.W. Zhou & Y.C. Dai = *Phellinus linteus* (Berk. & M.A. Curtis) Teng, *Inonotus linteus* (Berk. & M.A. Curtis) Teixeira	Central America, USA	ergosterol peroxide, (E)-(9CI)-2-methyl-6-(4-methyl-3-cyclohexen-1-yl)-2,6-heptadienoic acid, (22E,24R)-ergosta-7,22-dien-2α,3α,9α-triol, ergosterol, ergosterol peroxide glycoside, 3β-hydroxyergosta-7,22-dien-6-one, 3β,5α-dihydroxyergosta-	antitumor, antioxidant, anti-complement, antimicrobial, hepatoprotective, human neutrophil elastase (HNE) inhibitory, antibacterial, protein glycation inhibitory, prevention of peroxynitrite-induced DNA damage, cytotoxic,	Le et al. (2024), Zhang et al. (2022), Dai et al. (2021), He et al. (2021), Min & Kang (2021), Dong et al. (2019), Azeem et al. (2018), Lee et al. (2015), Huang et al. (2013), Nguyen et al. (2013), Samchai et al. (2011), Kobayashi et al. (2010), Kim et al. (2008a)

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		7,22-dien-6-one, 3β,5α,9α-trihydroxyergosta-7,22-dien-6-one, ergosta-7,22-dien-2β,3α,9α-triol, cerebroside B, N-acetyltyramine, 7-methoxyindole-3-carboxylic acid methyl ester, 1-methyindole-3-carboxaldehyde, 3-hydroxy-2-methyl-4-pyrone, atractylenolide I, phelligridins C and D, interfungins A–C, phellifuropyranone A, hispolon, inotilone, ellagic acid, caffeic acid, hispidin, inoscavin A, phellinusfurans A and B, phellinone, phellinulins A, H, I, K, M, phellinulins A–N, phellinstatin, davallialactone, 3,14'-bishispidinyl, hypholomin B, hypholomin B isomer, ergosterol, 5α,6α-epoxyergosta-8(14),22-diene-3β,7α-diol, 5α,6α-epoxyergosta-8(9),22-dien-7-on-3β-ol, 5α,6α,8α,9α-diepoxyergost-22-en-3β,7α-diol, 14α-hydroxyergosta-4,7,9(11),22-tetraen-3,6-dione, ergosta-4,7,22-trien-3,6-dione, 3β,5α-dihydroxy-6β-methoxyergosta-7,22-diene, ergosta-7,22-dien-3β,5α,6β,9α-tetraol, 4-(3,4-dihydroxyphenyl)-3-buten-2-one, 1,1-distyrylpyrylethan, R1, PL-A11, PL-N1, PLPE, β-glucan, PLP, PIP, PLPS, CPLPS, 3,4-	antidiabetic, neuraminidase inhibitory, antiviral, prolyl endopeptidase inhibitory, antiangiogenic, anti-inflammatory, antiallergic, immunomodulatory, antiproliferative, antimalarial, central nervous system (CNS) activity, anticancer, anti-Alzheimer, hypoglycemic, antimetastatic, pro-apoptotic activities	

Table 1 Continued.

Species	Distribution	Compounds[b]	Bioactivity	References
		dihydroxybenzalacetone, phellilanes H and L, (2E,4E)-(+)-40-hydroxy-γ-ionylideneacetic acid, (2E,4E)-γ-ionylideneacetic acid, (−)-trans-γ-monocyclofarnesol, (+)-γ-ionylideneacetic acid, phellidene E, gammaaminobutyric acid, ergothioneine, meshimakobnols A and B, phellilins A–C, (E)-4-(3,4-dihydroxyphenyl)but-3-en-2-one, homogentisic acid, pyrogallol, 5-sulfosalicylic acid, chlorogenic acid, benzoic acid		

[a] West Asian reports of *Inonotus andersonii* may indeed be *Inonotus krawtzewii* (see Ghobad-Nejhad 2016).
[b] Unspecified reports are mentioned in brackets.
[c] ACE: angiotensin-converting enzyme.

Table 2 Fungal isolates used in phylogenetic analyses with GenBank accession numbers.

Species	Voucher	ITS	LSU
Asterodon ferruginosus	KHL 11176	-	AY586631
Coltricia perennis	Dai 20982	MZ484524	MZ437385
Coltricia pseudodependens	Cui 8138	KJ540931	KJ000227
Coltricia pusilla	Dai 15168	KU360701	KU360667
Coltricia rigida	Dai 13622a	KX364793	KX364813
Coltricia strigosipes	Dai 15145	KX364795	KX364815
Coniferiporia qilianensis	Yuan 6424	KR350561	KJ635808
Coniferiporia sulphurascens	Cui 10429	KR350565	KR350555
Coniferiporia uzbekistanensis	LWZ 20160909-7	MT420709	MT416472
Coniferiporia weirii	JV 0407/8J	KR350569	KR350557
Cylindrosporus flavidus	Dai 13213	KP875564	KP875561
Flaviporellus splitgerberi	JV 1908/6	MZ484525	MZ437386
Fomitiporella badia	CBS 449.76	AY558609	–
Fomitiporella pertenuis	PPT 111	MG806101	MG806100
Fomitiporella subinermis	Dai 15114	KX181308	KX181344
Fomitiporella tenuissima	Dai 12245	KC456242	KC999902
Fomitiporella umbrinella	JV 0509/114	KX181314	KX181336
Fomitiporella vietnamensis	Dai 18377	MG657332	MG657326
Fomitiporia aethiopica	MUCL 44777	GU478341	AY618204
Fomitiporia alpina	Dai 15735	KX639627	KX639645
Fomitiporia bannaensis	MUCL 46926	KF444682	KF444705
Fomitiporia erecta	MUCL 49871	GU461939	GU461976
Fomitiporia gaoligongensis	Cui 16433	MG867712	MG867714
Fomitiporia hainaniana	CL06-372	KX663826	–
Fomitiporia hartigii	MUCL 31400	JQ087882	JQ087909
Fomitiporia hippophaeicola	MUCL 31746	GU461945	AY618207
Fomitiporia langloisii	MUCL 46375	EF429242	EF429225

Table 2 Continued.

Species	Voucher	ITS	LSU
Fomitiporia maxonii	MUCL 46017	EF433559	EF429230
Fomitiporia pseudopunctata	MUCL 38514	GU461953	AY618201
Fomitiporia norbulingka	Cui 9766	KU364417	KU364427
Fomitiporia pentaphylacis	Yuan 6012	JQ003900	JQ003901
Fomitiporia pseudopunctata	MUCL 46168	JQ087891	JQ087918
Fomitiporia punctata	MUCL 53548	JX093790	JX093834
Fomitiporia punicata	Dai 10640	KX663825	KX639653
Fomitiporia rhamnoides	LWZ 20180905-15	ON063643	ON063842
Fomitiporia robusta	MUCL 51297	JQ087892	JQ087919
Fomitiporia subhippophaeicola	BIFC 008271	NR_164013	NG_068767
Fomitiporia subrobusta	Dai 13577	KX639618	KX639636
Fomitiporia subtropica	Cui 9122	KX639622	KX639640
Fomitiporia tenuitubus	Dai 16204	KX639619	KX639637
Fomitiporia texana	MUCL 47690	JQ087894	JQ087921
Fomitiporia torreyae	Dai 15517	KX639633	KX639651
Fulvifomes coffeatoporus	JV0904_1	KX960762	KX960765
Fulvifomes fastuosus	Dai 18292	MH390411	MH390381
Fulvifomes grenadensis	PH 6	MH048096	MH048086
Fulvifomes lloydii	Dai 9642	MH390429	MH390379
Fulvifomes luteoumbrinus	CBS 296.56	AY558603	AY059051
Fulvifomes merrillii	unknown	JX484013	JX484002
Fulvifomes rimosus	M 2392655	MH628255	MH628017
Fulvifomes robiniae	CBS 211.36	AY558646	AF411825
Fulvifomes squamosus	CS456	MF479267	MF479266
Fulvifomes thailandicus	LWZ 20140731-1	KR905672	KR905665
Fulvifomes xylocarpicola	MU 8	JX104676	JX104723
Fulvifomes yoroui	OAB0097	MN017126	MN017120
Fulvoderma australe	Dai 11671	MF860771	MF860722
Fulvoderma scaurum	LWZ 20130909-2	MF860780	MF860731
Fuscoporia acutimarginata	Dai 15137	MH050751	MH050765
Fuscoporia atlantica	MV230	KP058515	KP058517
Fuscoporia contigua	Dai 16025	MG008401	MG008454
Fuscoporia ferrea	Cui 11801	KX961101	KY189101
Fuscoporia ferruginosa	JV 0408/28	KX961103	KY189103
Fuscoporia gilva	JV 1209/65	MN816719	MN810006
Fuscoporia rhabarbarina	Cui 6464	JQ780413	JQ797671
Fuscoporia torulosa	Dai 15518	MN816732	MN810023
Fuscoporia viticola	He 2123	MN816725	MN810017
Hydnoporia corrugata	Jon Klepsland 11.021	MK514613	MK514613
Hydnoporia gigasetosa	He 1442	KT828670	KT828674
Hydnoporia lamellata	Cui 7629	JQ279603	JQ279617
Hydnoporia olivacea	Dai 12789	KT828678	KT828679
Hydnoporia tabacina	He 810	JQ279611	JQ279626
Hymenochaete japonica	He 245	JQ279590	JQ279680
Hymenochaete luteobadia	He 8	JQ279569	KU975515
Hymenochaete microcycla	CLZhao 9903	OM959418	OM967407
Hymenochaete mougeotii	CBS 289.54	MH857337	MH868878
Hymenochaete peroxydata	JMB2102	KF371646	KF371649
Hymenochaete pinnatifida	He 2193	KU975472	KU975519
Hymenochaete rheicolor	He 2192	KU975475	KU975522
Hymenochaete rubiginosa	He 1049	JQ716407	JQ279667
Hymenochaete setipora	Cui 8349	JQ279516	JQ279638
Hymenochaete subporioides	Cui 10163	KT283051	KU975520
Hymenochaete xerantica	CLZhao 4168	OM959451	OM967411
Inocutis dryophilus	L(61)5-20-A	AM269783	AM269846
Inocutis levis	IRAN4562C	OR978377	–
Inocutis rheades	HAI 1246	GQ253454	–
Inocutis tamaricis	CBS 384.72	AY558604	MH872221
Inocutis tenuicarnis	Dai 19813	MZ484528	MZ437387

Table 2 Continued.

Species	Voucher	ITS	LSU
Inonotopsis subiculosa	Dai 14799	KU598212	KU598217
Inonotus andersonii	JV 1209/22-J	KF446592	–
Inonotus cuticularis	JV 0609/22	MZ484527	OL413402
Inonotus griseus	Dai 13436	KX364802	KX364823
Inonotus henanensis	Dai 13157	KX674581	KX832918
Inonotus hispidus	S 45	EU282482	EU282484
Inonotus nidus-pici	JV 0107/6	MN318440	MN318440
Inonotus obliquus	Dai 10715	MZ484606	OL413405
Inonotus pseudoglomeratus	JV 1707/15J	MN318437	MN318437
Inonotus rickii	Dai 12996	KC479128	MH101019
Inonotus aff. *levis*	IRNHM-BAS2	KU058398	–
Meganotus everhartii	JV 0108/30	MZ484529	MZ437388
Mensularia lithocarpi	Dai 13235	–	KF684968
Mensularia nodulosa	JV 0909/29	MZ484614	–
Mensularia radiata	A.C. Dirks Mushroom Observer #380182	ON364090	ON369543
Mensularia rhododendri	Dai 14951	–	KP420016
Neomensularia arizonica	JV 1209/56	MZ484530	MZ437389
Neomensularia castanopsidis	Dai 19907	MZ484531	MZ437390
Neomensularia duplicata	LWZ 20150529-4	KX078217	KX078221
Neomensularia kanehirae	Dai 10418	KX078220	KX078223
Neomensularia rectiseta	Dai 15136	NR_154246	NG_060343
Neophellinus uncisetus	MUCL 46231	GU461960	EF429235
Nothonotus nothofagi	1177	MH410007	–
Nothophellinus andinopatagonicus	MR12483	KP347544	KP347531
Ochrosporellus neonoxius	JV 1607/87	MN318448	MN318448
Ochrosporellus portoricensis	JV 1504/121	MN318447	MN318447
Ochrosporellus taiwanensis	Wu 1407-163	LC214361	LC214358
Ochrosporellus tricolor	Dai 15279	MZ484533	MZ437392
Onnia leporina	JV 1207/2	KT281960	KT281972
Onnia microspora	Dai 11897	KT281957	KT281971
Onnia subtriquetra	MB 2	KT281955	KT281969
Onnia tibetica	Yuan 1964	KT281962	KT281974
Onnia tomentosa	Niemela 9079	MF319075	MF318931
Onnia triquetra	CBS 278.55	MH857481	MH869023
Pachynotus punctatus	Dai 17803	MZ484535	MZ437394
Perenninotus shoreicola	Dai 13614	KJ575522	KT749416
Phellinidium asiaticum	Spirin 5097	KR350572	KC859424
Phellinidium ferrugineofuscum	Cui 10042	KR350573	KR350559
Phellinidium fragrans	CBS 202.90	AY059027	AY558619
Phellinidium pouzarii	DSM 108285	MK501618	MK501618
Phellinopsis andinus	MR12003	KP347542	KP347528
Phellinopsis asetosa	Dai 13553	KJ425524	KJ425523
Phellinopsis conchata	L-7601	KU139188	KU139257
Phellinopsis overholtsii	CBS 169.55	AY558634	AY059019
Phellinopsis resupinata	IFP 016035	NR_158798	–
Phellinus ellipsoideus	Cui 4270	JQ837948	JQ837955
Phellinus gabonensis	MUCL 52025	HM635715	NG059453
Phellinus guttiformis	CMW45332	MH599107	MH599136
Phellinus igniarius	575	AM269797	AM269860
Phellinus laevigatus	CBS 122.40	MH856059	MH867554
Phellinus lundellii	TN5760	AY340060	AF311035
Phellinus monticola	Cui 10482	JQ828888	–
Phellinus mori	LWZ 20150825-1	ON063661	ON063861
Phellinus nigricans	T. Niemela 9065	MF319077	MF318934
Phellinus orientoasiaticus	Cui 9751	JQ828925	–
Phellinus padicola	Cui 2257	JQ828905	–
Phellinus parmastoi	TN-6432	KU139158	KU139245
Phellinus piceicola	LWZ 20190921-5	ON063662	ON063862

Table 2 Continued.

Species	Voucher	ITS	LSU
Phellinus pomaceus	LWZ 20160908-1	ON063663	ON063863
Phellinus populicola	CBS 638.75	NR_145350	NG_064106
Phellinus setulosus	MUCL 54670	KU954536	KU954537
Phellinus tremulae	FP-135820-T	KU139136	KU139206
Phellopilus nigrolimitatus	MF 85-823	–	AF311036
Phylloporia fontanesiae	Cui 12356	MH151188	MH165871
Phylloporia lonicerae	Dai 17900	MH151175	MG738802
Phylloporia nodostipitata	FLOR 51173	KJ639055	KJ631412
Phylloporia parasitica	Ryvarden 19843	KU198361	–
Phylloporia perangusta	Dai 18139	MH151169	MG738803
Phylloporia pseudopectinata	Cui 13749	MF410323	KX242356
Phylloporia rattanicola	Dai 18235	MH151172	MG738808
Phylloporia ribis	K(M):194378	MZ159520	–
Porodaedalea alpicola	Cui 12272	MG585275	MH152375
Porodaedalea chinensis	Cui 10252	KX673606	MH152358
Porodaedalea chrysoloma	Dai 12674	KY000004	MH152354
Porodaedalea himalayensis	LWZ 20180903-21	ON063667	ON063867
Porodaedalea kesiyae	Dai 18417	MG585278	MH152382
Porodaedalea laricis	LWZ 20190724-9	ON063668	ON063868
Porodaedalea microsperma	Cui 12047	MG585280	MH152378
Porodaedalea pini	No-6170-T	JX110037	JX110081
Porodaedalea yamanoi	Dai 14795	KX673607	MH152370
Porodaedalea yunnanensis	Dai 3072	MG585282	MH152380
Pseudoinonotus dryadeus	JV 1907/7	MZ484540	MZ437400
Pseudophylloporia australiana	Dai 18846	MZ484541	MZ437401
Pyrrhoderma adamantinum	Dai 13832	MF860790	MF860736
Pyrrhoderma hainanense	LWZ 20150530-1	MF860794	MF860739
Pyrrhoderma lamaense	Dai 16227	MF860802	MF860743
Pyrrhoderma noxium	Dai 17754	MF860809	MF860752
Pyrrhoderma thailandicum	LWZ 20140731-17	MF860812	MF860753
Rigidonotus glomeratus	JV 1608/15J	MN318449	MN318449
Rigidonotus pruinosus	Dai 21863	MZ484543	–
Sanghuangporus alpinus	Cui 12444	MF772782	MF772800
Sanghuangporus baumii	Cui 11769	MF772784	MF772803
Sanghuangporus lonicericola	Dai 8376	JQ860308	MF772805
Sanghuangporus lonicerinus	Dai 17093	MF772788	MF772807
Sanghuangporus quercicola	LWZ 20170821-18	ON063669	ON063869
Sanghuangporus sanghuang	Cui 14419	MF772789	MF772810
Sanghuangporus vaninii	Dai 8236	MF772791	MF772812
Sanghuangporus weigelae	Dai 16077	MF772794	MF772815
Sanghuangporus weirianus	CBS 618.89	AY558654	AY059035
Sanghuangporus zonatus	Dai 10841	JQ860306	KP030775
Tropicoporus cubensis	MUCL 47079	JQ860325	KP030776
Tropicoporus excentrodendri	Yuan 6232	NR_137949	–
Tropicoporus guanacastensis	JV 1408/25	KP030793	KP030778
Tropicoporus linteus	JV 0904/64	JQ860322	JX467701
Tropicoporus tropicalis	CBS 617.89	AF534077	AY059037
Lenzitopsis daii [outgroup]	Yuan 2959	JN169799	JN169795
Donkioporiella mellea [outgroup]	LWZ 20140622-12	KX258957	KX258955

Sesquiterpenoids

Sesquiterpenoids constitute the most plentiful class among all terpenoids produced by fungi and display a diverse range of bioactive properties, more prevalently cytotoxicity and enzyme inhibition (Dai et al. 2021). Sesquiterpenoids are also a noteworthy class of compounds in the Hymenochaetaceae family (Fig. 3).

Our survey shows that approximately 140 various sesquiterpenoids are known in the family (Table 1, Supplementary Table 1). They are predominantly reported from *Phellinus igniarius* and

Tropicoporus linteus. Hymenochaetaceae sesquiterpenoids represent largely diverse types, among which are alliacane-type (e.g., inonoalliacanes A–I) and cyclofarnesane-type (e.g., inonofarnesane) sesquiterpenoids in *Inonotus* sp., bisabolane-type sesquiterpenoids (e.g., phellilane in *T. linteus*, inonolane A in *S. vaninii*), cadinene-type (e.g., 3α,12-dihydroxy-δ-cadinol in *P. igniarius*), drimane-type (e.g., phellinuins A–G in *P. pomaceus*, 3α,6β-dihydroxycinnamolide in *I. rickii*, and inonolactones E–H in *I. obliquus*), eudesmane-type (e.g., eudesm-1β,6α,11-triol in *P. igniarius*, and atractylenolide I in *T. linteus*), illudane-type (e.g., phellinignin D in *P. igniarius*, and phellinuin J in *P. pomaceus*), aromadendrane-type (e.g., inonotins in *Inonotus* sp. BCC 23706), spiroaxane-type sesquiterpenoids (e.g., in *P. igniarius*), and guaiane-type (e.g., in *Neomensularia kanehirae*). In addition, cyclohumulanoid sesquiterpenes have recently been reported in *Phellinus orientoasiaticus* (Pham et al. 2022). Tremulane-type sesquiterpenoids were initially introduced from *Phellinus tremulae* (e.g., tremulenedial, tremulenedial dibenzyl acetal, tremulenediols A–C, tremuladienol, tremulenolides A and B). Later, numerous tremulane sesquiterpenoids have been identified in other species such as *P. igniarius* (e.g., (−)-(2S,3S,6S,7S,9R)-tremul-1(10)-ene-11,12,14-triol, (+)-(1R,6S,7S)-tremul-2-ene-12(11)-lactone, 6β,12-dihydroxy-tremulene, (+)-(3S,6R,7R)-tremulene-6,11,12-triol, (−)-(2R,3S,6S,7S,9R)-tremul-1(10)-ene-11,12,14-triol, and 12,15-dihydroxy-tremulene) some of which reported to have antiplasmodial and vascular-relaxing properties (He et al. 2021).

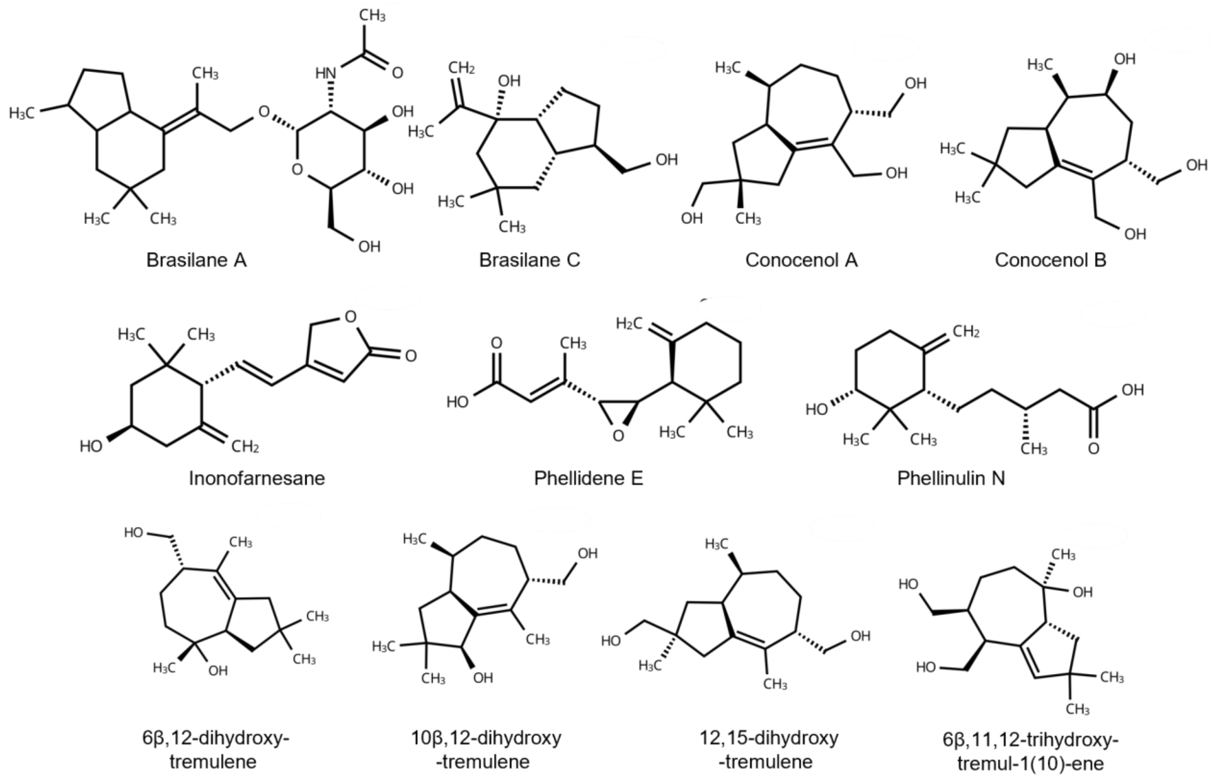

Figure 3 – Chemical structures of selected sesquiterpenoids in Hymenochaetaceae.

Triterpenoids

Medicinal mushrooms contain a significant number of triterpenoids making them the predominant class of terpenes found in these fungi. Triterpenoids constitute a diverse class of compounds in the fungal terpenome as a whole, but also in Hymenochaetaceae family (Fig. 4). Our survey revealed that about 110 triterpenoids have been reported from the family (Table 1, Supplementary Table 1), many recorded in *Inonotus obliquus*, *Inocutis rheades*, and *Fuscoporia torulosa*. The renowned Chaga (*Inonotus obliquus*) is rich in lanostane triterpenoids (e.g., inonotsuoxides A and B, inonotsutriols A–C, inoterpenes A–F, spiroinonotsuoxodiol, inonotusols

A–G, inotolactones A and B). As mentioned before, the new lanostane-type triterpenoids phellibarins A–D were isolated from *Fuscoporia rhabarbarina* (Feng et al. 2016). The pregnenolone triterpenoids namely aethiopinolones A–E have recently been found in *Fomitiporia aethiopica* (Chepkirui et al. 2018a). Moreover, lupane triterpenoids (e.g., betulin, betulinic acid) and taraxerane triterpenoids which are mainly plant-based and are generally less common in fungi, have been occasionally found in Hymenochaetaceae (Table 1).

Steroids

Steroids are structurally key components in the fungal cell membranes. A diverse range of steroid compounds have been reported from dried basidiomata or cultured mycelia of Hymenochaetaceae species, including triterpene steroids and sterols (Fig. 5). About 70 steroids have been recognized in Hymenochaetaceae, mostly reported from *I. obliquus, P. igniarius*, and *T. linteus* (Table 1, Supplementary Table 1).

Some triterpene steroids include ergosta-4,6,8(14),22-tetraen-3-one in *Fuscoporia torulosa* and *P. igniarius*, 24-methylenelanost-8-ene-3β,22-diol in *Fuscoporia gilva*, and (3β,22R,23E)-lanosta-8,23-diene-3,22,25-triol and (3β,22R,23E)-lanosta-7,9(11),23-triene-3,22,25-triol in *I. obliquus.* Examples of sterols include various ergosterol derivatives as well as cerevisterol e.g., in *I. hispidus, Phylloporia* sp., and *Pseudoinonotus dryadeus*, lanosterol in *Inocutis rheades*, and *Inonotus nidus-pici*, and episterol in *Porodaedalea pini*. Kahlos & Hiltunen (1988) reported several sterols from *M. radiata*: cholesterol, β-sitosterol, sitostanol, stigmasterol, ergosta-7,22-dien-3β-ol, and fungisterol. Phellinignincisterols A–C are considered as heptanor sterols with unusual skeletons introduced from *P. igniarius*, and 3,17,20-trihydroxy-4-methylpregn-8-en-7-one is a 4-methyl homopregnane derivative sterol isolated from this species (Wu et al. 2010). The most common ergosterol derivative in Hymenochaetaceae is ergosterol peroxide (Supplementary Table 1). Some phytosterols recorded in Hymenochaetaceae are β-sitosterol in *F. torulosa*, *M. radiata*, and *Phylloporia* sp., sitostanol in *M. radiata*, and stigmasterol in *I. obliquus, M. radiata,* and *Phylloporia* sp. (Table 1, Supplementary Table 1).

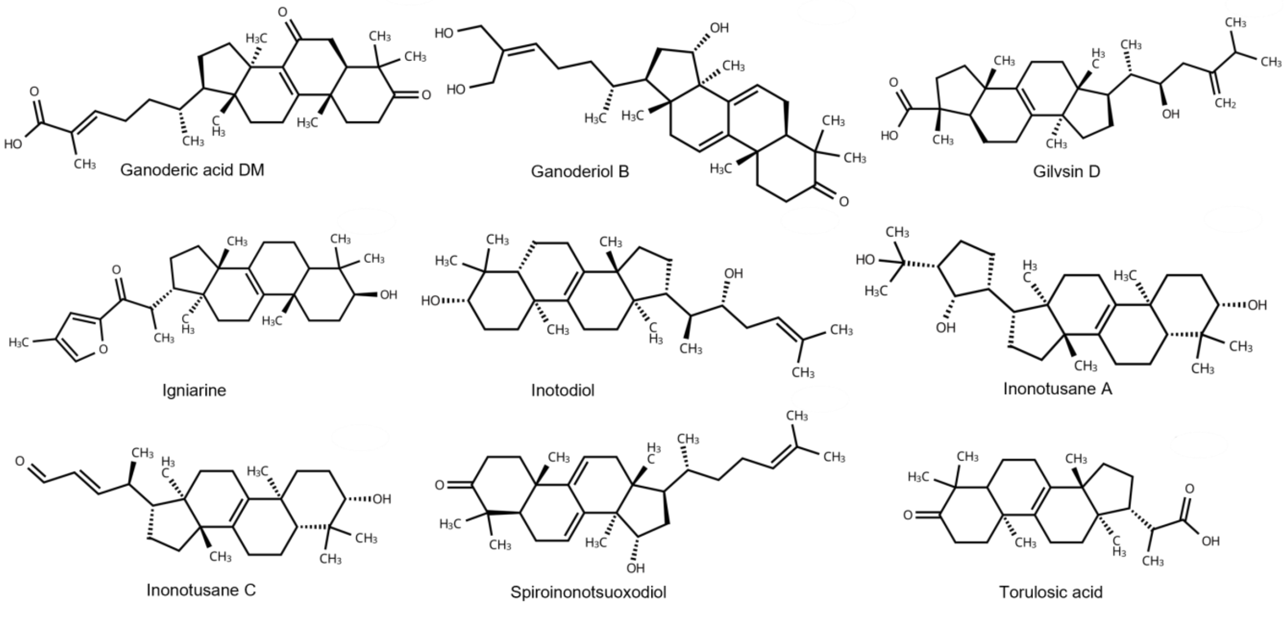

Figure 4 – Chemical structures of selected triterpenoids in Hymenochaetaceae.

Phenolic compounds

Mushroom-derived phenolics are highly diverse, and have found a remarkable place in the food, medicine, and cosmetics market. Fungal phenolic compounds generally include phenolic acids, methyl esters of aromatic acids, tannins, flavonoids and other polyphenolics (Abdelshafy et al. 2021). In our survey, Hymenochaetaceae is shown to be rich in various phenolic compounds (Table 1, Supplementary Table 1, Fig. 6). Styrylpyrones are special phenolics abundantly produced in Hymenochaetaceae and are discussed separately in the following section.

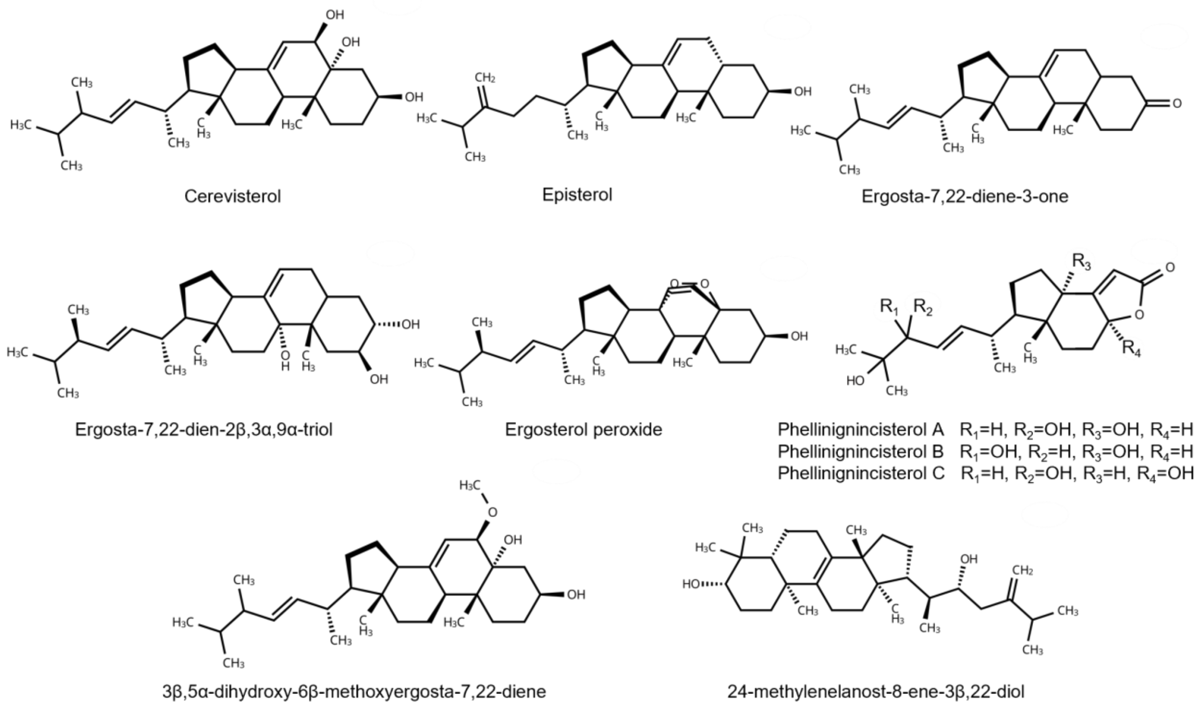

Figure 5 – Chemical structures of selected steroids in Hymenochaetaceae.

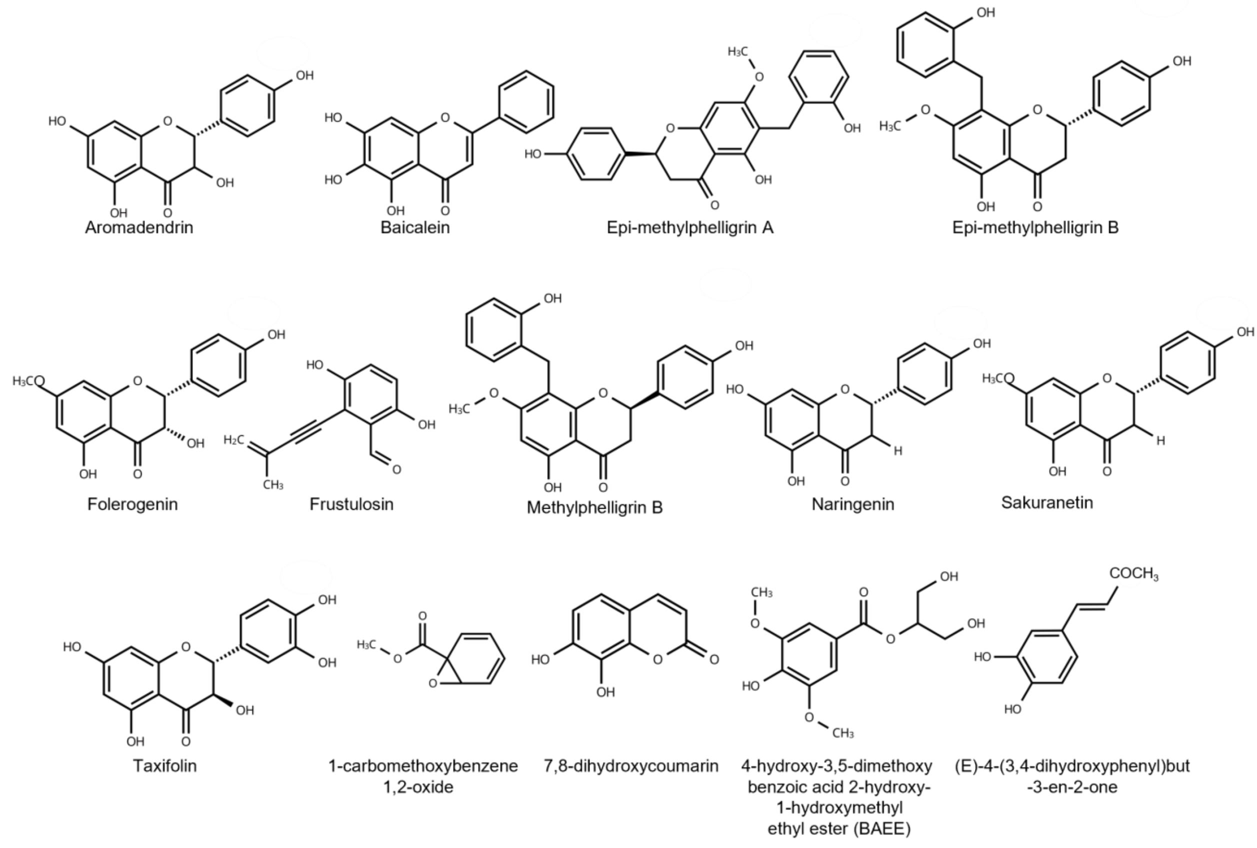

Figure 6 – Chemical structures of selected phenolics in Hymenochaetaceae.

Flavonoid compounds are widely distributed in plants. Although numerous studies have reported flavonoids from many mushroom species, the production of flavonoids in fungi was challenged by Gil-Ramírez et al. (2016) who informed the lack of genes encoding the key enzymes chalcone synthase/chalcone isomerase in fungal genomes. However, based on a more recent full genome scrutiny across fungal kingdom, Mohanta (2020) ascertained fungi to encompass genes and enzymes involved the biosynthesis of flavonoids. Whether or not fungi would be direct producers of flavonoids, we thought it would be worth stating the compounds reported from Hymenochaetaceae so far declared in the literature (Table 1, Supplementary Table 1).

Likewise other compound classes, flavonoids in Hymenochaetaceae have been reported as total flavonoid content, or as specific molecules, here as flavones, flavonoles, flavanes, and alike. About 30 flavonoid molecules have been recorded from various species in the family (Supplementary Table 1). Most of Hymenochaetaceae flavonoids have been reported from the two species *Phellinus igniarius* and *Sanghuangporus baumii* (Zhang et al. 2022), although we suggest that the species epithets must be used with caution due to the uncertain taxonomy of the isolates used in the respective studies.

Styrylpyrones

Styrylpyrones are among the most remarkable low molecular weight polyphenolic compounds in the family Hymenochaetaceae accounting for the characteristic yellow to brown colors in the majority of species (Figs 1, 7). They are known for radical scavenging and anti-inflammatory effects as well as biocidal and cytotoxic properties. About 90 styrylpyrones can be enumerated from members of this family, with the most widespread ones including: hispidin, hispolon, hypholomin B, inoscavins, phelligridins, and 3,14'-bishispidinyl (Table 1, Supplementary Table 1).

Several styrylpyrones are hispidin derivatives. Hispidin has attracted special attention for its noteworthy bioactive properties such as anti-dementia and activity against influenza viruses (Lee & Yun 2011), and has recently been applied as a natural colorant in nutricosmetics (Bergmann et al. 2022). Davallialactone has shown anti-platelet aggregation properties (Kim et al. 2008b) which is promising in development of platelet inhibitory drugs prescribed for stroke prevention.

A number of styrylpyrone pigments are derived from cinnamic acids e.g., the orange pigment phelliribsin A from *P. ribis*, and the yellow pigments inonotusin A and B from *I. hispidus*. Phaeolschidins A–C in *P. pomaceus* and pinillidine from *P. pini* are regarded as rare natural compounds (Chen & Liu 2017). Protocatechualdehyde isolated from *Fuscoporia gilva* has been identified as the major compound responsible for the species' antioxidant and anti-inflammatory activities (Chang et al. 2011).

Polysaccharides

Polysaccharides are important macromolecules frequently studied in edible mushrooms in different parts of the world. Though Hymenochaetaceae species are seldom regarded as edible, a diverse range of polysaccharides and proteoglycans with bioactive properties have been isolated and characterized in the family. They are composed of monosaccharides such as glucose, galactose, fructose, arabinose, fucose, mannose, rhamnose, ribose, xylose, glucuronic acid, and galacturonic acid. About 40 polysaccharides can be enumerated from members of Hymenochaetaceae family, besides α-glucans, β-glucans, cellulose, and hemicellulose (Table 1, Supplementary Table 1). Noteworthy taxa with regard to the number of their studied polysaccharides are *T. linteus* and *Sanghuangporus* species, particularly *S. baumii* and *S. sanghuang* (Table 1, Supplementary Table 1). Several biological effects of *T. linteus* including regulating blood glucose levels, improving blood circulation, protecting the liver, and boosting the immune system have been attributed to its polysaccharides (Nguyen et al. 2023). Similarly, *S. sanghuang* polysaccharides have shown immunostimulatory, antidiabetic, and anti-inflammatory properties (Li et al. 2023b). The polysaccharide fractions from *S. vaninii* were shown to promote uric acid excretion and alleviate kidney pathological damage, hence promising for the treatment of gouty arthritis (Li et al

2023a). Exopolysaccharides Fr-I, Fr-II from *Inocutis tamaricis* are polysaccharide-protein complexes (Zheng et al. 2014). Polysaccharides extracted from *P. pini* have demonstrated antioxidant activities (Devi et al. 2022).

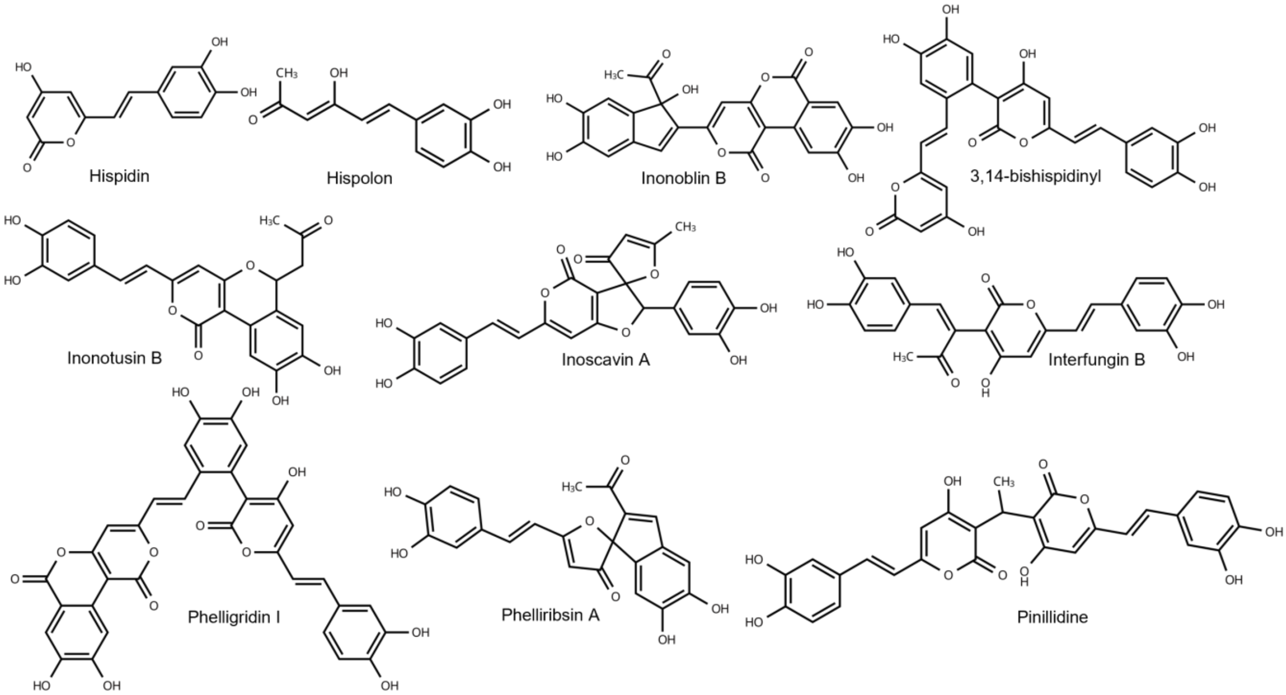

Figure 7 – Chemical structures of selected styrylpyrones in Hymenochaetaceae.

Other chemical constitutes

Other chemical constitutes reported in the family Hymenochaetaceae are diterpenoids, limonoids, chlorine- and nitrogen-containing compounds, furans and furanones, and alkanes and alkenes (Supplementary Table 1). Diterpenoids recorded in Hymenochaetaceae include: dehydroabietic acid, inonotolides A–C, inonotusic acid, phellinulin A, phellinulin I, 12-hydroxy-7-oxo-5,8,11,13-tetraene-18,6-abietanolide, 17-hydroxy-ent-atisan-19-oic acid, 8,14-labdadien-13-ol, and (−)-trans-γ-monocyclofarnesol (Wang et al. 2006, Jang & Yang 2011, Chen & Liu 2017, Ding et al. 2018, Dong et al. 2019, He et al. 2021, Supplementary Table 1). There are few limonoids reported in Hymenochaetaceae: fulvifomins A–C, methyl angolensate, and 6-deoxydetigloyl-swietenine acetate (Isaka et al. 2021).

Chlorine-containing compounds recorded in Hymenochaetaceae include: chloromethane, chloroneb, chrysophanic acid, chlorophellins A–C, drosophilin A, drosophilin A methyl ether, hymenoquinone, and 3,5-dichloro-p-anisyl alcohol (Table 1, Supplementary Table 1). It has been shown that chloromethane is produced by several Hymenochaetaceae species: *Hydnoporia corrugata, Inocutis rheades, Inonotus andersonii, I. cuticularis, I. hispidus, I. obliquus, Onnia leporina*, and *Phellinus pomaceus* (Watling & Harper 1998). Drosophilin A and its methyl ether called DAME are produced by some *Fulvifomes* and *Phylloporia* species (Table 1, Supplementary Table 1).

Some of the nitrogen-containing compounds reported from Hymenochaetaceae are: cerebroside B, ergothioneine, gammaaminobutyric acid (GABA), lectins, melanin, muscimol, tryptamine, L-tryptophan, pterins, 7-methoxyindole-3-carboxylic acid methyl ester, 7-methoxy-2-methylisoquinoline-3,5,8-trione,, 1-methyindole-3-carboxaldehyde, N-butylbenzenesulfonamide, N-(4-chlorophenyl)-N-(phenylmethyl)-benzenemethanamine, N-acetyltyramine, N-(2'-hydroxynonacosanoyl)-D-erythro-1,3,4-trihydroxy-2-aminooctadecane, and N-(2'-hydroxytriacontanoyl)-D-erythro-l,3,4-trihydroxy-2-aminooctadecane, most of which having been recorded from *T. linteus* (Table 1, Supplementary Table 1). The list of furans and alkanes known from Hymenochaetaceae is available in Supplementary Table 1.

In addition to the above classified metabolites, some other compounds have been reported in Hymenochaetaceae: the cyclitol compound called cyclophellitol in *Phellinus* sp., the alkaloids uplandicine in *I. hispidus* and nepetidin in *P. igniarius*, the tryptamine derivative serotonin in *P. pomaceus*, the cyclohexenone derivative (4S,5S)-4-hydroxy-3,5-dimethoxycyclohex-2-enone (HDE) in *I. hispidus*, the two compounds 2-(3,4-hydroxy-2-methoxyphenyl)-1,3-benzodioxole-5-carbaldehyde and 4-(3,4-hydroxyphenyl)-3-buten-2-one in *Phellinus noxius*, and 2-farnesyl-5-methylbenzoquinone in *Porodaedalea pini* (Table 1, Supplementary Table 1).

Also, organic compounds such as humins, resins, fiber, and lignin (in *I. hispidus*), tannins and proanthocyanidins (in *F. torulosa*), macrolides (in *P. igniarius*), hemoproteid peroxidase (in *M. radiata*), naphthalenes A and B (in *P. igniarius*), the hexane derivatives 2-methylbutanal, 3-methylbutanal and hexanal (in *Phylloporia* sp.), vitamin A (in *M. radiata*), vitamin C (in numerous species), and niacin (in *Phylloporia* sp.) have been reported (Table 1, Supplementary Table 1).

Apart from linoleic acid which is widespread in mushrooms, some fatty acids have been reported in Hymenochaetaceae, for instance arachidic acid, azelaic acid, docosanoic acid, dodecanoic acid, eicosanoic acid, heneicosanoic acid, heptadecanoic acid, hexadecanoic acid, nonadecanoic acid, oleic acid, octadecanoic acid, palmitic acid, petroselinic acid, pentadecanoic acid, succinic acid, tetracosanoic acid, tetradecanoic acid, tricosanoic acid, hydroxy-docosanoic acid, hydroxy-tricosanoic acid, hydroxy-tetracosanoic acid, hydroxy-pentacosanoic acid, hydroxy-hexacosanoic acid, 2-hydroxytetracosanoic acid, and the omega fatty acids C16:1 ω5, C16:1 ω7, C18:1 ω9, C20:1 ω11, C22:1 ω11, C18:2 ω6. Sphingosine and diacylglycerophospholipids have been detected in *Pseudoinonotus dryadeus* (Table 1). Also, organic acids (oxalic acid, formic acid, acetic acid, butyric acid, paraoxybenzoic acid, obliquequinic acid) and minerals (silicon, iron, aluminum, calcium, magnesium, sodium, potassium, zinc, copper, manganese) have been reported in Hymenochaetaceae (Khojimatov et al. 2023).

Numerous bioassays in Hymenochaetaceae have been performed based on crude extracts. Ethanol, methanol, acetone, ethyl acetate, chloroform, aqueous solution, hot water, cold water, boiled water, and hexane have been the most frequently used solvents. Other solvents include n-butanol, NaOH (5%), ethereal and alcoholic extracts, ethanol-petroleum-ether, ethanol-petroleum, and a solvent cocktail of dH_2O:ethyl alcohol:methyl alcohol:acetone:CH_2Cl_2 (1:2.5:2.5:2:2). Total phenol, flavonoid, carbohydrate, triterpene, polysaccharide contents have been widely studied in Hymenochaetaceae. Crude and total extracts may be suitable and cost-effective for fast and small-scale screenings, but have the disadvantage of masking the actual biological activities of the compounds.

Pharmacology and bioactive properties

A diverse array of bioactive properties have been detected in various members of the family Hymenochaetaceae and based on literature survey, we tentatively classified them into 11 major groups (Fig. 8, Supplementary Table 2): antioxidant, biocidal, cancer treatment, cardiovascular disease treatment, digestive system disease treatment, enzyme inhibitory, immune system treatment, joint disease treatment, metabolism regulation, neural system disease treatment, systemic infection treatment, and other bioactivities. It seems that antioxidant, biocidal effects, cancer treatment, and immune system treatment are the most common biological activities shown in numerous Hymenochaetaceae species (Fig. 8, Table 1, Supplementary Table 2). The major groups mentioned above cover about 100 types of bioactivities (Fig. 9) with the most prevalent types being antioxidant, antitumor, antidiabetic, immunomodulatory, anti-inflammatory, improving immunity, antibacterial, and antifungal effects (Supplementary Table 2). On a terminology basis, some of these types may be overlapping and may infer duplicate implication (e.g., 'improving immunity' and 'strengthening immunity'), or can be variants or part of mechanism of a same property; however, we made an attempt to keep the terminology as expressed in the surveyed literature, for any future reference. There are specific properties currently known by a single species, such as aldose reductase inhibitory detected in *Fulvifomes merrillii*, human neutrophil elastase (HNE) inhibitory shown by *Tropicoporus linteus*, tyrosinase inhibitory shown by *Fuscoporia torulosa*, PPAR-γ agonistic by *Phylloporia ribis*, hypouricemic by *Sanghuangporus vaninii*, estrogenic by *Sanghuangporus lonicerinus*, and treatment of candidiasis by *Inonotus hispidus* (see Supplementary Table 2 for a full list).

Species with the most diverse biological properties include *Fuscoporia gilva*, *Inonotus hispidus*, *I. obliquus*, *Phellinus igniarius*, *Porodaedalea pini*, *Sanghuangporus baumii*, and *Tropicoporus linteus* (Table 1, Fig. 10). Taken together, the top 15 medicinal Hymenochaetaceae species with a comparatively higher number of reported compounds and bioactive properties are: *Fuscoporia gilva*, *F. torulosa*, *Inocutis levis*, *Inonotus cuticularis*, *I. hispidus*, *I. obliquus*, *Mensularia radiata*, *Phellinus igniarius*, *P. pomaceus*, *Phylloporia ribis*, *Porodaedalea pini*, *Sanghuangporus baumii*, *S. sanghuang*, *S. vaninii*, and *Tropicoporus linteus* (Figs 10, 11).

In the following, selected important bioactive properties in Hymenochaetaceae are briefly discussed.

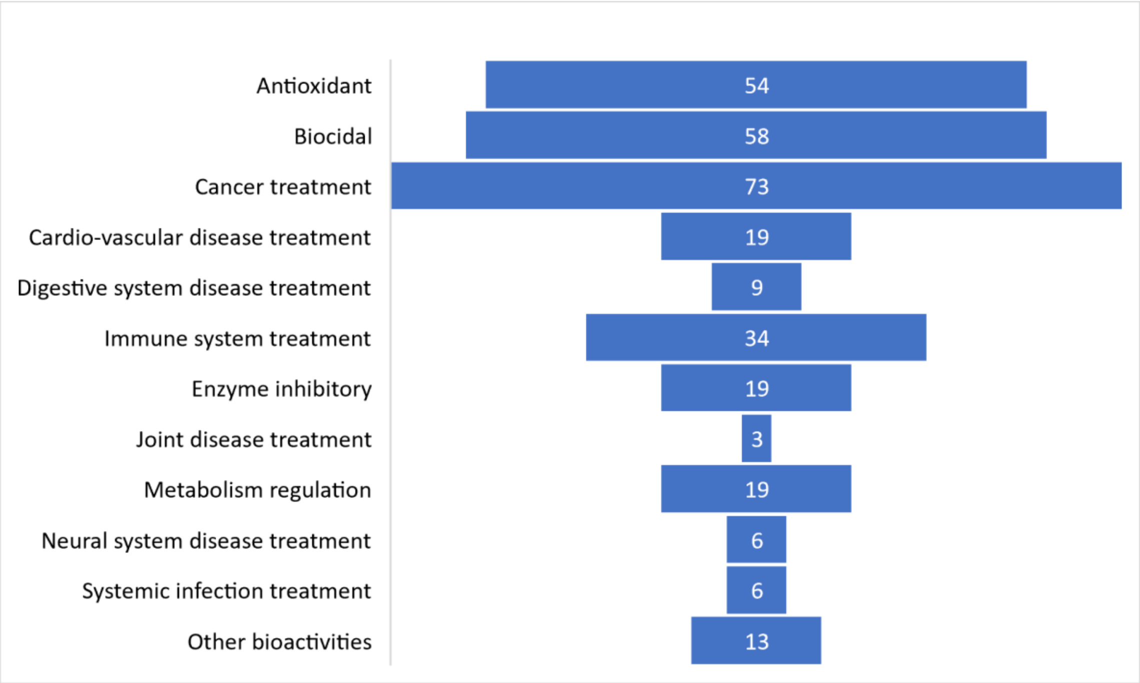

Figure 8 – The major biological properties in Hymenochaetaceae and the number of species (bars) in each category.

Antioxidant

Antioxidants are crucial for counteracting free radical reactions in human body, which have the potential to induce oxidative stress and harm cells. The cellular damage is implicated in human diseases such as cancer, diabetes mellitus, and inflammation. Consequently, the exploration and study of potent bioactive compounds with significant antioxidant activity and minimal cytotoxicity are essential for the advancement of natural products. Phytochemicals exhibiting free radical scavenging properties hold promise for the prevention and treatment of various inflammation-related diseases, including cancer (Thammavong et al. 2021). Among Hymenochaetaceae, 53 species belonging to 20 genera have demonstrated antioxidant effects (Table 1, Supplementary Table 2). Polyphenols extracted from *Inonotus obliquus* show promise as natural antioxidants and present favorable prospects for application development (Wang et al. 2021). Within the genus *Inonotus*, *I. clemensiae*, *I. hispidus*, *I. nidus-pici*, *I. obliquus*, and *I. rickii* exhibit antioxidant properties. Other noteworthy Hymenochaetaceae genera in terms of species diversity related to this property include *Fomitiporia*, *Fuscoporia*, *Phellinus*, and *Sanghuangporus* (Supplementary Table 2).

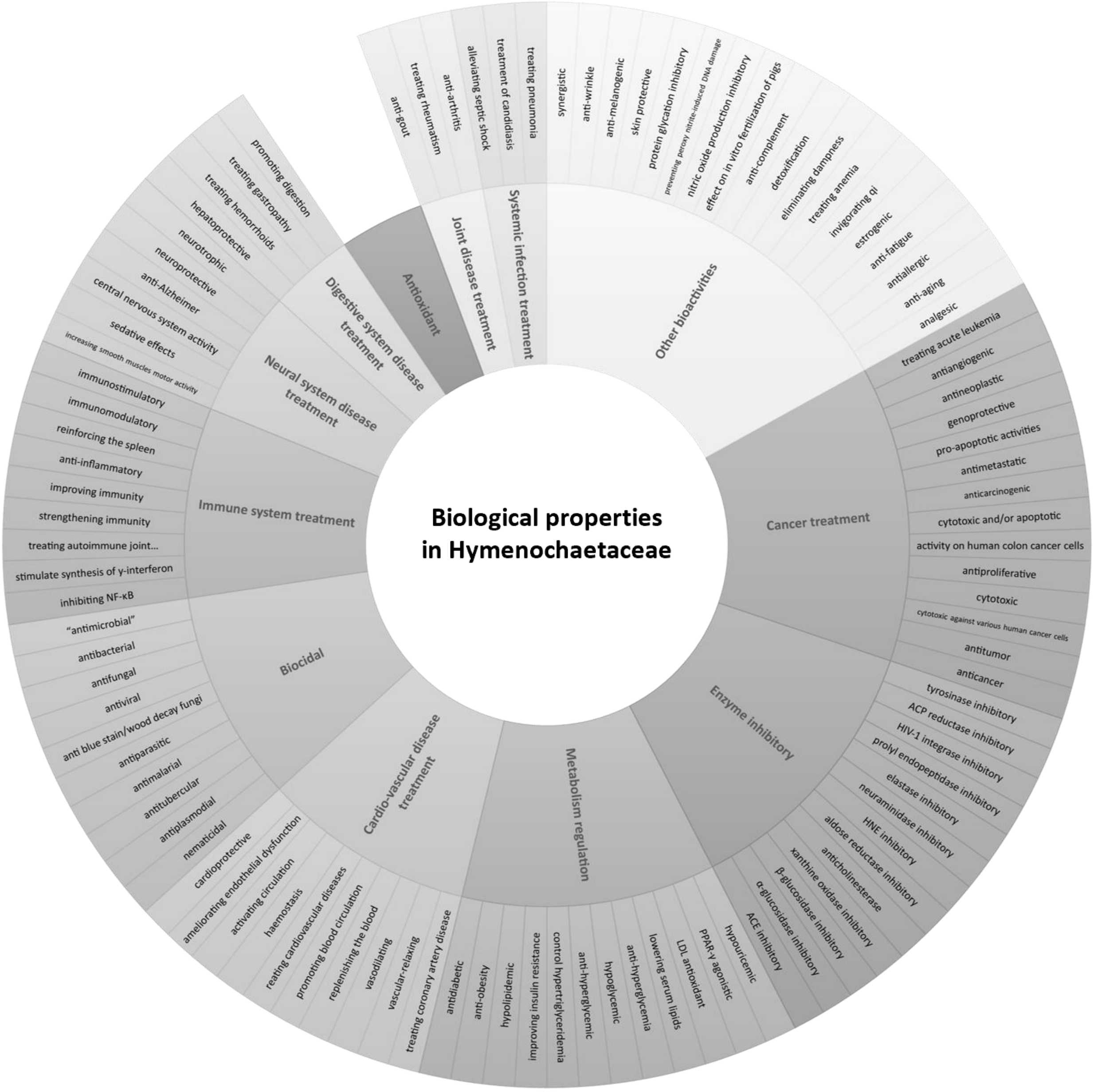

Figure 9 – Various biological properties in Hymenochaetaceae. Segments are not to scale.

Biocidal

Biocidal activity, the ability of a substance to kill or inhibit the growth of microorganisms, is a critical aspect in various fields such as healthcare, agriculture, food preservation, and environmental protection. The emergence of antibiotic resistance among microorganisms has underscored the urgency of finding novel compounds capable of combating them. There is a growing imperative to investigate alternative antimicrobial substances and natural sources have become a focal point in this pursuit. Fungi, known for their diverse metabolic capabilities, present a promising avenue for discovering such compounds. They produce an extensive array of secondary metabolites, many of which exhibit biocidal activity against pathogenic microorganisms. Here, we summarized available information on this sort of bioactivity in Hymenochaetaceae (Table 1, Supplementary Table 2). While numerous species have been marked in the literature as having "antimicrobial" properties in its wide sense, specific biocidal effects have also been documented. For instance, 35 species from 16 genera in particular are shown to exhibit antibacterial effects; the genera *Fomitiporia*, *Fulvifomes*, and *Inonotus* dominate in this regard. Moreover, 13 species show antifungal properties, mostly belonging to *Fulvifomes*, and eight species have antiviral properties

(Table 1, Supplementary Table 2). Other biocidal properties in Hymenochaetaceae include anti blue stain/wood decay fungi (in *P. pini*) antiparasitic (in *Fulvifomes rimosus* and *Hymenochaete rheicolor*), antimalarial (in *Fulvifomes xylocarpicola* and *T. linteus*), antitubercular (in *Fulvifomes xylocarpicola*), antiplasmodial (in *Phellinus igniarius*), and nematicidal (*Sanghuangporus* sp.) effects (Table 1, Supplementary Table 2).

Cancer treatment

Cancer is one of the foremost causes of mortality worldwide, with approximately 10 million deaths reported in 2020 by the World Health Organization. Precise cancer diagnosis is crucial for devising effective treatment strategies, as each cancer type demands a tailored approach. Current cancer treatments encompass a range of modalities, including surgery, chemotherapy, radiotherapy, and systemic therapies like targeted biological treatments. However, existing anticancer medications lack specificity, leading to drug resistance and often inducing adverse effects during clinical chemotherapy. Consequently, there is a pressing need to develop new and potent anticancer agents with minimal toxicity. Natural compounds have emerged as promising candidates, with mushrooms drawing attention for their immunomodulatory, anticancer, and anti-inflammatory properties, having been long utilized in traditional East Asian medicine (Cabral et al. 2018, Joseph et al. 2018). Several studies have revealed that *I. obliquus* exhibits cytotoxic effects against various types of cancer cells, including colon cancer, melanoma, sarcoma, lung adenocarcinoma, and hepatocellular carcinoma (Abugomaa et al. 2023). Within the Hymenochaetaceae family, at least 63 species from 16 different genera demonstrate antitumor activity; species belonging to the genera *Fomitiporia* and *Sanghuangporus* are important in this regard (Table 1, Supplementary Table 2). In their detailed chemical analysis of *Fuscoporia torulosa*, Béni et al. (2021) revealed that ergosta-7,22-diene-3-one not only demonstrated a considerable cytotoxic effect on human colon adenocarcinoma cell lines, but also shows synergism with the reference compound doxorubicin. According to Zhou et al. (2022) and Deveci et al. (2021), at least half of the currently known species within the genus *Porodaedalea* possess antitumor activity. *Tropicoporus linteus* also exhibits antimetastatic, pro-apoptotic, and antiangiogenic activities (Table 1). Other related properties include genoprotective (in *Fomitiporia robusta*), antineoplastic (in *Fulvifomes rimosus* and *Hymenochaete rheicolor*), and treating acute leukemia (in *Ochrosporellus taiwanensis*).

Cardiovascular disease treatment

Cardiovascular diseases pose a significant challenge globally, with elevated rates of morbidity and mortality. Myocardial ischemia/reperfusion (MI/R) injury stands as a primary risk factor in the progression of heart disease. Despite reperfusion being the most effective method to simulate tissue damage, it is acknowledged for inducing various adverse events upon the re-establishment of blood supply (Robin et al. 2007). Furthermore, MI/R triggers endoplasmic reticulum (ER) stress and activates apoptosis-related signaling pathways (Wang et al. 2016).

Hymenochaetaceae species have shown capabilities in treating cardiovascular diseases through various effects such as cardioprotective, ameliorating endothelial and vascular dysfunction, activating the circulation to remove blood stasis, haemostasis, preventing and treating cardiovascular diseases, promoting blood circulation, replenishing the blood, vasodilating, vascular-relaxing, and treating coronary artery disease; at least six species of *Fomitiporia* exhibit capabilities in treating coronary artery disease (Table 1, Supplementary Table 2).

Recently, Wu et al. (2021) revealed that *I. obliquus* extract provided pretreatment protection for cardiomyocytes against MI/R injury by mitigating oxidative damage and suppressing ER stress-induced apoptosis. It was found that *I. obliquus* extract may attenuate ER stress-induced cardiomyocyte apoptosis via the protein kinase RNA-like endoplasmic reticulum kinase (PERK)/eukaryotic initiation factor 2α (eIF2α)/CHOP (Cyclophosphamide, Hydroxydaunorubicin, Oncovin, Prednisone) pathway through the activation of silent information regulator sirtuin 1 (SIRT1). Thus, *I. obliquus* emerges as a promising therapeutic candidate for cardiovascular diseases.

Digestive system disease treatment and metabolism regulation

Hymenochaetaceae species are shown to have an effect on the treatment of digestive system diseases via promoting digestion (in *Fuscoporia gilva*), treating gastropathy (in *Pyrrhoderma adamantinum*), and treating hemorrhoids (in *Inocutis rheades, I. tamaricis*). Moreover, a number of species have shown hepatoprotective effects: *Fulvifomes merrillii*, *F. rimosus*, *Fuscoporia gilva*, *P. igniarius*, *Sanghuangporus baumii*, *Tropicoporus linteus* (Table 1, Supplementary Table 2). Chaga (*Inonotus obliquus*) has been a traditional remedy since the sixteenth century and has shown promising results in treating digestive system disorders without adverse effects (Reid 1976, Saar 1991, Wasser 2002, Kim et al. 2005). Despite numerous studies highlighting biological activities in Chaga, there remains a limited understanding of its impact on inflammatory bowel disease (IBD) (Ghia et al. 2009). IBDs, such as Crohn's disease and ulcerative colitis, are chronic intestinal disorders causing symptoms like abdominal pain, weight loss, diarrhea, and rectal bleeding, significantly affecting patients' quality of life (Rijnierse et al. 2007).

Effects on metabolism regulation have been documented in Hymenochaetaceae in a way that several species have shown antidiabetic, anti-obesity, hypolipidemic, hypoglycemic, improving insulin resistance, anti-hyperglycemic, low-density lipoprotein (LDL) antioxidant, PPAR-γ agonistic, and hypouricemic properties (Table 1, Supplementary Table 2). Species with antidiabetic properties include: *Fomitiporella badia*, *Fulvifomes merrillii*, *Inocutis levis, Inonotus obliquus*, *M. radiata*, *P. igniarius*, *Phylloporia ribis*, *S. baumii*, and *T. linteus. Inocutis levis* has been shown to improve insulin resistance and glucose tolerance and has exhibited potential to control hypertriglyceridemia (Ehsanifard et al. 2017, 2019). Moreover, six Hymenochaetaceae species have shown hypoglycemic properties: *I. obliquus*, *P. igniarius*, *P. pini*, *S. baumii*, *S. sanghuang*, and *T. linteus.* Various *Sanghuangporus* species seem particularly noteworthy for their potential in lowering serum lipids (Table 1, Supplementary Table 2).

Immune system treatment

Mushrooms are known for their potential in boosting the immune system and are particularly important for vegetarians and immunosuppressed individuals, such as those with HIV/AIDS. Research suggests that mushrooms can stimulate the immune system, modulate humoral and cellular immunity, and exhibit antimutagenic and antitumorigenic properties and they have also been found to rejuvenate the immune system weakened by cancer treatments like radiotherapy and chemotherapy (Davis et al. 2020). In particular, *Inonotus obliquus* and *Tropicoporus linteus* could enhance immune activation for cancer treatments, help resolve host defense-induced inflammatory reactions, and facilitate a return to homeostasis for cancer patients (Zhang et al. 2022). In Asian countries, *I. obliquus*, among some other species, is recognized as beneficial adjuncts for inflammation therapy. In a study by Choi et al. (2010), the anti-inflammatory effects of *I. obliquus* were investigated in a mouse model of colitis induced by dextran sodium sulfate and RAW 264.7 cells.

A key protective mechanism attributed to mushrooms against cancer is their ability to stimulate the immune system response, particularly through the action of β-glucans, a type of water-soluble polysaccharides. β-glucans activate the immune cells and proteins such as macrophages, T cells, natural killer cells, and cytokines, which target and attack tumor cells (Vetvicka et al. 2008). Within the Hymenochaetaceae family, at least 12 species from eight genera are known to possess immunomodulatory properties. Several *Sanghuangporus* species exhibit anti-inflammatory activity, and at least seven species of *Phellinus* and six species of *Porodaedalea* play a role in improving immunity. *Phellinus igniarius* has been shown to stimulate the synthesis of y-interferon and to inhibit the nuclear factor-κB (Table 1, Supplementary Table 2).

Neural system disease treatment

Among Hymenochaetaceae members, at least five species have been shown beneficial in treatment of neural system diseases: *Inonotus hispidus*, *I. obliquus*, *I. rickii*, *Phylloporia ribis*, and *Tropicoporus linteus* (Table 1, Supplementary Table 2). Degenerative neurological conditions such as Parkinson's disease (PD), characterized by symptoms related to movement, remain without a definite cure. Hispidin, a styrylpyrone polyphenol originally isolated from *I. hispidus* and later commonly found in medicinal Hymenochaetaceae, demonstrates significant biological effects. In a recent study conducted by Lai et al. (2023) on PD cell model, they highlighted the neuroprotective effects of hispidin against mitochondrial dysfunction induced by 1-methyl-4-phenylpyridinium and cellular apoptosis, suggesting potential role of hispidin in preventing PD. Moreover, in recent research on sedative properties of fruiting bodies of *I. hispidus* in mice model of insomnia, Bao et al. (2023) showed that the fungus significantly increased the rate of falling asleep, shortened the sleep latency, and prolonged the sleep duration. Extracts from *P. igniarius* have shown inhibitory effects on tumor growth, immune-regulatory effects, and potential neuroprotective benefits after cerebral ischemia (Zapora et al. 2016).

Hymenochaetaceae in aesthetic medicine

Currently, there is a growing consumer demand for cosmetics that contain natural and/or organic ingredients, as they are perceived to be healthier and more environmentally friendly. As a result, various substances extracted from macrofungi are now being incorporated into cosmetics, including phenolic compounds, polysaccharides, terpenoids, amino acids, and vitamins (Taofiq et al. 2016a). Chitin-glucan, a copolymer found in the cell wall of various mushrooms, is used in moisturizing and anti-aging formulations due to its excellent moisturizing capabilities (Aranaz et al. 2018, Gautier et al. 2008).

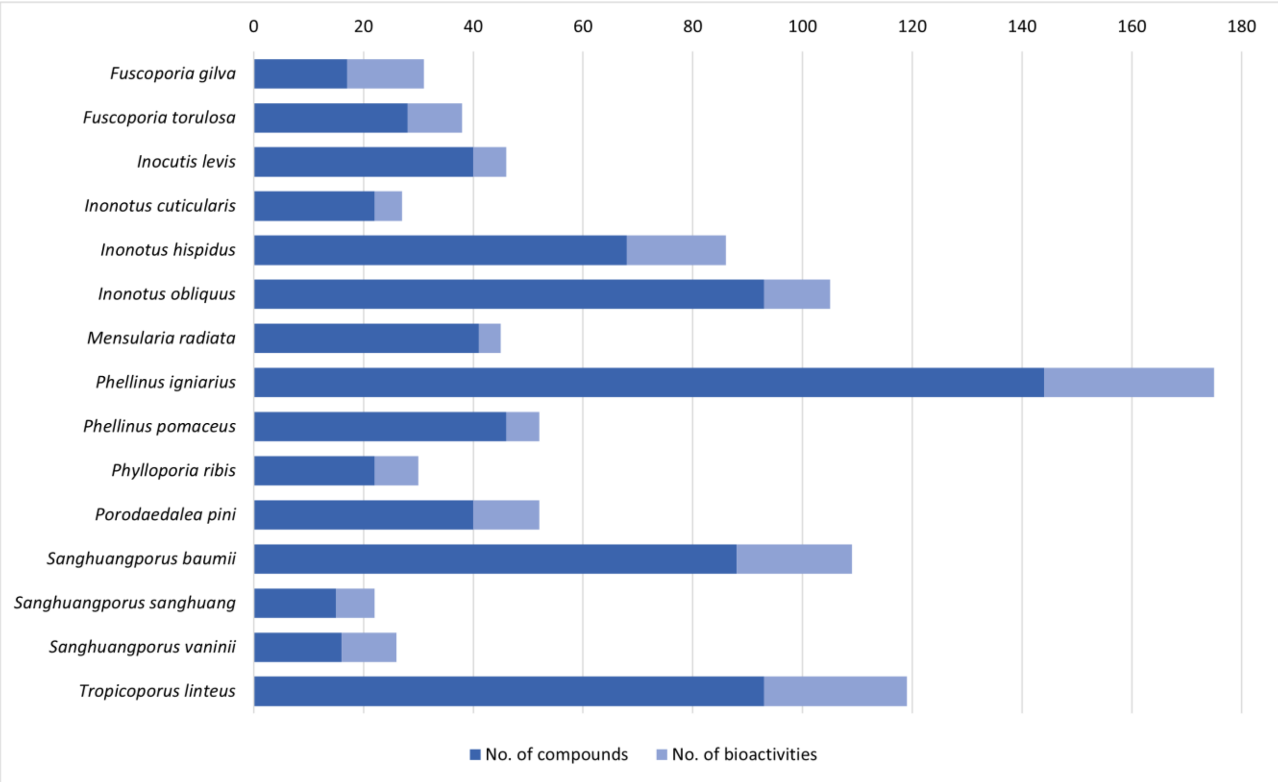

Figure 10 – Medicinal Hymenochaetaceae species with a relatively higher number of reported compounds (dark blue bars) and bioactive properties (light blue bars).

Phenolic compounds such as caffeic acid, ferulic acid, gallic acid, p-hydroxybenzoic acid, homogentisic acid, protocatechuic acid, and myricetin, have been identified in different Hymenochaetaceae species (Kim et al. 2008a, Machado-Carvalho et al. 2023; Table 1, Supplementary Table 1). Additionally, commercial phenolic compounds like caffeic acid, cinnamic acid, p-coumaric acid, gallic acid, and p-hydroxybenzoic acid, documented in various Hymenochaetaceae species, are known to brighten the skin by melanin content reduction and tyrosinase inhibition (Lee et al. 2015, Sujarit et al. 2021). Therapeutic actions such as antioxidant, and anti-tyrosinase activities help maintain the balance of reactive oxygen species (ROS) to prevent oxidative stress in body cells. ROS are generated when the skin is exposed to high UV light, leading to DNA damage, skin inflammation, hyperpigmentation, and a decrease in collagen, elastin, and hyaluronic acid, resulting in premature skin aging (Masaki 2010). Utilizing mushroom antioxidants presents a practical alternative to slow down the skin aging process (Hamza et al. 2024, Taofiq et al. 2016b). Our survey shows that antioxidant properties and tyrosinase inhibitory effects are indeed prevalent in numerous members of Hymenochaetaceae family (Table 1, Supplementary Table 1).

The growing interest of systemic Aesthetic Medicine (AM) in medicinal mushrooms is attributed to recent studies, published in multiple articles, that highlight the effectiveness of certain fungal extracts or their active ingredients in combating aging, particularly skin aging (Angelini et al. 2022). Mushroom extracts, such as those from *T. linteus*, have been recommended for incorporation into skincare products like lotions, brightening creams, serums, moisturizers, cleansing gels, primer creams, and facial masks (de Silva et al. 2012). Fungal extracts and preparations can be obtained from mycelium, spores, and fruiting bodies, containing a complex mixture of metabolites in liquid, semi-solid, or dry powder form, intended for external use in cosmetics or oral use in nutricosmetics (Wani et al. 2010).

Cosmeceuticals and nutricosmetics

Cosmeceuticals are a combination of cosmetics and pharmaceuticals aimed at enhancing beauty by incorporating ingredients that provide additional functions i.e., health benefits. When applied topically, they act as cosmetics but contain ingredients that affect the biological processes of skin (Anuradha et al. 2015), utilized in both human and veterinary medicine. In human medicine, the main focus is on anti-aging products, but some also target acne or provide hydration.

Nutricosmetics are dietary supplements designed to support skin function and structure. Known as “beauty pills”, “beauty from within”, and even “oral cosmetics”, nutricosmetics involve the oral intake of nutrients (Barel et al. 2014, Sujarit et al. 2021). Their primary application being anti-aging, they contribute to reducing wrinkles by combating free radicals generated by solar radiation (Anunciato & da Rocha Filho 2012). Various Hymenochaetaceae genera such as *Fomitiporia*, *Fuscoporia*, *Phellinus*, *Porodaedalea*, and *Sanghuangporus* are marked for their health benefits (Dai et al. 2010, Covino et al. 2019, Deveci et al. 2019b, Thammavong et al. 2021), and are candidates for developing nutricosmetics via innovative cultivation technologies.

Through interdisciplinary research utilizing genomics, proteomics, metabolomics, and systems pharmacology, the molecular mechanisms of fungal medicinal effects will be uncovered. This field, known as molecular cosmetology research, will lead to the incorporation of more fungal species into cosmetics in Aesthetic Medicine (AM), a field of medicine focused on achieving psycho-physical well-being through the study of humans and the environment. Through their rich metabolome profile and beneficial properties, Hymenochaetaceae taxa are prospective in this regard.

Molecular phylogeny of hymenochaetaceae medicinal species

The majority of available publications on medicinal Hymenochaetaceae species have generally recognized a very limited number of genera, basically centered on *Phellinus* and *Inonotus*. In the present research, we provided an up-to-date phylogeny backbone of the family to show the positioning of medicinal species (Fig. 11). To obtain a robust phylogeny and reduce bias in the phylogenetic signal, the taxon sampling was enhanced by incorporating candidates of all major genera of Hymenochaetaceae.

As depicted in the phylogram in Fig. 11, medicinal species are distributed in well-supported clades representing 27 known monophyletic genera. Moreover, for the following 20 genera, the type of the genus is a medicinal species: *Coltricia*, *Cylidrosporus*, *Flaviporellus*, *Fulvifomes*, *Fuscoporia*, *Hymenochaete*, *Inocutis*, *Inonotus*, *Meganotus*, *Mensularia*, *Nothonotus*, *Onnia*, *Phellinidium*, *Phellinus*, *Phellinopsis*, *Phellopilus*, *Porodaedalea*, *Pseudoinonotus*, *Pyrrhoderma*, and *Sanghuangporus*. Type species are taxonomically the core species in a genus and serve as the basis for interpretation of all entities assigned therein.

Is asia a hotspot for medicinal hymenochaetaceae?

Asia has been a cradle for recognition and utilization of medicinal fungi, holding a richly documented folk medicine. We questioned the relevance of Asia for a taxonomically specific group of medicinal fungi, herein Hymenochaetaceae family. We first elucidated the known geographic distribution of the medicinal Hymenochaetaceae worldwide, and made a survey using (fruiting body-based) species records in North America, Europe, Asia, and the Southern Hemisphere, as reported in the literature and the sources detailed in the methodology. Basically, species with no reported bioactivity containing compounds lacking biological properties were not considered as medicinal. Taken together, seven species with no reported bioactivity and containing only compounds with unspecified (e.g., "triterpenes") or no recorded biological properties (e.g., drosophilin A methyl ether) were not taken into account in calculations of geographic distribution: *Coniferiporia weirii*, *Hydnoporia corrugata*, *Neomensularia kanehirae*, *Onnia leporina*, *Phellinus populicola*, *Phellinus pseudolaevigatus*, and *Phellinus yucatanensis* (Table 1). Insufficiently characterized species (sp.) were only considered with caution.

The results show that North America, Europe, Asia, and the Southern Hemisphere harbor 32, 42, 97, and 23 species, respectively (Fig. 12, left chart). As far as the Asian species dominated (Fig. 12), we further surveyed the distribution of the species in Asia, tentatively partitioned into West Asia, Central Asia, East Asia (mainly China), and India. According to the results, 40 medicinal Hymenochaetaceae species are currently known in West Asia, 47 in Central Asia, 79 in East Asia, mainly China, and 37 species are known in India (Fig. 12, right chart). Therefore, it seems that the majority of the medicinal Hymenochaetaceae species are known from China. This might be in accordance with the extensive ethnomycological background in the country (Wu et al. 2019, 2022).

Valued species and compounds

Presently, the market offers a diverse range of pharmaceutical and nutraceutical products derived from Hymenochaetaceae species, as pure or blended with other beneficial ingredients in the form of dried slices, powders, tablets, tea beverages, and extract pastes (e.g., see iHerb.com©). Low toxicity and scarce side effects have offered Hymenochaetaceae taxa as suitable candidates for development of pharmaceuticals and nutraceuticals (Lee & Yun 2011, He et al. 2021, Cheng et al. 2023). The products are utilized across multiple sectors, including food, healthcare, and the cosmetics industries.

Several Hymenochaetaceae species are commercially cultivated for direct use of the fruiting bodies in the market or to be further processed for various applications in food and medicine: *Sanghuangporus sanghuang*, *S. vaninii*, *S. baumii* (Lei et al. 2022, Yang et al. 2023), *Phylloporia fontanesiae*, *P. pulla* and *P. lonicerae* (Jiang et al. 2020), though the precise identity of some cultivars may be negotiated.

In the present review, we identified 15 species from nine independent genera in the Hymenochaetaceae family with a comparatively higher number of biological properties and metabolites (Fig. 10). There are also examples of optimization of metabolite production in the prized species. For instance, *I. obliquus* co-cultured with *Fomitiporia punctata* has shown a quantitative increase in its bioactive compound yields (Zheng et al. 2011). Indeed, due to poorly active nature of biosynthetic pathways in basidiomycetes in general, their mycelial co-culturing with other microorganisms has been suggested beneficial for production of metabolites (Gressler et al. 2021).

Patent repositories also present several cases of patented compounds derived from Hymenochaetaceae taxa. Examples are sesquiterpenoids such as (E)-(9CI)-2-methyl-6-(4-methyl-3-cyclohexen-1-yl)-2,6-heptadienoic acid derived from *T. linteus* with antibacterial properties for oral cavity composition of mouthwash and toothpaste (Kobayashi et al. 2010). Several patents were also documented from a single genus *Phylloporia* (Cheng et al. 2023).

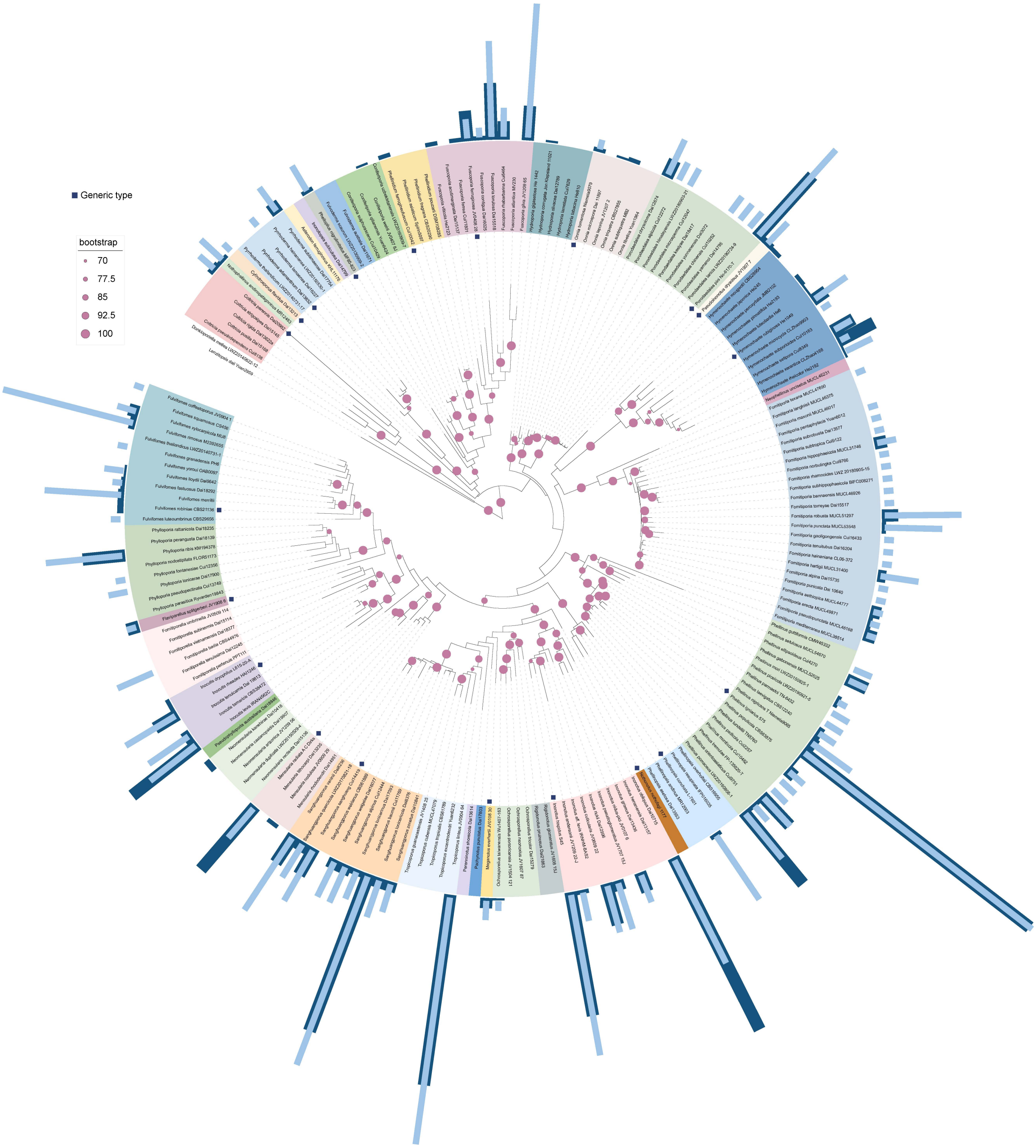

Figure 11 – Phylogram of Hymenochaetaceae based on a combined dataset of ITS and nrLSU sequences showing the phylogenetic distribution of medicinal species, hence species with at least one bioactive metabolite (dark blue bars) and/or at least one medicinal property (light blue bars). Each genus is shown by a colored box. The medicinal species which are type of their genus (generic types), are marked with a small dark blue square next to their names. Phylogram is rooted with *Donkioporiella mellea* and *Lenzitopsis daii*. (*Fomitiporia mediterranea* is a synonym of *F. pseudopunctata*, as confirmed by phylogeny. Bar chart is given for the former, current name).

Aethiopinolones from *Fomitiporia aethiopica* may represent candidates for development of contraceptives and hydrocortisone (Sandargo et al. 2019). Among lead compounds with prospects for development of pharmaceuticals, hispidin may be highlighted. Interestingly, the antioxidant properties of hispidin and some of its derivatives were shown 2–3 times more effective than those of the commercial trolox. Due to its considerable protein kinase C (PKC) inhibitory effects, hispidin has become commercially available for standard PKC-related researches (Lee & Yun 2011). Among compounds detected in *I. hispidus*, N-butylbenzenesulfonamide and lauramidopropyl betaine maybe noteworthy. N-butylbenzenesulfonamide is used as a plasticizer in polyacetals and polyamides and also has high antiandrogenic and antifungal activity, while lauramidopropyl betaine is a mild surfactant known for its excellent foaming and viscosity properties, along with antimicrobial effects (Angelini et al. 2019). Recently, the metabolomics profiling in *I. hispidus* led to the detection and biosynthesis pathway elucidation of the two coumarin derivatives coumestrol and psoralen mainly found in plants and reputed for their anticancer and anti-inflammation roles (Liu et al. 2024).

Chaga contains a high concentration of melanin. The water-soluble melanins found in *I. obliquus* have been shown to safeguard DNA from carcinogenic harm, thereby expediting the preclinical investigations involving Chaga (Babitskaya et al. 2000, Duru et al. 2019). Moreover, inotolactones A and B discovered from *I. obliquus* (Ying et al. 2014) exhibited a more potent α-glucosidase inhibitory compared to the positive control acarbose, proposing their strong perspective in treatment of hyperglycemia and diabetes. *Sanghuangporus sanghuang* has recently shown implications for therapy of pulmonary fibrosis as its polyphenol extracts effectively decreased bleomycin-induced acute lung injury (Su et al. 2021). The significant PPAR- γ-agonistic activity of chlorophellin C introduced from *Phylloporia ribis* was shown to be comparable to rosiglitazone (Lee et al. 2008) and therefore highly promising for the treatment of type 2 diabetes mellitus.

Fuscoporia torulosa and *P. igniarius* were recently used for yoghurt fortification to enhance its antioxidant abilities, thus being candidates for development of functional foods with fungal extracts (Dimitrova-Shumkovska et al. 2022). Application of pulverized mycelia of *T. linteus* for bread fortification has also been reported (Ulziijargal et al. 2013).

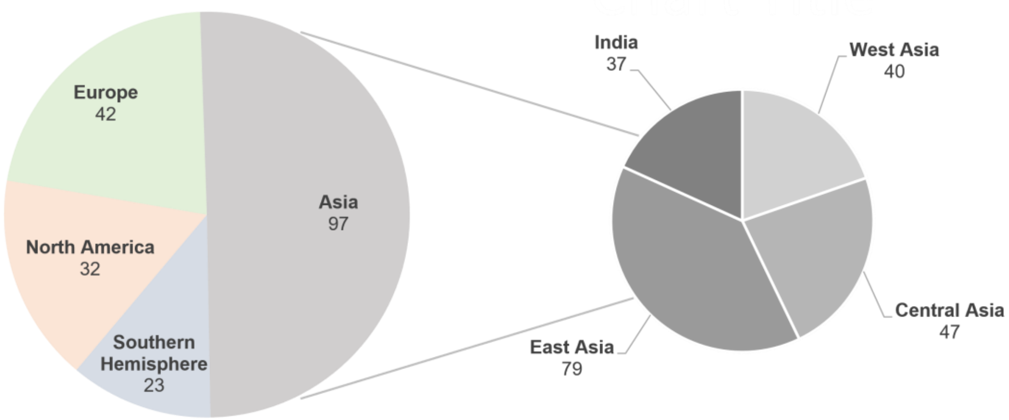

Figure 12 – Geographic distribution of the medicinal species of Hymenochaetaceae. Numbers refer to the number of species.

Taxonomic challenges

As awareness about health and wellness continues to rise, there is a growing trend among consumers towards embracing edible and medicinal mushrooms, renowned for their health-enhancing properties. This surge in popularity is attributed to their potential benefits, making these fungi highly sought after for their nutritional and therapeutic qualities. However, literature surveys reveal poorly characterized isolates in many studies of this kind. While it is well-certified that the compound composition and biological properties of organisms vary by species, there has been insufficient consideration to verify the identity of the organisms involved.

The name of many prized species has indeed been collectively used in literature, each later revealed to represent species complexes on account of taxonomic and phylogenetic inquiry. Local communities can hardly distinguish among sympatrically occurring species of different pileate genera and species. However, even professionals in biomedical research appear to sometimes overlook the importance of accurately identifying the species under study. Here, we consider *Sanghuangporus,* one of the most significant medicinal genera in Hymenochaetaceae, as an example. Several remarkable pileate Hymenochaetaceae species have been collectively named as 'Sanghuang' in older Chinese literature (Wu et al. 2012). It is found that more than half from 271 available ITS sequences related to *Sanghuangporus* in GenBank were misidentified (Shen et al. 2021). To facilitate the identification and rapid detection of *Sanghuangporus*, its species delimitation was revised and the wrongly labeled ITS sequences were corrected (Shen et al. 2021).

Thanks to the progress in molecular species clarifications and natural product chemistry, outcomes and consequences of poor taxonomy in biomedical research has been more elucidated. In simple words, it is increasingly acknowledged that the attributed chemical content and biological properties can be misinterpreted due to the incorrect identification of a source fungus. Moreover, obscure or compromised identity of the fungal material obstacles the reproducibility of the obtained results. It is evident that reproducibility is a fundamental principle in scientific research. Indeed, proper taxonomy knowledge is crucial for academic and industrial advancements of medicinal Hymenochaetaceae and other fungal groups (Zhou 2020).

Therefore, highlighting the importance of valid identification and correct nomenclature of the isolates, we present a set of recommendations for application of fungi in biomedical, biotechnological, and other applied fields of research, with emphasis on medicinal Hymenochaetaceae.

General recommendations:

- We recommend that, in biomedical and other applied studies, the species identification and authentication should preferably be confirmed by expert taxonomists. Nilsson et al. (2023) give an agreeable definition of 'mycology taxonomist': "someone who has [co-]authored at least one fungal species name as indexed in Index Fungorum/MycoBank/Fungal Names".

- We recommend that the isolates in applied studies be obtained from- and deposited in valid fungaria/herbaria/culture collections. Valid repositories usually have higher chance of professional management and curation the nomenclature of their holdings at a regular basis.

- DNA sequences derived from the specimens and isolates are recommended to be deposited at GenBank and alike public repositories, preferably annotated with precise metadata of the source fungus.

- Effective dissemination of expert knowledge on fungal diversity (e.g., guidebooks, printed and online resources, courses) produced by the mycology taxonomists in a given area, especially local communities with extensive mushroom foraging, would increase the chance of correct application of fungal names as well as sustainable utilization of natural resources.

Concluding remarks

Progress in molecular taxonomy of Hymenochaetaceae and biodiversity inventories intuitively opens new windows for exploration of its chemical diversity and pharmacological effects. Species is the core entity in biological science and functional evolutionary research. Disentanglement of species complexes leads to a better understanding of species-wise chemical architecture and biological properties. This study revealed that the family Hymenochaetaceae is comprised of at least 124 potential medicinal species. Phylogenetic analyses may help to detect close relatives of the potent medicinal species which would be marked as next candidates for future chemical and biomedical explorations, what applied phylogeny may aim to cover. Various Hymenochaetaceae species have been provided with their whole genomes sequenced (Huo et al. 2020, Zhao et al. 2023, Jin et al. 2024). Advances in phylogenomics and comparative -omis research enables deeper understanding of the evolution of the species, genetic context of medicinal properties, and biosynthetic machinery of valued compounds.

In this survey, we showed that approximately 500 metabolites from various compound classes are known from Hymenochaetaceae. As far as the chemical diversity is concerned (Table 1, Supplementary Table 1), it must be remembered that many compounds may have been reported via chromatography or other moderately accurate approaches, and need structure verification via NMR and other spectral methods. Therefore, we regard those reports tentative at best. Moreover, due to uncertainties in species distinguishment, the diversity of compounds and bioactivities may be wiser to be interpreted at a species group or species complex level, rather than a particular species epithet. We have put forth a series of recommendations with the aim of encouraging better focus on accurate characterization of Hymenochaetaceae species that play a role in pharmacology, biochemistry, and other practical fields of study.

The bulk of conducted research on medicinal Hymenochaetaceae has primarily concentrated on a limited number of species, and the focus has been on those taxa that have been deeply rooted in Asian ethnomycology, calling for investigations in favor of less inventoried areas and little explored species. Hymenochaetaceae is a medicinally marvelous fungal group; however, similar to other natural resources, its utilization must be optimized to ensure sustainability and conservation – for instance via high-throughput screening technologies as well as innovative cultivation techniques, co-culture, culture on biowaste, and genetic engineering of isolates.

ACKNOWLEDGEMENTS

The support received from Iran National Science Foundation (INSF no. 4000655) and National Natural Science Foundation of China (NSFC nos. 32070006, 32270011, 32161143013, U23A20142) are acknowledged. The data management of Central Asian fungi kept in TAAM fungarium was supported by Estonian Ministry of Education and Research, from the scientific collection infrastructure program. The comments by the two anonymous reviewers are acknowledged.

REFERENCES

Abdelshafy AM, Belwal T, Liang Z, Wang L et al. 2021 – A comprehensive review on phenolic compounds from edible mushrooms: Occurrence, biological activity, application and future prospective. Critical Reviews in Food Science and Nutrition 62(22), 6204–6224.

Abugomaa A, Elbadawy M, Ishihara Y, Yamamoto H et al. 2023 – Anti-cancer activity of Chaga mushroom (*Inonotus obliquus*) against dog bladder cancer organoids. Frontiers in Pharmacology 14, 1159516.

Adongbede EM, Aduralere IT. 2019 – Evaluation of compounds extracted from eight genera of wild mushrooms from Nigeria for anti-cell proliferation activity in vitro. Iraqi Journal of Science 60(5), 952–960.

Albornoz V, Casas-Arrojo V, Figueroa F, Hernández V et al. 2022 – Evaluation of cytotoxic effect against tumour cells of the acidic polysaccharides of the fungus *Nothophellinus andinopatagonicus.* Journal of the Chilean Chemical Society 67, 5418–5424.

Ali NA, Jansen R, Pilgrim H, Liberra K, Lindequist U. 1996 – Hispolon, a yellow pigment from *Inonotus hispidus*. Phytochemistry 41(3), 927–929.

Angelini P, Girometta C, Tirillini B, Moretti S et al. 2019 – A comparative study of the antimicrobial and antioxidant activities of *Inonotus hispidus* fruit and their mycelia extracts. International Journal of Food Properties 22(1), 768–783.

Angelini P, Girometta CE, Venanzoni R, Bertuzzi G. 2022 – Anti-aging properties of medicinal mushrooms in systemic aesthetic medicine. In: Arya A, Rusevska K. (eds.) Biology, Cultivation and Applications of Mushrooms. Springer, Singapore.

Antonelli A, Fry C, Smith RJ, Simmonds MSJ et al. 2020 – State of the world's plants and fungi 2020. Rep., R. Bot. Gardens, Kew, London.

Anunciato TP, da Rocha Filho PA. 2012 – Carotenoids and polyphenols in nutricosmetics, nutraceuticals, and cosmeceuticals. J. Cosmet. Dermatol. 11, 51–54.

Anuradha SN, Vilashene G, Lalithambigai J, Arunkumar S. 2015 – Cosmeceuticals: An opinion in the direction of pharmaceuticals. Asian J. Pharm. Clin. Res. 8, 64–69.

Aqueveque P, Anke T, Saéz K, Silva M, Becerra J. 2010 – Antimicrobial activity of submerged cultures of Chilean Basidiomycetes. Planta Medica 76(15), 1787–1791.

Aranaz I, Castro C, Heras A, Acosta N. 2018 – On the ability of low molecular weight chitosan enzymatically depolymerized to produce and stabilize silver nanoparticles. Biomimetics 3, 21.

Atsumi S, Umezawa K, Inuma H, Naganawa H et al. 1990 – Production, isolation and structure determination of a novel β-glucosidase inhibitor, cyclophellitol, from *Phellinus* sp., J. Antibiot. 43(1), 49–53.

Ayer WA, Brandt EV, Coetzee J, Daniewski WM et al. 1999 – Secondary Metabolites and the Control of Some Blue Stain and Decay Fungi. Fortschritte der Chemie organischer Naturstoffe/Progress in the Chemistry of Organic Natural Products, 1–20.

Ayer WA, Cruz ER. 1993 – The tremulanes, a new group of sesquiterpenes from the aspen rotting fungus *Phellinus tremulae*. The Journal of Organic Chemistry 58(26), 7529–7534.

Ayer WA, Cruz ER. 1995 – 2-Carbomethoxyoxepin: 1-carbomethoxybenzene 1,2-oxide and the biosynthesis of methyl salicylate in *Phellinus tremulae*. Journal of Natural Products 58(4), 622–624.

Azeem U, Dhingra GS, Shri R. 2018 – Pharmacological potential of wood inhabiting fungi of genus *Phellinus* Quél.: An overview. Journal of Pharmacognosy and Phytochemistry 7, 1161–1171.

Badalyan SM, Gharibyan NG. 2020 – Pharmacological properties and resource value of hymenochaetoid Fungi (Agaricomycetes) distributed in Armenia. International Journal of Medicinal Mushrooms 22(12), 1135–1146.

Bai J, Li T, Jia X, Chen Y et al. 2020 – Effect of tween 40 and ethanol on the secretion, structure and antioxidant activities of exopolysaccharides from *Inonotus rickii*. Anais da Academia Brasileira de Ciências, 92. Suppl 2, e20180838. Doi 10.1590/0001-3765202020180838

Babitskaya VG, Shcherba VV, Ikonnikova NV. 2000 – Melanin complex of the fungus *Inonotus obliquus*. Applied Biochemistry and Microbiology 36, 377–381.

Balandaykin ME, Zmitrovich IV. 2015 – Review on Chaga medicinal mushroom, *Inonotus obliquus* (higher basidiomycetes): Realm of medicinal applications and approaches on estimating its resource potential. International Journal of Medicinal Mushrooms 17, 95–104.

Ballini R, Bosica G. 1994 – Synthesis of 1-phenylheptane-1, 5-dione, a new natural product found in *Phellinus tremulae*. Journal of Natural Products 57(10), 1462–1463.

Bao HY, Zou HM, Wang QC, Han C, Liu Y. 2023 – Sedative effects of water extracts of *Inonotus hispidus* at different developmental stages. Mycosystema 42(7), 1622–1634.

Barel AO, Paye M, Maibach I. 2014 – Use of food supplements as nutricosmetics in health and fitness. In: Handbook of Cosmetic Science and Technology, 4th ed. CRC Press: Boca Raton, FL, USA. pp. 583–596.

Bergmann P, Takenberg M, Frank C, Zschätzsch M et al. 2022 – Cultivation of *Inonotus hispidus* in stirred tank and wave bag bioreactors to produce the natural colorant hispidin. Fermentation 8(10), 541.

Béni Z, Dékány M, Sárközy A, Kincses A et al. 2021 – Triterpenes and phenolic compounds from the fungus *Fuscoporia torulosa*: isolation, structure determination and biological activity. Molecules 26(6), 1657.

Bernicchia A, Gorjón SP. 2020 – Polypores of the Mediterranean Region. Romar, Italy.
Blanchette RA, Renner CC, Held BW, Enoch C, Angstman S. 2002 – The current use of *Phellinus igniarius* by the Eskimos of western Alaska. Mycologist 16, 142–145.
Borovskii GB, Gornostai TG, Polyakova MS, Lozovskaya EA, Nikiforov SB. 2022 – Antitumor properties of aqueous extracts from *Inonotus rheades* mycelium and their evaluation under various cultivation conditions. In: Doklady Biochemistry and Biophysics. Vol. 505. No. 1, pp. 151–155. Pleiades Publishing.
Brazee NJ. 2015 – Phylogenetic relationships among species of *Phellinus* sensu stricto, cause of white trunk rot of hardwoods, from Northern North America. Forests 6(11), 4191–211.
Butruille D, Dominguez XA. 1972 – Un nouveau produit naturel: 1,4-Dimethoxy- 2-nitro-3,5,6-trichlorobenzene. Tetrahedron Letters 3, 211–212.
Cabral C, Efferth T, Pires IM, Severino P, Lemos MFL. 2018 – Natural products as a source for new leads in cancer research and treatment. eCAM 2018, 8243680.
Campi M, Mancuello C, Ferreira F, Maubet Y et al. 2019 – Preliminary evaluation of phenolic compounds, antioxidant activity and bioactive compounds in some species of basidiomycetes fungi from Paraguay. Steviana 11(1), 26–41.
Cao C, Peng F, Cui BK. 2013 – Chemical characterization and structure of exopolysaccharides from submerged culture of new medicinal mushroom from China, *Phellinus mori* (higher basidiomycetes). International Journal of Medicinal Mushrooms 15(1), 57–69.
Cateni F, Zacchigna M, Altieri T, Procida G, Cichelli A. 2015 – Antioxidant properties of oak bracket mushroom, *Pseudoinonotus dryadeus* (higher basidiomycetes): a mycochemical study. International Journal of Medicinal Mushrooms 17(7), 627–637.
Çayan F, Tel-Çayan G, Deveci E, Duru ME. 2021a – HPLC–DAD characterization of phenolic profile and in vitro antioxidant, anticholinesterase, and antidiabetic activities of five mushroom species from Turkey. 3 Biotech 11(6), 273.
Çayan F, Tel-Çayan G, Deveci E, Duru ME. 2021b – A comprehensive study on phenolic compounds and bioactive properties of five mushroom species via chemometric approach. Journal of Food Processing and Preservation 45(9), e15695.
Chang ZQ, Gebru E, Lee SP, Rhee MH et al. 2011 – In vitro antioxidant and anti-inflammatory activities of protocatechualdehyde isolated from *Phellinus gilvus*. Journal of Nutritional Science and Vitaminology 57(1), 118–122.
Chaharmiri-Dokhaharani S, Ghobad-Nejhad M, Moghimi H, Farazmand A, Rahmani H. 2020 – Investigating antibacterial and antioxidant activity of *Inocutis levis* extracts and evaluating its phenolic compounds. Biological Journal of Microorganism 9(35), 1–6.
Chaharmiri-Dokhaharani S, Ghobad-Nejhad M, Moghimi H, Farazmand A, Rahmani H. 2021 – Biological activities of two polypore macrofungi (Basidiomycota) and characterization of their compounds using HPLC–DAD and LC–ESI–MS/MS. Folia Microbiologica 66(5), 775–786.
Chaharmiri-Dokhaharani S, Ghobad-Nejhad M, Moghimi H, Norouzi H, Moghaddam M. 2024 – Bioactivity and chemical profiling of medicinal fungi *Inonotus cuticularis* and *Inocutis levis* (Hymenochaetaceae) using chromatography and mass spectrometry. Journal of Medicinal Plants and By-products 13(1), 147–159.
Chao TL, Wang TY, Lee CH, Yiin SJ et al. 2018 – Anti-cancerous effect of *Inonotus taiwanensis* polysaccharide extract on human acute monocytic leukemia cells through ROS-independent intrinsic mitochondrial pathway. International Journal of Molecular Sciences 19(2), 393.
Chen HP, Dong WB, Feng T, Yin X et al. 2014 – Four new sesquiterpenoids from fruiting bodies of the fungus *Inonotus rickii*. Journal of Asian Natural Products Research 16(6), 581–586.
Chen HP, Liu JK. 2017 – Secondary metabolites from higher fungi. In: Kinghorn AD, Falk H, Gibbons S, Kobayashi J (eds.). Progress in the Chemistry of Organic Natural Products. Vol. 106, 1–201.

Cheng T, Chepkirui C, Decock C, Matasyoh JC, Stadler M. 2019 – Sesquiterpenes from an eastern African medicinal mushroom belonging to the genus *Sanghuangporus*. Journal of Natural Products 82(5), 1283–1291.

Cheng Y, Zhou LJ, Jiang JH, Tian XM, Zhou LW. 2023 – *Phylloporia* (Hymenochaetales, Basidiomycota), a medicinal wood-inhabiting fungal genus with much potential for commercial development. Food Reviews International 39(5), 2776–2789.

Chepkirui C, Cheng T, Matasyoh J, Decock C, Stadler M. 2018b – An unprecedented spiro [furan-2, 1'-indene]-3-one derivative and other nematicidal and antimicrobial metabolites from *Sanghuangporus* sp. (Hymenochaetaceae, Basidiomycota) collected in Kenya. Phytochemistry Letters 25, 141–146.

Chepkirui C, Sum WC, Cheng T, Matasyoh JC et al. 2018a – Aethiopinolones A–E, new pregnenolone type steroids from the East African basidiomycete *Fomitiporia aethiopica*. Molecules 23(2), 369.

Cho JY, Kwon YJ, Sohn MJ, Seok SJ, Kim WG. 2011 – Phellinstatin, a new inhibitor of enoyl-ACP reductase produced by the medicinal fungus *Phellinus linteus*. Bioorganic and Medicinal Chemistry Letters 21(6), 1716–1718.

Choi SY, Hur SJ, An CS, Jeon YH et al. 2010 – Anti-inflammatory effects of *Inonotus obliquus* in colitis induced by dextran sodium sulfate. Journal of Biomedicine and Biotechnology, 943516. Doi 10.1155/2010/943516

Cloete M, Fischer M, Mostert L, Halleen F. 2015 – Hymenochaetales associated with esca-related wood rots on grapevine with a special emphasis on the status of esca in South African vineyards. Phytopathologia Mediterranea 54(2), 299–312.

Covino S, D'Ellena E, Tirillini B, Angeles Flores G et al. 2019 – Characterization of biological activities of methanol extract of *Fuscoporia torulosa* (Basidiomycetes) from Italy. International Journal of Medicinal Mushrooms 21(11), 1051–1063.

Dai Q, Zhang FL, Feng T. 2021 – Sesquiterpenoids specially produced by fungi: Structures, biological activities, chemical and biosynthesis (2015–2020). Journal of Fungi 7(12), 1026.

Dai YC, Zhou LW, Cui BK, Chen YQ, Decock C. 2010 – Current advances in *Phellinus* sensu lato: medicinal species, functions, metabolites and mechanisms. Applied Microbiology and Biotechnology 87(5), 1587–1593.

Davis R, Taylor A, Nally R, Benson KF et al. 2020 – Differential immune activating, anti-inflammatory, and regenerative properties of the aqueous, ethanol, and solid fractions of a medicinal mushroom blend. Journal of Inflammation Research 13, 117–131.

Ding J, Li Z, Feng T, Liu J. 2018 – Inonotolides A–C, isopimarane diterpenoid lactones from *Inonotus sinensis*. Fitoterapia 127, 410–412.

Ding JH, Li ZH, Feng T, Liu JK. 2019 – A new guaiane sesquiterpene from cultures of the fungus *Fulvifomes kanehirae*. Natural Product Research 33(8), 1223–1226.

de Silva DD, Rapior S, Hyde KD, Bahkali AH. 2012 – Medicinal mushrooms in prevention and control of diabetes mellitus. Fungal Diversity 56, 1–29.

Deveci E, Çayan F, Tel-Çayan G, Duru ME. 2019b – Structural characterization and determination of biological activities for different polysaccharides extracted from tree mushroom species. J. Food Biochem. 43(9), e12965.

Deveci E, Tel-Çayan G, Duru ME, Öztürk M. 2019a – Isolation, characterization, and bioactivities of compounds from *Fuscoporia torulosa* mushroom. Journal of Food Biochemistry 43(12), e13074.

Deveci E, Tel-Cayan G, Karakurt S, Emin Duru M. 2021 – Cytotoxic activities of methanol extract and compounds of *Porodaedalea pini* against colorectal cancer. IJSM 8(1), 40–48.

Devi R, Sharma P, Rajput A, Rajput A et al. 2022 – Evaluation of taxonomic, phytochemical and antioxidant characteristics of wild mushroom *Porodaedalea pini*. Pharmacological Research – Modern Chinese Medicine 5, 100189.

Dimitrova-Shumkovska J, Kosharkoska-Spasovska F, Krstanoski L, Karadelev M. 2022 – Antioxidant properties of fortified yogurt with medicinal mushrooms from *Phellinus* species. Journal of Food Biochemistry 46, e14364.

Dong Y, Ma H, Zhou C, Moses GK et al. 2019 – Review of advances in bioactive low-molecular-weight compounds, extracts, and biology of *Phellinus* sensu lato mushrooms (Agaricomycetes) from 2011 to 2017. International Journal of Medicinal Mushrooms 21(9), 875–894.

Duru ME, Çayan GT. 2015 – Biologically active terpenoids from mushroom origin: a review. Records of Natural Products 9(4), 456.

Duru KC, Kovaleva EG, Danilova IG, van der Bijl P. 2019 – The pharmacological potential and possible molecular mechanisms of action of *Inonotus obliquus* from preclinical studies. Phytother. Res. 33, 1966–1980.

Ehsanifard Z, Mir-Mohammadrezaei F, Ghobad-Nejhad M, Safarzade AR. 2019 – The effect of aqueous extract of *Inocutis levis* on liver histopathology and hypertriglyceridemia in high sucrose-fed Wistar rats. Journal of Medicinal Plants 18(70), 181–187.

Ehsanifard Z, Mir-Mohammadrezaei F, Safarzadeh A, Ghobad-Nejhad M. 2017 – Aqueous extract of *Inocutis levis* improves insulin resistance and glucose tolerance in high sucrose-fed Wistar rats. Journal of Herbmed Pharmacology 6(4), 160–164.

Ern PT, Quan TY, Yee FS, Yin AC. 2023 – Therapeutic properties of *Inonotus obliquus* (Chaga mushroom): a review. Mycology 11, 1–8.

Feng T, Cai JL, Li XM, Zhou ZY et al. 2016 – Chemical constituents and their bioactivities of mushroom *Phellinus rhabarbarinus*. Journal of Agricultural and Food Chemistry 64(9), 1945–1949.

Fiasson JL. 1982 – Distribution of styrylpyrones in the basidiocarps of various Hymenochaetaceae. Biochemical Systematics and Ecology 10(4), 289–296.

Fischer J, Thines E. 2017 – Secondary metabolites of fungal vine pathogens. In: Biology of Microorganisms on Grapes, in Must and in Wine. Springer, Cham. Pp. 165–185.

Ganesan K, Xu B. 2018 – Anti-obesity effects of medicinal and edible mushrooms. Molecules 23(11), 2880.

Garádi Z, Dékány M, Móricz ÁM, Gaál A et al. 2021 – Antimicrobial, antioxidant and antiproliferative secondary metabolites from *Inonotus nidus-pici*. Molecules 26(18), 5453.

Gautier S, Xhauflaire-Uhoda E, Gonry P, Piérard GE. 2008 – Chitinglucan, a natural cell scaffold for skin moisturization and rejuvenation. Int. J. Cosmet. Sci. 30, 459–469.

Ghia J, Blennerhassett P, Deng Y, Verdu EF et al. 2009 – Reactivation of inflammatory bowel disease in a mouse model of depression. Gastroenterology 136(7), 2280–2288.

Ghobad-Nejhad M. 2011 – Updated checklist of corticioid and poroid basidiomycetes of the Caucasus region. Mycotaxon 117, 508, 70 pp.

Ghobad-Nejhad M. 2016 – *Inonotus krawtzewii* causes noteworthy damage to oak stands in Zagros, western Asia, with a key to morphologically similar species worldwide. Nordic Journal of Botany 34(4), 470–474.

Ghobad-Nejhad M, Hallenberg N. 2012 – Checklist of Iranian non-gilled/non-gasteroid hymenomycetes (Agaricomycotina). Mycotaxon 119, 494, 49 pp.

Ghosh SK. 2014 – Isolation of polysaccharides and terpenoids from some basidiomycota and their antibacterial activities. British Microbiology Research Journal 4(2), 155–166.

Gil-Ramírez A, Pavo-Caballero C, Baeza E, Baenas N et al. 2016 – Mushrooms do not contain flavonoids. Journal of Functional Foods 25, 1–3.

Girometta C, Dondi D, Baiguera RM, Bracco F et al. 2020 – Characterization of mycelia from wood-decay species by TGA and IR spectroscopy. Cellulose 27(11), 6133–6148.

Gómez-Espinoza J, Riquelme C, Romero-Villegas E, Ahumada-Rudolph R et al. 2023 – Diversity of Agaricomycetes in southern South America and their bioactive natural products. Natural Product Research 4, 1–5.

González AG, Expósito TS, Marante FJ, Pérez MM et al. 1994 – Lanosterol derivatives from *Phellinus torulosus*. Phytochemistry 35(6), 523–1526.
Gressler M, Löhr NA, Schäfer T, Lawrinowitz S et al. 2021 – Mind the mushroom: natural product biosynthetic genes and enzymes of Basidiomycota. Natural Product Reports 38(4), 702–722.
Gründemann C, Reinhardt JK, Lindequist U. 2020 – European medicinal mushrooms: Do they have potential for modern medicine? An update. Phytomedicine 66, 153131.
Guo Q, Zhao L, Zhu Y, Wu J. 2021 – Optimization of culture medium for *Sanghuangporus vaninii* and a study on its therapeutic effects on gout. Biomedicine and Pharmacotherapy 135, 111194.
Hai Bang T, Suhara H, Ishikawa H, Fukami K et al. 2014 – Wild mushrooms in Nepal: some potential candidates as antioxidant and ACE-inhibition sources. Evidence-Based Complementary and Alternative Medicine 2014, 195305.
Hamza A, Mylarapu A, Krishna KV, Kumar DS. 2024 – An insight into the nutritional and medicinal value of edible mushrooms: a natural treasury for human health. J. Biotech. 381, 86–99.
Han JG, Hyun MW, Kim CS, Jo JW et al. 2016 – Species identity of *Phellinus linteus* (sanghuang) extensively used as a medicinal mushroom in Korea. Journal of Microbiology 54, 290–295.
Handa N, Yamada T, Tanaka R. 2010 – An unusual lanostane-type triterpenoid, spiroinonotsuoxodiol, and other triterpenoids from *Inonotus obliquus*. Phytochemistry 71, 1774–1779.
Harms M, Lindequist U, Wende K. 2014 – Biological activity of different *Inonotus* species on human keratinocytes. Planta Medica 80, P1N34.
He J, Feng XZ, Lu Y, Zhao B. 2001 – Three new triterpenoids from *Fuscoporia obliqua*. Journal of Asian Natural Products Research 3(1), 55–61.
He JB, Feng T, Zhang S, Dong ZJ et al. 2014 – Seven new drimane-type sesquiterpenoids from cultures of fungus *Phellinus tuberculosus*. Nat. Prod. Bioprospect. 4, 21–25.
He JB, Tao J, Miao XS, Feng YP et al. 2015 – Two new illudin type sesquiterpenoids from cultures of *Phellinus tuberculosus* and *Laetiporus sulphureus*. Journal of Asian Natural Products Research 17(11), 1054–1058.
He P, Zhang Y, Li N. 2021 – The phytochemistry and pharmacology of medicinal fungi of the genus *Phellinus*: a review. Food and Function 12(5), 1856–1881.
Hobbs C. 2002 – Medicinal Mushrooms: An Exploration of Tradition, Healing, and Culture. Botanica Press, Summertown. 251 pp.
Hsu CS, Suzuji M, Yamada Y. 1971 – Chemical constituents of fungi I. 1, 4-dimethoxy-2, 3, 5, 6-tetrachlorobenzene (O-Drosophilin A) from *Phellinus yucatensis*. Chemical Abstracts 115864a, 75.
Huang S, Kuo P, Hwang T, Chan Y et al. 2013 – Three novel sesquiterpenes from the mycelium of *Phellinus linteus*. Tetrahedron Letters 54, 3332–3335.
Huang Y, Valiante V. 2022 – Chemical diversity and biosynthesis of drimane-type sesquiterpenes in the fungal kingdom. ChemBioChem 23(17), e202200173.
Hou WN, Chao KT, Bau T. 2023 – A new species of *Sanghuangporus* (Hymenochaetales, Basidiomycota) from Inner Mongolia of China. Mycosystema 42(4), 874–882.
Hu DB, Zhang S, He JB, Dong ZJ et al. 2015 – Brasilane sesquiterpenoids and alkane derivatives from cultures of the basidiomycete *Coltricia sideroides*. Fitoterapia 104, 50–54.
Huo J, Zhong S, Du X, Cao Y et al. 2020 – Whole-genome sequence of *Phellinus gilvus* (mulberry Sanghuang) reveals its unique medicinal values. Journal of Advanced Research 24, 325–335.
Isaka M, Palasarn S, Sakayaroj J, Srichomthong K et al. 2021 – Limonoids from fruiting bodies of the wood-rot basidiomycete *Fulvifomes xylocarpicola* associated with the mangrove tree *Xylocarpus granatum*. Phytochemistry 181, 112555.
Isaka M, Sappan M, Supothina S, Srichomthong K et al. 2017 – Alliacane sesquiterpenoids from submerged cultures of the basidiomycete *Inonotus* sp. BCC 22670. Phytochemistry 136, 175–181.

Isaka M, Yangchum A, Supothina S, Boonpratuang T et al. 2015 – Aromadendrane and cyclofarnesane sesquiterpenoids from cultures of the basidiomycete *Inonotus* sp. BCC 23706. Phytochemistry 118, 94–101.

Im KH, Baek SA, Choi J, Lee TS. 2019 – Antioxidant, anti-melanogenic and anti-wrinkle effects of *Phellinus vaninii*. Mycobiology (4), 494–505.

İnci Ş, Sevindik M, Kırbağ S, Akgül H. 2022 – Antioxidant, antibacterial, and antifungal activity of *Hymenochaete rubiginosa*. Indian Journal of Natural Products and Resources 13(1), 67–71.

Jang HJ, Yang KS. 2011 – Inhibition of nitric oxide production in RAW 264.7 macrophages by diterpenoids from *Phellinus pini*. Archives of Pharmacal Research 34, 913–917.

Jiang JH, Wu SH, Zhou LW. 2021 – The first whole genome sequencing of *Sanghuangporus sanghuang* provides insights into its medicinal application and evolution. Journal of Fungi 7(10), 787.

Jiang JH, Zhou LJ, Liu SL, Zhou LW, Tian XM. 2020 – Species clarification of the medicinal wood-inhabiting fungus *Phylloporia* (Hymenochaetales, Basidiomycota) in China. Phytotaxa 446, 209–219.

Jin C, Ma JX, Wang H, Tang LX et al. 2024 – First genome assembly and annotation of *Sanghuangporus weigelae* uncovers its medicinal functions, metabolic pathways, and evolution. Frontiers in Cellular and Infection Microbiology 13, 1325418.

Joseph TP, Chanda W, Padhiar AA, Batool S. 2018 – A preclinical evaluation of the antitumor activities of edible and medicinal mushrooms: A molecular insight. Integr. Cancer Ther 17, 200–209.

Kahlos K, Hintsanen E, Seppänen-Laakso T, Hiltunen R. 1989a – Lipid compounds of three species of cultivated *Inonotus*. Planta Medica 55(07), 621–622.

Kahlos K, Hiltunen R. 1988 – Triterpenes and sterols in *Inonotus radiatus*. Planta Medica 54, 579.

Kahlos K, Kangas L, Hiltunen R. 1989b – Ergosterol peroxide, an active compound from *Inonotus radiatus*. Planta Medica 55, 389–390.

Kalotas A. 1996 – Aboriginal knowledge and use of fungi. Introduction – Fungi in the Environment. In: Fungi of Australia. Vol. 1B. Melbourne: CSIRO. Pp. 269–295.

Khadhri A, Aouadhi C, Aschi-Smiti S. 2017 – Screening of bioactive compounds of medicinal mushrooms collected on Tunisian territory. International Journal of Medicinal Mushrooms 19(2), 127–135.

Khojimatov OK, Gafforov Y, Bussmann RW. 2023 – (eds.) Ethnobiology of Uzbekistan, Ethnomedicinal Knowledge of Mountain Communities. Springer Nature, Switzerland AG.

Kim MY, Seguin P, Ahn JK, Kim JJ et al. 2008a – Phenolic compound concentration and antioxidant activities of edible and medicinal mushrooms from Korea. Journal of Agricultural and Food Chemistry 56(16), 7265–7270.

Kim SD, Lee IK, Lee WM, Cho JY et al. 2008b – The mechanism of anti-platelet activity of davallialactone: involvement of intracellular calcium ions, extracellular signal-regulated kinase 2 and p38 mitogen-activated protein kinase. European Journal of Pharmacology 584, 361–367.

Kim YO, Han SB, Lee HW, Ahn HJ et al. 2005 – Immuno-stimulating effect of the endo-polysaccharide produced by submerged culture of *Inonotus obliquus*. Life Sciences 77(19), 2438–2456.

Kim YO, Park HW, Kim JH, Lee JY et al. 2006 – Anti-cancer effect and structural characterization of endo-polysaccharide from cultivated mycelia of *Inonotus obliquus*. Life Sciences 79(1), 72–80.

Kobayashi Y, Asada Y, Ino C, Hirotani M. 2010 – Oral cavity composition containing *Phellinus linteus*-derived. Japanese Patent JP2010047512.

Kojima K, Ohno T, Inoue M, Mizukami H, Nagatsu A. 2008 – Phellifuropyranone A: a new furopyranone compound isolated from fruit bodies of wild *Phellinus linteus*. Chemical and Pharmaceutical Bulletin 56, 173–175.

Kou RW, Du ST, Xia B, Zhang Q et al. 2021 – Phenolic and steroidal metabolites from the cultivated edible *Inonotus hispidus* mushroom and their bioactivities. Journal of Agricultural and Food Chemistry 69, 668–675.

Kovács B, Zomborszki ZP, Orban-Gyapai O, Csupor-Loffler B et al. 2017 – Investigation of antimicrobial, antioxidant, and xanthine oxidase inhibitory activities of *Phellinus* (Agaricomycetes) mushroom species native to central Europe. International Journal of Medicinal Mushrooms 19(5), 387–394.

Kubo M, Liu Y, Ishida M, Harada K, Fukuyama Y. 2014 – A new spiroindene pigment from the medicinal fungus *Phellinus ribis*. Chemical and Pharmaceutical Bulletin 62(1), 122–124.

Lai MC, Liu WY, Liou SS, Liu IM. 2023 – Hispidin in the medicinal fungus protects dopaminergic neurons from JNK activation-regulated mitochondrial-dependent apoptosis in an MPP+-induced in vitro model of Parkinson's Disease. Nutrients 15(3), 549.

Le AN, Nguyen TN, Dong DTA. 2024 – Development of RP HPLC-PDA method for simultaneous quantitative analysis of inoscavin A and meshimakobnol A and application on some *Phellinus* mushroom species. Food Science and Nutrition 2024, 1–10. Doi 10.1002/fsn3.4031

Lee IK, Han MS, Lee MS, Kim YS, Yun BS. 2010 – Styrylpyrones from the medicinal fungus *Phellinus baumii* and their antioxidant properties. Bioorganic and Medicinal Chemistry Letters 20(18), 5459–5461.

Lee IK, Lee JH, Yun BS. 2008 – Polychlorinated compounds with PPAR-γ agonistic effect from the medicinal fungus *Phellinus ribis*. Bioorganic and Medicinal Chemistry Letters 18(16), 4566–4568.

Lee IK, Yun BS. 2011 – Styrylpyrone-class compounds from medicinal fungi *Phellinus* and *Inonotus* spp., and their medicinal importance. Journal of Antibiotics 64, 349–359.

Lee IK, Yun BS. 2007 – Highly oxygenated and unsaturated metabolites providing a diversity of hispidin class antioxidants in the medicinal mushrooms *Inonotus* and *Phellinus*. Bioorganic and Medicinal Chemistry 15(10), 3309–3314.

Lee MS, Hwang BS, Lee IK, Seo GS,Yun BS. 2015 – Chemical constituents of the culture broth of *Phellinus linteus* and their antioxidant activity. Mycobiology 43, 43–48.

Lei P, Zhang WJ, Wu YZ, Ma JJ. 2022 – Comparative analysis of cultivation characteristics and functional constituents of five varieties of *Sanghuangporus baumii*. Mycosystema 41(2), 274–280.

Li TT, Wang Q, Li YC, Lu Y et al. 2023a. – Uric acid-lowering effects and mechanism of *Sanghuangporus vaninii* extracts and crude polysaccharides. Mycosystema 42(4), 997–1008.

Li T, Wang Q, Yang Y, Song D. 2023b – The mechanism of polysaccharide synthesis of *Sanghuangporus sanghuang* based on multi-omic analyses and feedback inhibition. Carbohydrate Polymers 321, 121288.

Li H, Zhang X, Gu L, Li Q et al. 2022 – Anti-gout effects of the medicinal fungus *Phellinus igniarius* in hyperuricaemia and acute gouty arthritis rat models. Frontiers in Pharmacology 12, 801910.

Li IC, Chen CC, Sheu SJ, Huang IH, Chen CC. 2020 – Optimized production and safety evaluation of hispidin-enriched *Sanghuangporus sanghuang* mycelia. Food Science and Nutrition 8(4), 1864–1873.

Li J, Jia X, Yao Y, Bai Y. 2019 – Characterization of exopolysaccharide produced by *Phellinus vaninii* (Agaricomycetes) and antioxidant potential for meat batter. International Journal of Medicinal Mushrooms 21(5), 459–467.

Li J, Zan L, Bao H, Li D, Ye J. 2017 – Chemical components of *Phellinus ellipsoidea* fruit bodies. Acta Edulis Fungi 24(3), 46–50.

Lima VX de, Oliveira VR de, Lima-Júnior NC de, Oliveira-Filho JR et al. 2022 – Taxonomy and phylogenetic analysis reveal one new genus and three new species in *Inonotus* sl (Hymenochaetaceae) from Brazil. Cryptogamie, Mycologie 43(1), 1–21.

Liu Y, Huang CS, Yang BW, Xiang SX et al. 2024 – Transcriptomics and metabolomics profiling coumestrol and psoralen synthesis pathways and potential regulators in *Inonotus hispidus* L-1. Mycosystema 43(4), 230290.
Liu HK, Tsai TH, Chang TT, Chou CJ, Lin LC. 2009 – Lanostane-triterpenoids from the fungus *Phellinus gilvus*. Phytochemistry 70(4), 558–563.
Lobarzewski J. 1977 – Hemoproteid peroxidase from *Inonotus radiatus*. Acta Microbiologica Polonica 26(2), 179–184.
Lourenço A, Lobo AM, Rodríguez B, Jimeno ML. 1996 – Ceramides from the fungus *Phellinus pini*. Phytochemistry 43(3), 617–620.
Łysakowska P, Sobota A, Wirkijowska A. 2023 – Medicinal mushrooms: their bioactive components, nutritional value and application in functional food production – a review. Molecules 28(14), 5393.
Ma JC, Wei JR, Wang XR, Chen G et al. 2024 – Extracts of *Sanghuangporus vaninii* inhibit SARS-CoV-2 and inflammation. Mycosystema 43(1), 230199.
Machado-Carvalho L, Martins T, Aires A, Marques G. 2023 – Optimization of phenolic compounds extraction and antioxidant activity from *Inonotus hispidus* using ultrasound-assisted extraction technology. Metabolites 13, 524.
Masaki H. 2010 – Role of antioxidants in the skin: anti-aging effects. Journal of Dermatological Science 58(2), 85–90.
Meunink J. 2015 – Basic Illustrated Edible and Medicinal Mushrooms. Rowman & Littlefield, Lanham, Maryland, USA. 112 pp.
Min GJ, Kang HW. 2021 – Artificial cultivation characteristics and bioactive effects of novel *Tropicoporus linteus* (syn. *Phellinus linteus*) strains HN00K9 and HN6036 in Korea. Mycobiology 49(2), 161–172.
Mo S, Wang S, Zhou G, Yang Y et al. 2004 – Phelligridins C–F: cytotoxic pyrano[4,3-c][2]benzopyran-1,6-dione and furo[3,2-c]pyran-4-one derivatives from the fungus *Phellinus igniarius*. Journal of Natural Products 67, 823–828.
Moghaddam M, Ghobad-Nejhad M, Moridi Farimani M. 2024 – Nutritional and mineral contents of *Inocutis levis* and antioxidant activity of its fermented mycelia. Journal of Food Science and Technology (Iran). Accepted.
Mohanta TK. 2020 – Fungi contain genes associated with flavonoid biosynthesis pathway. Journal of Functional Foods 68, 103910.
Munir E, Lutfia A, Hartanto A, Yurnaliza Y, Lenny S. 2022 – Metabolites produced by endophytic fungi isolated from *Hornstedtia scyphifera* (J. Koenig) Steud. and their antioxidant activities. Agriculture and Natural Resources 56(6), 1249–1258.
Nakajima Y, Sato Y, Konishi T. 2007 – Antioxidant small phenolic ingredients in *Inonotus obliquus* (Pers.) Pilat (Chaga). Chemical and Pharmaceutical Bulletin 55(8), 1222–1226.
Nakata T, Taji S, Yamada T, Tanaka R. 2009 – New lanostane triterpenoids inonotsutriols D and E from *Inonotus obliquus*. Bulletin of Osaka University of Pharmaceutical Sciences 3, 53–64.
Nguyen MT, Hoang VH, Do TH, Do BD, Pham TPL. 2023 – Determination of polysaccharide and phenolic contents and antioxidant activity of the crude extract from mycelial biomass of strain *Tropicoporus linteus* NTH-PL3. VJST 65(8B). Doi 10.31276/VJST.65(8).05-10
Nguyen TH, Nagasaka R, Ohshima T. 2013 – The natural antioxidant ergothioneine: resources, chemical characterization, and applications. In: Lipid Oxidation. Logan A, Nienaber U, Pan X (eds.). AOCS Press, Elsevier. Pp. 381–415.
Nilsson RH, Ryberg M, Wurzbacher C, Tedersoo L et al. 2023 – How, not if, is the question mycologists should be asking about DNA-based typification. MycoKeys 96, 143–157.
Nurdiansyah SI, Sofiana MS, Trianasta M, Hidayat M. 2021 – Antibacterial activity of *Caulerpa racemosa* endophytic fungi from Lemukutan Island waters. Jurnal Ilmu Kelautan SPERMONDE 7(2), 38–43.

Olennikov DN, Gornostai TG, Penzina TA, Borovskii GB. 2017 – Lupane triterpenoids and sterols from *Inonotus rheades* mycelium and their anti-glucosidase activity. Chemistry of Natural Compounds 53(5), 988–990.

Olennikov DN, Sof'ya VA, Tat'yana AP, Borovski GB. 2014 – Fatty acid composition of fourteen wood-decaying basidiomycete species growing in permafrost conditions. Records of Natural Products 8(2): 184–188.

Ota K, Yamazaki I, Saigoku T, Fukui M et al. 2017 – Phellilane L, sesquiterpene metabolite of *Phellinus linteus*: Isolation, structure elucidation, and asymmetric total synthesis. Journal of Organic Chemistry 82, 12377–12385.

Pattengale ND, Alipour M, Bininda-Emonds ORP, Moret BME, Stamatakis A. 2010 – How many bootstrap replicates are necessary? Journal of Computational Biology 17, 337–354.

Pham HT, Doan TP, Kim HW, Kim TW et al. 2022 – Cyclohumulanoid sesquiterpenes induced by the noncompetitive coculture of *Phellinus* orientoasiaticus and *Xylodon flaviporus*. Journal of Natural Products 85(3), 511–518.

Prasher IB. 2015 – Wood-rotting non-gilled Agaricomycetes of Himalayas. Berlin: Springer.

Rajchenberg M, Pildain MB, Madriaga DC, de Errasti A et al. 2019 – New poroid Hymenochaetaceae (Basidiomycota, Hymenochaetales) from Chile. Mycological Progress 18, 865–877.

Ranadive KR. 2013 – An overview of Aphyllophorales (wood rotting fungi) from India. International Journal of Current Microbiology and Applied Sciences 2(12), 112–139.

Ranadive KR, Belsare MH, Deokule SS, Jagtap NV et al. 2013 – Glimpses of antimicrobial activity of fungi from World. Journal on New Biological Reports 2(2), 142–162.

Ranadive KR, Jagtap NV, Jagtap PN, Zmitrovich IV, Perelygin VV. 2021 – Investigating the effects of *Inonotus rickii* extracts on the muscle contraction intensity. Pharmacy Formulas 3(1), 92–96.

Ranadive KR, Vaidya JG, Jite PK, Ranade VD et al. 2011 – Checklist of Aphyllophorales from the Western Ghats of Maharashtra State, India. Mycosphere 2(2), 91–114.

Reid DA. 1976 – *Inonotus obliquus* (Pers. ex Fr.) pilat in Britain. Transactions of the British Mycological Society 67(2), 329–332.

Rijnierse A, Nijkamp FP, Aletta D. 2007 – Mast cells and nerves tickle in the tummy – Implications for inflammatory bowel disease and irritable bowel syndrome. Pharmacology & Therapeutics 116(2), 207–235.

Riquelme C, Candia B, Ruiz D, Herrera M et al. 2020 – The de novo production of halogenated hydroquinone metabolites by the Andean-Patagonian white-rot fungus *Phylloporia boldo*. Current Research in Environmental and Applied Mycology 10(1), 198–205.

Riquelme C, Rajchenberg M. 2021 – Aphyllophoroid fungi (Basidiomycota) of Chile: an annotated checklist. Mycotaxon 136(3), 691, 57 pp.

Robin E, Guzy RD, Loor G, Iwase H et al. 2007 – Oxidant stress during simulated ischemia primes cardiomyocytes for cell death during reperfusion. Journal of Biological Chemistry 282, 19133–19143.

Rony KA, Ajith TA, Nima N, Janardhanan KK. 2014 – Hypolipidemic activity of *Phellinus rimosus* against triton WR-1339 and high cholesterol diet induced hyperlipidemic rats. Environmental Toxicology and Pharmacology 37(2), 482–492.

Ryvarden L, Melo I. 2017 – Poroid fungi of Europe. Synopsis Fungorum 37. Fungiflora. Oslo. 430 pp.

Saar M. 1991 – Fungi in Khanty folk medicine. Journal of Ethnopharmacology 31(2), 175–179.

Samchai S, Seephonkai P, Kaewtong C. 2011 – Two indole derivatives and phenolic compound isolated from mushroom *Phellinus linteus*. Chinese Journal of Natural Medicines (CJNM) 9(3), 0173−0175.

Sandargo B, Chepkirui C, Cheng T, Chaverra-Muñoz L et al. 2019 – Biological and chemical diversity go hand in hand: Basidiomycota as source of new pharmaceuticals and agrochemicals. Biotechnology Advances 37(6), 107344.

Sárközy A, Kúsz N, Zomborszki ZP, Csorba A et al. 2020 – Isolation and characterization of chemical constituents from the poroid medicinal mushroom *Porodaedalea chrysoloma* (Agaricomycetes) and their antioxidant activity. International Journal of Medicinal Mushrooms 22(2), 125–131.

Schwarze FW. 2007 – Wood decay under the microscope. Fungal Biology Reviews 21(4), 133–170.

Serck-Hanssen K, Wikström C. 1978 – Novel 7-phenylheptan-3-ones from the fungus *Phellinus tremulae*. Phytochemistry 17(9), 1678–1679.

Shashkina MY, Shashkin PN, Sergeev AV. 2006 – Chemical and medicobiological properties of chaga. Pharmaceutical Chemistry Journal 40(10), 560–568.

Shen S, Liu SL, Jiang JH, Zhou LW. 2021 – Addressing widespread misidentifications of traditional medicinal mushrooms in *Sanghuangporus* (Basidiomycota) through ITS barcoding and designation of reference sequences. IMA Fungus 12(1), 1–21.

Shin Y, Tamai Y, Terazawa M. 2000 – Chemical constituents of *Inonotus obliquus* I. A new triterpene, 3 β-hydroxy-8,24-dien-lanosta-21,23-lactone from sclerotium. Eurasian Journal of Forest Research 1, 43–50.

Silva FS, de Sa MS, Costa JF, Pinto FP et al. 2009 – In vitro pharmacological screening of macrofungi extracts from the Brazilian northeastern region. Pharmaceutical Biology 47(5), 384–389.

Singh P, Rangaswami S. 1966 – Occurrence of O-methyl-drosophilin A in *Fomes fastuosus* Lev. Tetrahedron Letters 11, 1229–1231.

Song AR, Sun XL, Kong C, Zhao C et al. 2014 – Discovery of a new sesquiterpenoid from *Phellinus igniarius* with antiviral activity against influenza virus. Archives of Virology 159, 753–760.

Stamatakis A. 2014 – RAxML version 8: A tool for phylogenetic analysis and post-analysis of large phylogenies. Bioinformatics 30, 1312–1313.

Stoyneva-Gärtner MP, Uzunov BA, Dimitrova PH, Chipev N. 2018 – Ethno-mycological notes on the use of polypore fungi in domestic production of alcoholic beverages in Bulgaria. Research Journal of Food and Nutrition 2, 13–17.

Su X, Liu K, Xie Y, Zhang M et al. 2021 – Mushroom *Inonotus sanghuang* alleviates experimental pulmonary fibrosis: implications for therapy of pulmonary fibrosis. Biomedicine & Pharmacotherapy 133, 110919.

Sujarit K, Suwannarach N, Kumla J, Lomthong T. 2021 – Mushrooms: splendid gifts for the cosmetic industry. Chiang Mai Journal of Science 48(3), 699–725.

Sunthudlakhar P, Sithisarn P, Wannissorn B, Jarikasem S, Rojsanga P. 2019 – Phytochemical profiles, antioxidant and antibacterial activities of 11 *Phellinus* mushrooms collected in Thailand. The Natural Products Journal 9(2), 144–156.

Swarts HJ, Teunissen PJ, Verhagen FJ, Field JA, Wijnberg JB. 1997 – Chlorinated anisyl metabolites produced by basidiomycetes. Mycological Research 101(3), 372–374.

Szychowski KA, Skóra B, Pomianek T, Gmiński. 2021 – *Inonotus obliquus* – from folk medicine to clinical use. Journal of Traditional and Complementary Medicine 11, 293–302.

Tamrakar S, Nishida M, Amen Y, Tran HB et al. 2017 – Antibacterial activity of Nepalese wild mushrooms against *Staphylococcus aureus* and *Propionibacterium acnes*. Journal of Wood Science 63(4), 379–387.

Tamrakar S, Tran HB, Nishida M, Kaifuchi S et al. 2016 – Antioxidative activities of 62 wild mushrooms from Nepal and the phenolic profile of some selected species. Journal of Natural Medicines 70(4), 769–779.

Taofiq O, González-Paramás AM, Martins A, Filomena Barreiro M, Ferreira ICFR. 2016a – Mushrooms extracts and compounds in cosmetics, cosmeceuticals and nutricosmetics – A review. Ind. Crops Prod. 90, 38–48.

Taofiq O, Heleno SA, Calhelha RC, Alves MJ et al. 2016b – Development of mushroom-based cosmeceutical formulations with anti-inflammatory, anti-tyrosinase, antioxidant, and antibacterial properties. Molecules 21, 1372.
Thammavong S, Phadungkit M, Laovachirasuwan P, Naksuwankul K et al. 2021 – Antioxidant and cytotoxic activity of *Phellinus* mushrooms from Northeast Thailand. RJP 8(1), 91–99.
Thanh NT, Tuan NN, Kuo PC, Dung DM et al. 2018 – Chemical constituents from the fruiting bodies of *Phellinus igniarius*. Natural Product Research 32(20), 2392–2397.
Thiers BM. 2024 – Index Herbariorum. (updated continuously). https://sweetgum.nybg.org/science/ih/
Titilawo MA, Oluduro AO, Odeyemi O. 2020 – Proximate and chemical properties of some underutilized Nigerian wild mushrooms. Journal of Microbiology, Biotechnology and Food Sciences 10(3), 390–397.
Ulziijargal E, Yang JH, Lin LY, Chen CP, Mau JL. 2013 – Quality of bread supplemented with mushroom mycelia. Food Chemistry 138(1), 70–76.
van Santen JA, Poynton EF, Iskakova D, McMann E et al. 2022 – The Natural Products Atlas 2.0: A Database of Microbially-Derived Natural Products. Nucleic Acids Research 50, D1317–D1323.
Vetvicka V, Vashishta A, Saraswat-Ohri S, Vetvickova J. 2008 – Immunological effects of yeast- and mushroom-derived β-glucans. Journal of Medicinal Food 11(4), 615–622.
Vinogradov E, Wasser SP. 2005 – The structure of a polysaccharide isolated from *Inonotus levis* P. Karst. mushroom (Heterobasidiomycetes). Carbohydrate Research 340(18), 2821–2825.
Wang J, Hu X, Jiang H. 2016 – ER stress-induced apoptosis: A novel therapeutic target in myocardial ischemia and reperfusion injury. International Journal of Cardiology 214, 233–234.
Wang J, Lv H, Chen B, Huang W. 2019 – Methyl-hispolon from *Phellinus lonicerinus* (Agaricomycetes) affects estrogen signals in MCF-7 breast cancer cells and premature aging in rats. International Journal of Medicinal Mushrooms 21(5), 381–92.
Wang H, Ma JX, Wu DM, Gao N et al. 2023b – Identifying bioactive ingredients and antioxidant activities of wild *Sanghuangporus* species of medicinal fungi. Journal of Fungi 9(2), 242.
Wang Y, Ouyang F, Teng C, Qu J. 2021 – Optimization for the extraction of polyphenols from *Inonotus obliquus* and its antioxidation activity. Preparative Biochemistry & Biotechnology 51(9), 852–859.
Wang Y, Wang SJ, Mo SY, Li S et al. 2006 – An abietane diterpene and a sterol from fungus *Phellinus igniarius*. Chin. Chem. Lett. 17(4), 481–484.
Wang XW, Liu SL, Zhou LW. 2023a – An updated taxonomic framework of Hymenochaetales (Agaricomycetes, Basidiomycota). Mycosphere 14 (1), 452–496.
Wani BA, Bodha RH, Wani AH. 2010 – Nutritional and medicinal importance of mushrooms. Journal of Medicinal Plants Research 4(24), 2598–2604.
Wasser SP. 2002 – Medicinal mushrooms as a source of antitumor and immunomodulating polysaccharides. Applied Microbiology and Biotechnology 60, 258–274.
Watling R, Harper DB. 1998 – Chloromethane production by wood-rotting fungi and an estimate of the global flux to the atmosphere. Mycological Research 102(7), 769–787.
White RH. 1982 – Biosynthesis of methyl chloride in the fungus *Phellinus pomaceus*. Archives of Microbiology 132, 100–102.
Wu CS, Lin ZM, Wang LN, Guo DX et al. 2011 – Phenolic compounds with NF-κB inhibitory effects from the fungus *Phellinus baumii*. Bioorganic and Medicinal Chemistry Letters 21(11), 3261–3267.
Wu F, Zhou LW, Vlasák J, Dai YC. 2022 – Global diversity and systematics of Hymenochaetaceae with poroid hymenophore. Fungal Diversity 113(1), 1–92.
Wu F, Zhou LW, Yang ZL, Bau T et al. 2019 – Resource diversity of Chinese macrofungi: edible, medicinal and poisonous species. Fungal Diversity 98(1), 1–76.

Wu PF, Ding R, Tan R, Liu J et al. 2020 – Sesquiterpenes from cultures of the fungus *Phellinus igniarius* and their cytotoxicities. Fitoterapia 140, 104415.

Wu SH, Dai YC, Hattori T, Yu TW et al. 2012 – Species clarification for the medicinally valuable "sanghuang" mushroom. Botanical Studies 53, 135–149.

Wu XL, Lin S, Zhu CG, Yue ZG et al. 2010 – Homo- and heptanor-sterols and tremulane sesquiterpenes from cultures of *Phellinus igniarius*. Journal of Natural Products 73, 1294.

Wu YD, Bian LS, Vlasák J, Liu HG, Dai YC. 2024 – *Coltricia aridicola* sp. nov. derived from the *Coltricia perennis* complex (Hymenochaetaceae) confirmed by molecular phylogeny. Phytotaxa 642 (2), 182–190

Wu YI, Cui H, Zhang Y, Yu P et al. 2021 – *Inonotus obliquus* extract alleviates myocardial ischemia/reperfusion injury by suppressing endoplasmic reticulum stress. Molecular Medicine Reports 23, 77.

Yang J, Wang N, Yuan HS, Hu JC, Dai YC. 2013 – A new sesquiterpene from the medicinal fungus *Inonotus vaninii*. Chemistry of Natural Compounds 49, 261–263.

Yang S, Bao H, Wang H, Li Q. 2019 – Anti-tumour effect and pharmacokinetics of an active ingredient isolated from *Inonotus hispidus*. Biological and Pharmaceutical Bulletin 42(1), 10–17.

Yang Y, Chen XH, Dai YC, Zhou LW et al. 2023 – Sanghuang industry in China: current status, challenges and perspectives – The Qiandao Lake declaration for sanghuang industry development. Mycosystema 42, 855–873.

Yin R, Zhao Z, Chen H, Yin X et al. 2014 – Tremulane sesquiterpenes from cultures of the fungus *Phellinus igniarius* and their vascular-relaxing activities. Phytochemistry Letters 10, 300–303.

Yin RH, Zhao ZZ, Ji X, Dong ZJ et al. 2015 – Steroids and sesquiterpenes from cultures of the fungus *Phellinus igniarius*. Natural Products and Bioprospecting 5, 17–22.

Ying J, Mao X, Ma Q. 1987 – Icons of Medicinal Fungi from China. Science Press, Beijing.

Ying Y, Zhang L, Zhang X, Bai H et al. 2014 – Terpenoids with alpha-glucosidase inhibitory activity from the submerged culture of *Inonotus obliquus*. Phytochemistry 108, 171–176.

Yuan Y, Bian LS, Wu YD, Chen JJ et al. 2023 – Species diversity of pathogenic wood-rotting fungi (Agaricomycetes, Basidiomycota) in China. Mycology 14, 204–226.

Zan LF, Guo HY, Bao HY, Bau T, Fan YG. 2023 – Characterization of cytotoxicity and chemical constituents of extracts of *Sanghuangporus baumii* basidiomata. Mycosystema 42(4), 961–972.

Zapora E, Wołkowycki M, Bakier S, Zjawiony JK. 2016 – *Phellinus igniarius*: A pharmacologically active polypore mushroom. Natural Product Communications 11(7), 1043–1046.

Zeb M, Lee CH. 2021 – Medicinal properties and bioactive compounds from wild mushrooms native to North America. Molecules 26(2), 251.

Zhang H, Jiang F, Li L, Liu X, Yan JK. 2022 – Recent advances in the bioactive polysaccharides and other key components from *Phellinus* spp. and their pharmacological effects: A review. International Journal of Biological Macromolecules 222, 3108–3128.

Zhang HQ, Deng GG, Wang JZ, Hu K et al. 2021 – Study on constituents from cultures of fungus *Phellinus lonicerinus*. Natural Product Research and Development 33(11), 1866–1870.

Zhang J, Hou YH, Du JF, Zhou QS, Li N. 2023 – A comparative study on immunomodulatory effects of water extracts of *Inonotus hispidus, Sanghuangporus sanghuang* and *S. vaninii*. Mycosystema 42(4), 907–915.

Zhang SY, Yu SW, Wei YL. 2024 – A comparative study on the bioactive components and antioxidant activities of *Phellinus orientoasiaticus* and two species of *Sanghuangporus.* Mycosystema 43(2), 230220.

Zhao F, Mai Q, Ma J, Xu M et al. 2015 – Triterpenoids from *Inonotus obliquus* and their antitumor activities. Fitoterapia 101, 34–40.

Zhao H, Dai YC, Wu F, Liu XY et al. 2023 – Insights into the ecological diversification of the Hymenochaetales based on comparative genomics and phylogenomics with an emphasis on Coltricia. Genome Biology and Evolution 15(8), evad136.
Zheng JQ, Mao XJ, Geng LJ, Yang GM, Xu CP. 2014 – Production optimization, preliminary characterization and bioactivity of exopolysaccharides from *Inocutis tamaricis* (Pat.). Fiasson & Niemela. Journal of the Taiwan Institute of Chemical Engineers 45(3), 725–733.
Zheng YB, Lu CH, Shen YM. 2012 – New abscisic acid-related metabolites from *Phellinus vaninii*. Journal of Asian Natural Products Research 14(7), 613–617.
Zheng W, Zhao Y, Zheng X, Liu Y et al. 2011 – Production of antioxidant and antitumor metabolites by submerged cultures of *Inonotus obliquus* cocultured with *Phellinus punctatus*. Applied Microbiology and Biotechnology 89, 157–167.
Zhou LW, Ghobad-Nejhad M, Tian XM, Wang YF, Wu F. 2022 – Current status of 'Sanghuang' as a group of medicinal mushrooms and their perspective in industry development. Food Reviews International 38(4), 589–607.
Zhou LW. 2020 – Systematics is crucial for the traditional Chinese medicinal studies and industry of macrofungi. Fungal Biology Reviews 34, 10–12.
Zhu F, Lu W, Feng W, Song Z et al. 2017 – Preliminary investigation on the chemical constituents and antioxidant activities of two *Phellinus* mushrooms collected in Foshan. International Journal of Organic Chemistry 7, 25–33.
Zou CX, Wang XB, Lv TM, Hou ZL et al. 2020 – Flavan derivative enantiomers and drimane sesquiterpene lactones from the *Inonotus obliquus* with neuroprotective effects. Bioorganic Chemistry 96, 103588.

Supplementary Table 1 Diversity of compounds in Hymenochaetaceae.

Compound groups		Compounds	Species	Selected citing Ref.
Terpenoids	*Sesquiterpenoids*	abscisic acid	*Hymenochaete setipora*	Tamrakar et al. (2016)
		atractylenolide I	*Tropicoporus linteus*	He et al. (2021)
		brasilanes A–C	*Inonotus sideroides*	Hu et al. (2015)
		conocenols A and B	*Phellinus igniarius*	He et al. (2021)
		elgonenes C, D, G/H, I, J, K, L	*Sanghuangporus* sp.	Chepkirui et al. (2018b)
		elgonenes A–L	*Sanghuangporus* sp.	Cheng et al. (2019)
		eudesm-1β,6α,11-triol	*Phellinus igniarius*	Song et al. (2014)
		inonoalliacanes A–I	*Inonotus* sp.	Isaka et al. (2017)
		inonofarnesane	*Inonotus* sp.	Isaka et al. (2015)
		inonolane A	*Sanghuangporus vaninii*	Chen & Liu (2017)
		inonolactones E–H	*Inonotus obliquus*	Zou et al. (2020)
		inonotic acid	*Inonotus hispidus*	Khojimatov et al. (2023)
		inonotic acid A	*Inonotus rickii*	Chen et al. (2014)
		inonotins A–L	*Inonotus* sp.	Isaka et al. (2015)
		inonotins C and H	*Inocutis levis*, *Inonotus cuticularis*	Chaharmiri-Dokhaharani et al. (2024)
		inotolactone C	*Inonotus obliquus*	Ying et al. (2014)
		phellidene E	*Tropicoporus linteus*	Dong et al. (2019)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	phellidine D	*Sanghuangporus* sp.	Chepkirui et al. (2018b)
	phellidine E	*Sanghuangporus* sp.	Chepkirui et al. (2018b)
	phellilane H	*Tropicoporus linteus*	Chen & Liu (2017)
	phellilane L	*Tropicoporus linteus*	Ota et al. (2017)
	phellilins A–C	*Tropicoporus linteus*	Huang et al. (2013)
	phellinene acids A and B	*Sanghuangporus vaninii*	Zheng et al. (2012)
	phellinignins A–C	*Phellinus igniarius*	Wu et al. (2020)
	phellinignin D	*Phellinus igniarius*	Wu et al. (2020)
	phellinuins A–G	*Phellinus pomaceus*	Chen & Liu (2017)
	phellinuin J	*Phellinus pomaceus*	Chen & Liu (2017), He et al. (2015)
	phellinulins A–N	*Tropicoporus linteus*	He et al. (2021)
	phellinulin B	*Inocutis levis*, *Inonotus cuticularis*	Chaharmiri-Dokhaharani et al. (2024)
	phellinulin H	*Tropicoporus linteus*	He et al. (2021)
	phellinulin K	*Fuscoporia ferruginosa*	Chaharmiri-Dokhaharani et al. (2021)
	phellinulin M	*Fuscoporia ferruginosa*, *Inocutis levis*	Chaharmiri-Dokhaharani et al. (2021)
	tremulenolides A and B	*Phellinus tremulae*	Ayer & Cruz (1993)
	tremulenedial	*Phellinus tremulae*	Ayer & Cruz (1993)
	tremulenedial dibenzyl acetal	*Phellinus tremulae*	Ayer & Cruz (1993)
	tremulenediol A–C	*Phellinus igniarius*, *Phellinus tremulae*	Ayer & Cruz (1993)
	tremuladienol	*Phellinus tremulae*	He et al. (2021)
	xylaritriol	*Inonotus hispidus*	Khojimatov et al. (2023)
	2(S)-hydroxyalbicanol-11-acetate	*Fuscoporia ferruginosa*	Chaharmiri-Dokhaharani et al. (2021)
	3-O-formyl inonotic acid A	*Inonotus rickii*	Chen et al. (2014)
	3α,12-dihydroxy-δ-cadinol	*Phellinus igniarius*	Chen & Liu (2017)
	3α,6α-dihydroxyspiroax-4-ene	*Phellinus igniarius*	He et al. (2021)
	3α,6α-hydroxycinnamolide	*Inonotus rickii*	Huang & Valiante (2022)
	3α,6β-dihydroxycinnamolide	*Inonotus rickii*	Chen & Liu (2017), Chen et al. (2014)
	3β-hydroxycinnamolide	*Sanghuangporus baumii*	Zhang et al. (2022)
	3S,4S,9R,10S-11,12,14-trihydroxydrimene	*Phellinus igniarius*	He et al. (2021)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	3S,9R,10S-3-hydroxy-11,12-O-isopropyldrimene	*Phellinus igniarius*	He et al. (2021)
	3S,9R,10S-3,11,12-trihydroxydrimene	*Phellinus igniarius*	He et al. (2021)
	6β,11,12-trihydroxy-tremul-1(10)-ene	*Phellinus igniarius*	Khojimatov et al. (2023)
	6β,12-dihydroxy-tremulene	*Phellinus igniarius*	Khojimatov et al. (2023)
	10β,12-dihydroxy-tremulene	*Phellinus igniarius*	Khojimatov et al. (2023)
	11,12-epoxy-12β-hydroxy-1-tremulen-5-one	*Phellinus igniarius*	Khojimatov et al. (2023)
	11,12-dihydroxy-7β-peroxy-hydroxyl-tremul-1(10)-ene	*Phellinus igniarius*	Khojimatov et al. (2023)
	12-hydroxy-α-cadinol	*Phellinus igniarius*	Khojimatov et al. (2023)
	12,15-dihydroxy-tremulene	*Phellinus igniarius*	He et al. (2021)
	(E)-(9CI)-2-methyl-6-(4-methyl-3-cyclohexen-1-yl)-2,6-heptadienoic acid	*Tropicoporus linteus*	Kobayashi et al. (2010)
	(2E,4E)-(+)-40-hydroxy-γ-ionylideneacetic acid	*Tropicoporus linteus*	Chen & Liu (2017)
	(2E,4E)-γ-Ionylideneacetic acid	*Tropicoporus linteus*	Chen & Liu (2017)
	(6R,7S,10R)-7,10-epoxy-7,11-dimethyldodec-1-ene-6,11-diol	*Sanghuangporus* sp.	Cheng et al. (2019)
	(±)-(2E,4E)-γ-ionylideneacetic acid	*Sanghuangporus vaninii*	He et al. (2021)
	(±)-(2E,4E)-3′-hydroxy-γ-ionylideneacetic acid	*Sanghuangporus vaninii*	He et al. (2021)
	(±)-(2S,4E)-4′-hydroxy-γ-ionylideneacetic acid	*Sanghuangporus vaninii*	He et al. (2021)
	(+)-(2S,3R,6S,7S)-tremul-1(10)-ene-2,12-diol	*Phellinus igniarius*	Khojimatov et al. (2023)
	(+)-γ-ionylideneacetic acid	*Tropicoporus linteus*	Dong et al. (2019)
	(+)-(1R,6S,7S)-tremul-2-ene-12(11)-lactone	*Phellinus igniarius*	Khojimatov et al. (2023)
	(+)-(3S,6R,7R)-tremulene-6,11,12-triol	*Phellinus igniarius*	Khojimatov et al. (2023)
	(+)-(3S,6S,7S,10S)-tremulene-10,11,12-triol	*Phellinus igniarius*	Khojimatov et al. (2023)
	(+)-(3S,6R,7R,10S)-tremulene-6,10,12-triol	*Phellinus igniarius*	Khojimatov et al. (2023)
	(−)-(2S,3S,6S,7S,9R)-tremul-1(10)-ene-11,12,14-triol	*Phellinus igniarius*	Khojimatov et al. (2023)
	(−)-(2S,3S,4S,6S,7S)-tremul-1(10)-ene-4,11,12-triol	*Phellinus igniarius*	Khojimatov et al. (2023)
	(−)-(2S,3R,6S,7S)-tremul-1(10)-ene-2,12-diol	*Phellinus igniarius*	Chen & Liu (2017)
	(−)-(2S,3S,6S,7S,9S)-tremul-1(10)-ene-11,12,15-triol	*Phellinus igniarius*	Khojimatov et al. (2023)
Diterpenoids	dehydroabietic acid	*Porodaedalea pini*	Jang & Yang (2011)
	inonotolides A–C	*Neomensularia kanehirae*	Ding et al. (2018)
	inonotusic acid	*Inonotus cuticularis, Inonotus obliquus*	Chaharmiri-Dokhaharani et al. (2024)
	phellinulin A	*Tropicoporus linteus*	He et al. (2021)
	phellinulin I	*Tropicoporus linteus*	He et al. (2021)

Supplementary Table 1 Continued.

Compound groups		Compounds	Species	Selected citing Ref.
		12-hydroxy-7-oxo-5,8,11,13-tetraene-18,6-abietanolide	*Phellinus igniarius*	Wang et al. (2006)
		17-hydroxy-ent-atisan-19-oic acid	*Inonotus obliquus*	Chen & Liu (2017)
		8,14-labdadien-13-ol	*Porodaedalea pini*	Jang & Yang (2011)
		(−)-trans-γ-monocyclofarnesol	*Tropicoporus linteus*	Dong et al. (2019)
	Triterpenoids	acetylodollactone	*Sanghuangporus baumii*	He et al. (2021)
		aethiopinolones A–E	*Fomitiporia aethiopica*	Chepkirui et al. (2018a)
		albertic acid	*Fuscoporia torulosa*	Béni et al. (2021)
		botulin	*Phellinus igniarius*	Zhang et al. (2022)
		betulic acid (betulinic acid)	*Inocutis rheades*, *Phellinus igniarius*, *Phylloporia* sp.	Zhang et al. (2022)
		betulinic aldehyde	*Inocutis rheades*	Olennikov et al. (2017)
		betulone	*Inocutis rheades*	Olennikov et al. (2017)
		betulonic aldehyde (betulonic acid)	*Inocutis rheades*	Olennikov et al. (2017)
		chagabusone	*Inonotus obliquus*	Khojimatov et al. (2023)
		cycloatran-24-ene-1α,2α,3β-triol	*Sanghuangporus baumii*	He et al. (2021)
		cycloeucalenol	*Phellinus igniarius*	Zhang et al. (2022)
		ebricoic acid	*Fuscoporia gilva*	He et al. (2021)
		friedelin	*Sanghuangporus vaninii*	He et al. (2021)
		fuscoporic acid	*Fuscoporia torulosa*	Béni et al. (2021)
		fuscoporianol A–C	*Inonotus obliquus*	He et al. (2001)
		ganoderic acid DM	*Sanghuangporus baumii*	He et al. (2021)
		ganoderiol B	*Sanghuangporus baumii*	He et al. (2021)
		gilvsins A and C	*Phellinus igniarius*	Zhang et al. (2022)
		gilvsins A–D	*Fuscoporia gilva*	Liu et al. (2009)
		hispindic acids A and B	*Inonotus hispidus*	Angelini et al. (2019)
		igniarens A–D	*Phellinus igniarius*	He et al. (2021)
		igniarine	*Phellinus igniarius*	Thanh et al. (2018)
		inoterpenes A–F	*Inonotus obliquus*	Chen & Liu (2017)
		inoterpene B	*Fuscoporia ferruginosa*	Chaharmiri-Dokhaharani et al. (2021)
		inonoterpene A	*Inonotus hispidus*	Kou et al. (2021)
		inotolactones A and B	*Inonotus obliquus*	Ying et al. (2014)
		inonotsudiol A (lanosta-8,24-dien-3β,11β-diol)	*Inonotus cuticularis*, *Inonotus obliquus*	Handa et al. (2010)
		inonotsulides A–C	*Inonotus obliquus*	Nakata et al. (2009)
		inonotsuoxides A and B	*Inonotus obliquus*	Nakata et al. (2009)
		inonotsuoxodiol A	*Inonotus obliquus*	Handa et al. (2010)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	inonotsutriols A–C	*Inonotus obliquus*	Nakata et al. (2009)
	inonotsutriols D (lanost-8-ene-3β,22R,24R-triol) and E (lanost-8-ene-3β,22R,24S-triol)	*Inonotus obliquus*	Nakata et al. (2009)
	inonotusanes A–C	*Inonotus obliquus*	Zhao et al. (2015)
	inonotusols A–G	*Inonotus obliquus*	Chen & Liu (2017)
	inotodiol	*Inocutis rheades*, *Inonotus obliquus*	Nakata et al. (2009)
	ionylideneacetic acid	*Sanghuangporus* sp.	Chepkirui et al. (2018b)
	javeroic acid	*Fuscoporia torulosa*, *Phellinus pomaceus*	He et al. (2021)
	lanostane	*Inonotus nidus-pici*	Fiasson (1982)
	lupenon	*Inonotus obliquus*	Khojimatov et al. (2023)
	lupeol	*Inocutis rheades*, *Inonotus obliquus*, *Phellinus igniarius*	Khojimatov et al. (2023)
	oleanolic acid	*Fuscoporia torulosa*	Deveci et al. (2019a)
	oleanonic acid	*Fuscoporia torulosa*	Deveci et al. (2019a)
	natalic acid	*Fuscoporia torulosa*	Béni et al. (2021)
	phellibarins A–D	*Fuscoporia rhabarbarina*	Feng et al. (2016)
	phellinic acid	*Phellinus pomaceus*	He et al. (2021)
	phellinols A, B, G, and F	*Phellinus igniarius*	Khojimatov et al. (2023)
	phellinol	*Phellinus* sp.	He et al. (2021)
	pomacerone	*Fuscoporia torulosa*, *Phellinus pomaceus*	Khojimatov et al. (2023)
	senexdiolic acid	*Fuscoporia torulosa*, *Phellinus pomaceus*	Khojimatov et al. (2023)
	spiroinonotsuoxodiol [(3S,7S,9R)-3,7-dihydroxy-7(8 → 9) abeo-lanost-24-en-8-one]	*Inonotus obliquus*	Handa et al. (2010)
	sulfurenic acid	*Phellinus igniarius*	Zhang et al. (2022)
	taraxerol	*Phellinus pomaceus*	Khojimatov et al. (2023)
	trametenolic acid	*Fuscoporia gilva*, *Inonotus obliquus*	Nakata et al. (2009), Shin et al. (2000)
	trametenolic acid B	*Phellinus* sp.	He et al. (2021)
	torulosic acid	*Fuscoporia torulosa*	Béni et al. (2021), González et al. (1994)
	ursolic acid	*Phellinus pomaceus*	Khojimatov et al. (2023)
	β-boswellic acid	*Phellinus pomaceus*	He et al. (2021)
	1-phenylheptane-1,5-dione	*Inocutis levis*, *Phellinus tremulae*	Serck-Hanssen & Wikström (1978)

Supplementary Table 1 Continued.

Compound groups		Compounds	Species	Selected citing Ref.
		1-phenylhept-3-en-4-one	*Inocutis levis*, *Inonotus cuticularis*	Chaharmiri-Dokhaharani et al. (2024)
		1S-(2E)-5-[(1R)-2,2-dimethyl-6-methylidenecyclohexyl]-3-methylpent-2-enoic acid	*Sanghuangporus* sp.	Cheng et al. (2019)
		3β-acetyloleanolic acid	*Phellinus igniarius*	Zhang et al. (2022)
		3β-hydroxylanosta-8,24-dien-21-al	*Inonotus hispidus*, *Inonotus obliquus*	Nakata et al. (2009)
		3β-hydroxylanosta-8,24-diene-21,23-lactone	*Inonotus obliquus*	Shin et al. (2000)
		3β-hydroxy-25,26,27-trinorlanosta-8,22E-dien-24-oic acid	*Inonotus obliquus*	Zhao et al. (2015)
		3β,22-dihydroxylanosta-8,24-dien-7-one	*Inonotus obliquus*	Khojimatov et al. (2023)
		7-phenylheptan-3-ones	*Phellinus tremulae*	Serck-Hanssen & Wikström (1978)
		17-(2-hydroxy-1,5-dimethyl-hex-4-enyl)-4,4,10,13,14-pentamethyl-2,3,4,5,6,7,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta[a]phenanthrene	*Mensularia radiata*	
		23-hydroxybetulinic acid	*Phellinus igniarius*	Zhang et al. (2022)
	Limonoids	fulvifomins A–C	*Fulvifomes xylocarpicola*	Isaka et al. (2021)
		methyl angolensate	*Fulvifomes xylocarpicola*	Isaka et al. (2021)
		6-deoxydetigloyl-swietenine acetate	*Fulvifomes xylocarpicola*	Isaka et al. (2021)
Steroids		cerevisterol (ergosta-7,22-diene-3,5,6-triol)	*Inocutis levis*, *Inonotus hispidus*, *Phylloporia* sp., *Pseudoinonotus dryadeus*	Cheng et al. (2023)
		cholesterol	*Mensularia radiata*	Kahlos & Hiltunen (1988)
		daucosterin	*Phellinus igniarius*	Khojimatov et al. (2023)
		demethylincisterol A3	*Inocutis levis*	Moghaddam et al. (2024)
		episterol	*Porodaedalea pini*	Lourenço et al. (1996)
		episteryl acetate	*Porodaedalea pini*	Zhu et al. (2017)
		ergone	*Porodaedalea chrysoloma*	Sárközy et al. (2020)
		ergosta-4,6,8(14),22-tetraen-3-one	*Fuscoporia torulosa*, *Phellinus igniarius*, *Phellinus* sp.	Khojimatov et al. (2023)
		ergosta-4,7,22-trien-3,6-dione	*Fuscoporia rhabarbarina*, *Tropicoporus linteus*	He et al. (2021)
		ergost-6,8,22-trien-3β-ol	*Inonotus nidus-pici*	Garádi et al. (2021)
		ergosta-7,22-diene-3-one	*Fuscoporia torulosa*	Béni et al. (2021)
		ergosta-7,22-dien-3-ol	*Inocutis levis*	Chaharmiri-Dokhaharani et al. (2024)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	ergosta-7,22-dien-3β-ol	*Mensularia radiata*, *Sanghuangporus baumii*	Kahlos & Hiltunen (1988)
	ergosta-5,7,22-trien-3-ol	*Inocutis levis*, *Inonotus cuticularis*	Chaharmiri-Dokhaharani et al. (2024)
	ergosta-7,22-dien-3β,5α,6β,9α-tetraol	*Tropicoporus linteus*	Zhang et al. (2022)
	ergosta-7,22-dien-3β-yl pentadecanoate	*Sanghuangporus baumii*	Zhang et al. (2022)
	ergosta-7,22-dien-6β-ethoxy-3β,5α-diol	*Sanghuangporus baumii*	Zhang et al. (2022)
	ergosta-7-en-6β-ethoxy-3β,5α-diol	*Sanghuangporus baumii*	Zhang et al. (2022)
	ergosta-7,22-dien-2β,3α,9α-triol	*Tropicoporus linteus*	Zhang et al. (2022)
	ergostane-4,6,8,22-tetrad-ene-3-one	*Sanghuangporus vaninii*	Zhang et al. (2022)
	ergosterol peroxide	*Inocutis levis*, *Fuscoporia rhabarbarina*, *Fuscoporia torulosa*, *Inocutis rheades*, *Inonotus hispidus*, *Inonotus nidus-pici*, *Inonotus obliquus*, *Mensularia radiata*, *Phellinus igniarius*, *Porodaedalea pini*, *Sanghuangporus baumii*, *Tropicoporus linteus*	Kahlos & Hiltunen (1988)
	ergosterol peroxide glycoside	*Tropicoporus linteus*	Zhang et al. (2022)
	ergosterol-5,8-peroxide	*Phylloporia* sp.	Cheng et al. (2023)
	ergosterol (ergosta-5,7,22-trien-3β-ol)	*Inocutis levis*, *Inonotus hispidus*, *Inonotus obliquus*	Khojimatov et al. (2023)
	fungisterol	*Mensularia radiata*	Kahlos & Hiltunen (1988)
	inotodinol	*Inonotus hispidus*	Khojimatov et al. (2023)
	isoergosterone	*Phellinus igniarius*	Mo et al. (2004)
	lanosterol	*Inocutis rheades*, *Inonotus nidus-pici*	Garádi et al. (2021)
	lanosterol-3β-hydroxylanosta-8, 24-diene	*Inonotus obliquus*	Khojimatov et al. (2023)
	lanost-8-ene-3β,22,25-triol	*Inonotus obliquus*	Khojimatov et al. (2023)
	phellinignincisterols A–C	*Phellinus igniarius*	Wu et al. (2010)
	senexonol	*Phellinus* sp.	He et al. (2021)
	sitostanol	*Mensularia radiata*	Kahlos & Hiltunen (1988)
	sitosterol	*Inonotus obliquus*	Khojimatov et al. (2023)
	stigmasterol	*Inonotus obliquus*, *Mensularia radiata*, *Phylloporia* sp.	Kahlos & Hiltunen (1988)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	β-hydroxylanosta-8,24-dien-21-oic acid	*Inonotus obliquus*	Khojimatov et al. (2023)
	β-sitosterol	*Fuscoporia torulosa*, *Mensularia radiata*, *Phylloporia* sp.	Kahlos & Hiltunen (1988), Cheng et al. (2023)
	3,17,20-trihydroxy-4-methylpregn-8-en-7-one	*Phellinus igniarius*	Wu et al. (2010)
	3β-O-glucopyranosylergosta-5,7,22-triene	*Inonotus hispidus*	Khojimatov et al. (2023)
	3β-hydroxyergosta-7,22-diene	*Porodaedalea chrysoloma*	Sárközy et al. (2020)
	3β-hydroxyergosta-7,22-dien-6-one	*Tropicoporus linteus*	He et al. (2021),
	3β,22,25-trihydroxylanosta-8,23-diene	*Inonotus obliquus*	Khojimatov et al. (2023)
	3β,5α-dihydroxy-6β-methoxyergosta-7,22-diene	*Tropicoporus linteus*	Zhang et al. (2022)
	3β,5α-dihydroxyergosta-7,22-dien-6-one	*Tropicoporus linteus*	Zhang et al. (2022)
	3β,5α,9α-trihydroxyergosta-7,22-dien-6-one	*Tropicoporus linteus*	Zhang et al. (2022)
	3α,12α,17α,20-tetrahydroxy-4α-methylpregn-8-ene	*Phellinus igniarius*	Yin et al. (2015)
	3α,17α,19,20-tetrahydroxy-4α-methylpregn-8-ene	*Phellinus igniarius*	Yin et al. (2015)
	5α-ergosta-7,22-dien-3-one	*Phellinus igniarius*	Khojimatov et al. (2023)
	5α,6α-epoxyergosta-8(14),22-diene-3β,7α-diol	*Tropicoporus linteus*	Zhang et al. (2022)
	5α,6α-epoxyergosta-8(9),22-dien-7-on-3β-ol	*Tropicoporus linteus*	Zhang et al. (2022)
	5α,6β-dihydroxy-daucosterol	*Phellinus igniarius*	Khojimatov et al. (2023)
	5α,8α-epidioxy-22E-ergosta-6,22-dien-3β-ol	*Phellinus igniarius*	He et al. (2021)
	5α,8α-epidioxyergosta-6,22-dien-3β-il-palmitate	*Fuscoporia torulosa*	Deveci et al. (2019a)
	5α,6α,8α,9α-diepoxyergost-22-en-3β,7α-diol	*Fuscoporia rhabarbarina*, *Tropicoporus linteus*	He et al. (2021)
	8,9-epoxyergosta-5,22-dien-3β,15-diol	*Phellinus igniarius*	Khojimatov et al. (2023)
	9,11-dehydroergosterol peroxide	*Sanghuangporus baumii*	Zhang et al. (2022)
	14α-hydroxyergosta-4,7,9(11),22-tetraen-3,6-dione	*Fuscoporia rhabarbarina*, *Tropicoporus linteus*	He et al. (2021)
	21,24-cyclopentalanost-8-ene-3β,21,25-triol	*Inonotus obliquus*	Khojimatov et al. (2023)
	24-ethylcholesta-5,22-dien-3β-ol	*Sanghuangporus baumii*	Zhang et al. (2022)
	24-methylenelanost-8-en-3β-ol	*Inonotus hispidus*	Khojimatov et al. (2023)
	24-methylenelanost-8-ene-3β,22-diol	*Fuscoporia gilva*	Liu et al. (2009)
	(3β,22R,23E)-lanosta-8,23-diene-3,22,25-triol	*Inonotus obliquus*	Chen & Liu (2017)
	(3β,22R,23E)-lanosta-7,9(11),23-triene-3,22,25-triol	*Inonotus obliquus*	Chen & Liu (2017)

Supplementary Table 1 Continued.

Compound groups		Compounds	Species	Selected citing Ref.
		(22E,24R)-ergosta-7,22-diene -3β,5α,6β,9α-tetrol	*Inonotus hispidus*	Khojimatov et al. (2023)
		(22E,24R)-ergosta-7,22-dien-2α,3α,9α-triol	*Tropicoporus linteus*	He et al. (2021)
		(22E,24R)-ergosta-7,22-dien-3β,5α,6β -triol	*Fuscoporia rhabarbarina*	He et al. (2021)
		(3β,22R,25E)-lanosta-8,23-diene-triol	*Inonotus obliquus*	Nakata et al. (2009)
		(3β,22R,25E)-lanosta-7:9(11),23-triene -triol	*Inonotus obliquus*	Nakata et al. (2009)
Phenolics	*Phenolic acids, methyl esters of aromatic acids, polyphenols*	benzoate	*Fomitiporia hippophaëicola*, *Fulvifomes robiniae*, *Phellinus igniarius*, *Phellinus laevigatus*, *Phellinus lundellii*, *Phellinus nigricans*, *Phellinus pomaceus*, *Phellinus populicola*, *Phellinus pseudolaevigatus*, *Phellinus tremulae*, *Phylloporia ribis*	Watling & Harper (1998)
		caffeic acid	*Fuscoporia ferruginosa*, *Hymenochaete rubiginosa*, *Inocutis levis*, *Phellinus igniarius*, *Phellinus pomaceus*, *Pyrrhoderma* sp., *Tropicoporus linteus*	Chaharmiri-Dokhaharani et al. (2021)
		chavicol	*Inocutis levis*	Chaharmiri-Dokhaharani et al. (2024)
		chlorogenic acid	*Hymenochaete setipora*, *Inocutis levis*, *Pyrrhoderma* sp., *Sanghuangporus sanghuang*, *Tropicoporus linteus*	Munir et al. (2022), Kim et al. (2008a)
		cinnamate	*Phellinus igniarius*	Watling & Harper (1998)
		cinnamic acid	*Inocutis levis*, *Inonotus cuticularis*	Chaharmiri-Dokhaharani et al. (2024)
		coumestrol	*Inonotus hispidus*	Liu et al. (2024)
		coumaric acid	*Sanghuangporus baumii*	Zan et al. (2023)
		ellagic acid	*Mensularia radiata*, *Phellinus igniarius*, *Phellinus pomaceus*, *Tropicoporus linteus*	Chaharmiri-Dokhaharani et al. (2021)
		ferulic acid	*Inonotus obliquus*, *Phellinus igniarius*	Kim et al. (2008a)
		flavogallonic acid dilactone	*Phellinus pomaceus*	Khojimatov et al. (2023)
		fumaric acid	*Hymenochaete rubiginosa*, *Phellinus igniarius*	Çayan et al. (2021b)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	gallic acid	*Fuscoporia ferruginosa*, *Hymenochaete rubiginosa*, *Hymenochaete setipora*, *Inocutis levis*, *Mensularia radiata*, *Phellinus pomaceus*, *Pyrrhoderma* sp.	Çayan et al. (2021b)
	homovanillic acid	*Hymenochaete setipora*	Tamrakar et al. (2017)
	hydroxycinnamic acid	*Fuscoporia gilva*	Huo et al. (2020)
	hydroxyphenolcarboxylic acid	*Inonotus hispidus*	Khojimatov et al. (2023)
	methyl salicylate	*Phellinus tremulae*	Ayer & Cruz (1995)
	methyl (E)-3-(4-methoxycarbonylphenoxy)-acrylate	*Porodaedalea chrysoloma*	Sárközy et al. (2020)
	methyl 3-(4-methoxycarbonylphenoxy)-propionate	*Porodaedalea chrysoloma*	Sárközy et al. (2020)
	p-coumaric acid	*Hymenochaete rubiginosa*, *Hymenochaete setipora*, *Inocutis levis*, *Mensularia radiata*, *Phellinus igniarius*, *Sanghuangporus* sp.	Çayan et al. (2021b)
	p-hydroxybenzoic acid	*Mensularia radiata*	Çayan et al. (2021a)
	protocatechin	*Phellinus igniarius*	
	protocatechuic acid	*Fomitiporia hippophaëicola*, *Fuscoporia gilva*, *Hymenochaete rubiginosa*, *Hymenochaete setipora*, *Meganotus everhartii*, *Phellinus ellipsoideus*, *Phellinus nigricans*, *Phellinus pomaceus*, *Phylloporia* sp.	Khojimatov et al. (2023)
	rosmarinic acid	*Hymenochaete rubiginosa*, *Mensularia radiata*	Çayan et al. (2021a, b)
	salicylate	*Fomitiporia hippophaëicola*, *Fulvifomes robiniae*, *Phellinus igniarius*, *Phellinus lundellii*, *Phellinus nigricans*, *Phellinus pomaceus*, *Phellinus pseudolaevigatus*, *Phellinus tremulae*, *Phylloporia ribis*	Watling & Harper (1998)
	salicylic acid	*Inocutis levis*, *Inonotus cuticularis*	Chaharmiri-Dokhaharani et al. (2024)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	syringic acid	*Fuscoporia ferruginosa*, *Inocutis levis*, *Phellinus igniarius*, *Phellinus pomaceus*	Chaharmiri-Dokhaharani et al. (2020)
	vanillic acid	*Hymenochaete setipora*, *Inocutis levis*, *Inonotus cuticularis*, *Inonotus hispidus*	Chaharmiri-Dokhaharani et al. (2020)
	veratric acid	*Hymenochaete setipora*, *Inocutis levis*, *Inonotus cuticularis*, *Phellinus pomaceus*	Tamrakar et al. (2016)
	1-carbomethoxybenzene 1,2-oxide	*Phellinus tremulae*	Ayer & Cruz (1995)
	2,3-dihydroxy cinnamic acid	*Fuscoporia torulosa*	Deveci et al. (2019a)
	2-furoate	*Fomitiporia hippophaëicola*, *Phellinus igniarius*, *Phellinus lundellii*, *Phellinus pomaceus*, *Phylloporia ribis*	Watling & Harper (1998)
	3-furoate	*Fomitiporia hippophaëicola*	Watling & Harper (1998)
	3,4-dihydroxybenzoic acid	*Hymenochaete setipora*	Tamrakar et al. (2016)
	3,4-dihydroxyphenylacetic acid	*Phellinus pomaceus*	Khojimatov et al. (2023)
	4-hydroxystyrene	*Porodaedalea pini*	Ayer et al. (1999)
	4-vinylresorcinol	*Porodaedalea pini*	He et al. (2021)
	4-vinylphenol	*Porodaedalea pini*	He et al. (2021)
	4-hydroxy-3,5-dimethoxy benzoic acid 2-hydroxy-1-hydroxymethyl ethyl ester (BAEE)	*Inonotus obliquus*	Nakajima et al. (2007)
	5-sulfosalicylic acid	*Tropicoporus linteus*	Kim et al. (2008a)
	7-acetoxycoumarin-3 -carboxylic acid	*Sanghuangporus baumii*	Zan et al. (2023)
	12-hydroxy-a-cadinol	*Phellinus igniarius*	Khojimatov et al. (2023)
	dihydroactinolide	*Fomitiporia pseudopunctata*	Fischer & Thines (2017)
	ellagic acid	*Mensularia radiata*, *Phellinus igniarius*, *Phellinus pomaceus*, *Tropicoporus linteus*	Çayan et al. (2021a)
	frustulosin (3,6-dihydroxy-2-(3-methylbut-3-en-1-yn-1-yl)benzaldehyde)	*Fomitiporia pseudopunctata*	Fischer & Thines (2017)
	homogentisic acid	*Inonotus obliquus*, *Tropicoporus linteus*	Kim et al. (2008a)
	(+)-pinoresinol	*Porodaedalea pini*	Lourenço et al. (1996)
	phellinstatin	*Sanghuangporus baumii*, *Tropicoporus linteus*	Zan et al. (2023)
	pyrogallol	*Tropicoporus linteus*	Kim et al. (2008a)

Supplementary Table 1 Continued.

Compound groups		Compounds	Species	Selected citing Ref.
		resveratrol	*Inonotus obliquus*	Kim et al. (2008a)
		resorcinol	*Inocutis levis*	Chaharmiri-Dokhaharani et al. (2020)
		scopoletin	*Phellinus igniarius*	Mo et al. (2004)
		trans-cinnamic acid	*Mensularia radiata*, *Phellinus igniarius*	Çayan et al. (2021a)
		trans-2-hydroxycinnamic acid	*Mensularia radiata*	Çayan et al. (2021a)
		vanillin	*Hymenochaete rubiginosa*, *Hymenochaete setipora*	Tamrakar et al. (2016)
		1,1-distyrylpyrylethan	*Hymenochaete xerantica*, *Tropicoporus linteus*	Lee & Yun (2011)
		3-hexyloxy-4-hydroxybenzaldehyde	*Inocutis levis*	Chaharmiri-Dokhaharani et al. (2024)
		3,5-di-tert-butyl-4-hydroxybenzaldehyde	*Inonotus hispidus*	Angelini et al. (2019)
		4-hydroxybenzaldehyde	*Fomitiporia pseudopunctata*, *Inocutis levis*	Fischer & Thines (2017)
		4-(3,4-dihydroxyphenyl)but-3-en-2-one	*Fuscoporia torulosa*	Deveci et al. (2019a)
		6-formyl-2,2-methyl-4-chromanone	*Fomitiporia pseudopunctata*	Fischer & Thines (2017)
		6,7-dihydroxycoumarin	*Mensularia radiata*	Çayan et al. (2021a)
		7,8-dihydroxycoumarin	*Phellinus igniarius*	Zhang et al. (2022)
		3,4-dihydroxybenzaldehyde	*Fuscoporia ferruginosa*	Chaharmiri-Dokhaharani et al. (2021)
	Flavonoids	anthocyanin	*Fuscoporia torulosa*, *Inonotus obliquus*	Khojimatov et al. (2023)
		apigenin	*Phylloporia* sp.	Cheng et al. (2023)
		aromadendrin	*Phellinus igniarius*, *Sanghuangporus baumii*	Khojimatov et al. (2023)
		baicalein	*Sanghuangporus baumii*	Zhang et al. (2022)
		catechin	*Inocutis levis*, *Porodaedalea pini*, *Pyrrhoderma* sp.	Chaharmiri-Dokhaharani et al. (2020)
		catechin hydrate	*Mensularia radiata*	Çayan et al. (2021a)
		dihydrorhamnetin	*Sanghuangporus baumii*	Zhang et al. (2022)
		embinin	*Phellinus pomaceus*	Chaharmiri-Dokhaharani et al. (2021)
		epi-methylphelligrin A (epi-methylfeligrin A)	*Phellinus igniarius*, *Sanghuangporus baumii*	Wu et al. (2011), He et al. (2021)
		epi-methylphelligrin B (epi-methylfeligrin B)	*Phellinus igniarius*, *Sanghuangporus baumii*	Wu et al. (2011), He et al. (2021)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	eriodictyol	*Phellinus igniarius*, *Sanghuangporus baumii*	Khojimatov et al. (2023)
	folerogenin	*Phellinus igniarius*, *Sanghuangporus baumii*	Khojimatov et al. (2023)
	genkwanin	*Sanghuangporus baumii*	Zhang et al. (2022)
	icarisid II	*Sanghuangporus sanghuang*	Sujarit et al. (2021)
	isorhamnetin	*Sanghuangporus sanghuang*	Sujarit et al. (2021)
	kaempferol	*Inonotus obliquus*	Kim et al. (2008a)
	methylphelligrin A (methylfeligrin A)	*Phellinus igniarius*, *Sanghuangporus baumii*	Wu et al. (2011), He et al. (2021)
	methylphelligrin B (methylfeligrin B)	*Phellinus igniarius*, *Sanghuangporus baumii*	Wu et al. (2011), He et al. (2021)
	myricetin	*Inonotus hispidus*	Machado-Carvalho et al. (2023)
	naringin	*Inonotus obliquus*	Kim et al. (2008a)
	naringenin	*Phellinus igniarius*, *Phylloporia* sp., *Sanghuangporus baumii*	Khojimatov et al. (2023)
	phelligrin A (feligrin A)	*Fuscoporia ferruginosa*, *Phellinus igniarius*, *Sanghuangporus baumii*	Wu et al. (2011), He et al. (2021)
	phelligrin B (feligrin B)	*Phellinus igniarius*, *Sanghuangporus baumii*	Wu et al. (2011), He et al. (2021)
	quercetin	*Inocutis levis*, *Inonotus obliquus*, *Sanghuangporus sanghuang*	Kim et al. (2008a)
	rhamnetin	*Sanghuangporus baumii*	Zhang et al. (2022)
	rutin	*Hymenochaete setipora*, *Sanghuangporus sanghuang*	Tamrakar et al. (2016)
	sakuranetin	*Phellinus igniarius*, *Sanghuangporus baumii*	Khojimatov et al. (2023)
	taxifolin	*Phellinus igniarius*	Zhang et al. (2022)
	2-(3,4-dihydroxy-2-methoxyphenyl)-1	*Pyrrhoderma noxium*	Zhang et al. (2022)
	7,3'-dihydroxy-5'-methoxyisoflavone	*Phellinus igniarius*	Zhang et al. (2022)
	(E)-4-(3,4-dihydroxyphenyl)but-3-en-2-one	*Phellinus ellipsoideus*, *Tropicoporus linteus*	Samchai et al. (2011), Li et al. (2017)
	(E)-4-(3′,4′-dihydroxyphenyl)but-3-en-2-one	*Inonotus hispidus*	Khojimatov et al. (2023)
Styrylpyrones	baumin	*Fuscoporia ferruginosa*, *Inonotus cuticularis*, *Sanghuangporus baumii*	Lee et al. (2010)
	daedalin A	*Inonotus cuticularis*	Chaharmiri-Dokhaharani et al. (2024)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	davallialactone	*Hymenochaete xerantica*, *Phellinus igniarius*, *Sanghuangporus baumii*, *Tropicoporus linteus*	Khojimatov et al. (2023)
	hispidin	*Fomitiporia erecta*, *Fomitiporia hartigii*, *Fomitiporia pseudopunctata*, *Fomitiporia punctata*, *Fomitiporia robusta*, *Fulvifomes merrillii*, *Fulvifomes rimosus*, *Fuscoporia contigua*, *Fuscoporia ferrea*, *Fuscoporia viticola*, *Hymenochaete luteobadia*, *Hymenochaete cruenta*, *Hymenochaete pinnatifida*, *Hymenochaete rheicolor*, *Hymenochaete rubiginosa*, *Hymenochaete xerantica*, *Inocutis dryophila*, *Inocutis levis*, *Inocutis rheades*, *Inocutis tamaricis*, *Inonotus andersonii*, *Inonotus clemensiae*, *Inonotus cuticularis*, *Inonotus hispidus*, *Inonotus nidus-pici*, *Mensularia nodulosa*, *Mensularia radiata*, *Onnia tomentosa*, *Onnia triquetra*, *Phellinidium ferrugineofuscum*, *Phellinopsis conchata*, *Phellinus ellipsoideus*, *Phellinus igniarius*, *Phellinus laevigatus*, *Phellinus lundellii*, *Phellinus pomaceus*, *Phellinus tremulae*, *Phellinus* sp., *Phellopilus nigrolimitatus*, *Phylloporia ribis*, *Porodaedalea chrysoloma*, *Porodaedalea pini*, *Sanghuangporus baumii*,	Fiasson (1982)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
		Sanghuangporus lonicerinus, *Sanghuangporus sanghuang*, *Sanghuangporus* sp., *Tropicoporus linteus*	
	hispolon	*Fulvifomes merrillii*, *Inonotus hispidus*, *Phellinus ellipsoideus*, *Phellinus igniarius*, *Phellinus* sp., *Sanghuangporus baumii*, *Sanghuangporus lonicerinus*, *Tropicoporus linteus*	Zan et al. (2023), Ali et al. (1996), Fiasson (1982)
	hypholomin A	*Sanghuangporus baumii*	Zan et al. (2023)
	hypholomin B	*Fomitiporia erecta*, *Fomitiporia hartigii*, *Fomitiporia pseudopunctata*, *Fomitiporia punctata*, *Fomitiporia robusta*, *Fulvifomes rimosus*, *Fuscoporia contigua*, *Fuscoporia ferrea*, *Fuscoporia ferruginosa*, *Fuscoporia torulosa*, *Fuscoporia viticola*, *Hymenochaete xerantica*, *Inocutis dryophila*, *Inocutis rheades*, *Inocutis tamaricis*, *Inonotus hispidus*, *Inonotus nidus-pici*, *Mensularia nodulosa*, *Mensularia radiata*, *Onnia tomentosa*, *Onnia triquetra*, *Phellinopsis conchata*, *Phylloporia ribis*, *Porodaedalea chrysoloma*, *Porodaedalea pini*, *Sanghuangporus baumii*, *Tropicoporus linteus*	Fiasson (1982)
	hypholomin B isomer	*Tropicoporus linteus*	Zhang et al. (2022)
	inonoblin B	*Inonotus obliquus*, *Phellinus ellipsoideus*	Li et al. (2017)
	inonoblin C	*Inonotus obliquus*, *Phellinus igniarius*	Zhang et al. (2022)
	inonotusins A and B	*Inonotus hispidus*	Chen & Liu (2017)
	inonophenols A−C	*Inonotus hispidus*	Kou et al. (2021)
	inoscavin A	*Fuscoporia gilva*, *Fuscoporia torulosa*,	Li et al. (2017)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
		Hymenochaete xerantica, *Phellinus ellipsoideus*, *Phellinus igniarius*, *Phellinus nilgheriensis*, *Phellinus pomaceus*, *Porodaedalea pini*, *Sanghuangporus baumii*, *Tropicoporus linteus*	
	inoscavin B	*Hymenochaete xerantica*, *Phylloporia* sp.	Cheng et al. (2023)
	inoscavin C	*Hymenochaete xerantica*, *Phellinus ellipsoideus*, *Phellinus igniarius*	Zhang et al. (2022)
	inoscavin D	*Hymenochaete xerantica*	Lee & Yun (2011)
	inoscavin E (phellifuropyranone A)	*Hymenochaete xerantica*, *Inonotus cuticularis*, *Phellinus ellipsoideus*, *Phellinus pomaceus*, *Sanghuangporus baumii*, *Tropicoporus linteus*	Kojima et al. (2008), Zan et al. (2023)
	inoscavins A–E	*Hymenochaete xerantica*	Lee & Yun (2011)
	inotilone	*Fulvifomes merrillii*, *Inocutis levis*, *Inonotus cuticularis*, *Phellinus igniarius*, *Phellinus pomaceus*, *Sanghuangporus vaninii*, *Tropicoporus linteus*	He et al. (2021)
	interfungin A	*Hymenochaete xerantica*	Lee & Yun (2011)
	interfungin B	*Hymenochaete xerantica*, *Fuscoporia gilva*, *Phellinus* sp., *Tropicoporus linteus*	Lee & Yun (2011)
	interfungins A–C	*Hymenochaete xerantica*, *Fuscoporia gilva*, *Phellinus* sp., *Tropicoporus linteus*	Lee & Yun (2007)
	isohispidin	*Inonotus* sp.	Lee & Yun (2011)
	isophelligridimer A	*Sanghuangporus baumii*	Zan et al. (2023)
	isophelligridins C and D	*Sanghuangporus baumii*	Zan et al. (2023)
	methyldavallialactone	*Hymenochaete xerantica*	Lee & Yun (2011)
	methylhispolon	*Sanghuangporus lonicerinus*	Wang et al. (2019)
	methylinoscavins A–D	*Hymenochaete xerantica*	Lee & Yun (2011)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	methylinoscavin D	*Hymenochaete xerantica*, *Phellinus pomaceus*	Lee & Yun (2011)
	phaeolschidin A–C	*Phellinus pomaceus*	Chen & Liu (2017)
	phaeolschidin A	*Sanghuangporus baumii*	Zan et al. (2023)
	phaeolschidin E	*Inocutis levis*, *Sanghuangporus baumii*	Zan et al. (2023)
	phellibaumins A–E	*Sanghuangporus baumii*	Wu et al. (2011)
	phellibaumin D	*Fuscoporia gilva*, *Sanghuangporus baumii*	Wu et al. (2011)
	phellibaumin E	*Sanghuangporus baumii*, *Sanghuangporus vaninii*	Wu et al. (2011)
	phelligridimer A	*Fuscoporia gilva*, *Phellinus igniarius*, *Phylloporia ribis*, *Sanghuangporus baumii*	Zan et al. (2023)
	phelligridin A	*Inocutis levis*, *Phellinus igniarius*	Khojimatov et al. (2023)
	phelligridin B	*Phellinus igniarius*	He et al. (2021)
	phelligridin C (meshimakobnol B)	*Fuscoporia ferruginosa*, *Phellinus igniarius*, *Phellinus pomaceus*, *Sanghuangporus baumii*, *Tropicoporus linteus*	Zan et al. (2023)
	phelligridin D (meshimakobnol A)	*Hymenochaete xerantica*, *Inonotus cuticularis*, *Inonotus obliquus*, *Phellinus igniarius*, *Phellinus nilgheriensis*, *Phellinus pomaceus*, *Porodaedalea pini*, *Sanghuangporus baumii*, *Tropicoporus linteus*	He et al. (2021)
	phelligridin E	*Inonotus obliquus*, *Phellinus igniarius*, *Phellinus pomaceus*	He et al. (2021)
	phelligridin F	*Hymenochaete xerantica*, *Phylloporia* sp.	Lee & Yun (2011), Cheng et al. (2023)
	phelligridin G	*Inonotus obliquus*, *Phellinus igniarius*	Khojimatov et al. (2023)
	phelligridin H	*Phellinus igniarius*, *Phellinus pomaceus*, *Sanghuangporus baumii*	Zan et al. (2023)
	phelligridin I (inonoblin A)	*Inonotus obliquus*, *Phellinus igniarius*, *Sanghuangporus baumii*	Zan et al. (2023)
	phelligridin J	*Fuscoporia ferruginosa*, *Phellinus igniarius*, *Sanghuangporus baumii*	Zan et al. (2023)
	phelligridin K	*Phellinus ellipsoideus*	Li et al. (2017)
	phelligridin L	*Sanghuangporus* sp.	He et al. (2021)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	phellinins A–C	*Phellinus* sp.	Lee & Yun (2011)
	phellinins A1 and A2	*Phellinus* sp.	Lee & Yun (2011)
	pinillidine (1,1-distyrylpyrylethan)	*Porodaedalea pini*, *Hymenochaete xerantica*, *Sanghuangporus baumii*, *Tropicoporus linteus*	Chen & Liu (2017), Zan et al. (2023)
	phelliribsin A	*Phylloporia ribis*, *Phylloporia* sp.	Kubo et al. (2014)
	protocatechualdehyde	*Fuscoporia gilva*, *Hymenochaete setipora*, *Phellinus ellipsoideus*	Chang et al. (2011)
	ribisins A–D	*Phylloporia ribis*	He et al. (2021)
	ribisins E–G	*Phylloporia ribis*	Zhang et al. (2022)
	ribisin B	*Inocutis levis*	Chaharmiri-Dokhaharani et al. (2024)
	Z-inoscavin A	*Fuscoporia torulosa*	Béni et al. (2021)
	2,3-bis(4,7-dihydroxy-8-methyl-2-oxo-2H-chromen-3-yl)cyclohexa-2,5-diene-1,4-dione	*Sanghuangporus baumii*	Zhang et al. (2022)
	2,5-bis(4,7-dihydroxy-8-methyl-2-oxo-2H-chromen-3-yl)cyclohexa-2,5-diene-1,4-dione	*Phellinus igniarius*, *Sanghuangporus baumii*	Zhang et al. (2022)
	3-hydroxy-2-methyl-4-pyrone	*Phellinus igniarius*, *Tropicoporus linteus*	Zhang et al. (2022)
	3-hydroxyfriedel-3-en-2-one	*Sanghuangporus vaninii*	Zhang et al. (2022)
	3,4-dihydroxy benzaldehyde	*Fuscoporia torulosa*, *Sanghuangporus baumii*	Zhang et al. (2022)
	3,4-dihydroxybenzalacetone (osmundacetone)	*Fuscoporia torulosa*, *Inonotus cuticularis*, *Inonotus nidus-pici*, *Phellinus igniarius*, *Pyrrhoderma noxium*, *Sanghuangporus baumii*, *Tropicoporus linteus*	Zhang et al. (2022)
	3,14'-bishispidinyl	*Fomitiporia hartigii*, *Fomitiporia robusta*, *Fulvifomes rimosus*, *Fuscoporia torulosa*, *Hymenochaete xerantica*, *Inonotus hispidus*, *Phellinidium ferrugineofuscum*, *Phellinus igniarius*, *Phellinus laevigatus*, *Phellinus lundellii*, *Phellinus pomaceus*, *Phellinus tremulae*, *Phellopilus nigrolimitatus*, *Porodaedalea*	Fiasson (1982)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
		chrysoloma, Porodaedalea pini, Sanghuangporus sp., *Tropicoporus linteus*	
	4-hydroxybenzylideneacetone	*Phellinus* sp.	Zhang et al. (2022)
	4-(3,4-dihydroxyphenyl)-3-buten-2-one	*Sanghuangporus baumii, Tropicoporus linteus*	Zhang et al. (2022)
	4-(4-hydroxyphenyl)-3-buten-2-one	*Sanghuangporus baumii*	Zhang et al. (2022)
	4-(4-hydroxyphenyl)-3-butene-2-one	*Sanghuangporus vaninii*	Zhang et al. (2022)
Polysaccharides	CPLPS	*Tropicoporus linteus*	Zhang et al. (2022)
	EPS	*Sanghuangporus vaninii*	Li et al. (2019)
	EPS-C	*Sanghuangporus baumii*	Zhang et al. (2022)
	EPS-D	*Sanghuangporus baumii*	Zhang et al. (2022)
	EP-AV1	*Porodaedalea pini*	Azeem et al. (2018)
	EP-AV2	*Porodaedalea pini*	Azeem et al. (2018)
	Fr-I	*Inocutis tamaricis*	Zheng et al. (2014)
	Fr-II	*Inocutis tamaricis*	Zheng et al. (2014)
	PBF-I	*Sanghuangporus baumii*	He et al. (2021)
	PBF3	*Sanghuangporus baumii*	He et al. (2021)
	PBF6	*Sanghuangporus baumii*	He et al. (2021)
	PIP	*Tropicoporus linteus*	Zhang et al. (2022)
	PIP-1	*Phellinus igniarius*	He et al. (2021)
	PIP60-1	*Phellinus igniarius*	He et al. (2021)
	PISP1	*Phellinus igniarius, Phylloporia ribis*	He et al. (2021)
	PL-A11	*Tropicoporus linteus*	He et al. (2021)
	PL-N1	*Tropicoporus linteus*	He et al. (2021)
	PLP	*Tropicoporus linteus*	Zhang et al. (2022)
	PLPE	*Tropicoporus linteus*	Zhang et al. (2022)
	PLPS	*Tropicoporus linteus*	Zhang et al. (2022)
	PM-EPS1	*Phellinus mori*	Cao et al. (2013)
	PM-EPS3	*Phellinus mori*	Cao et al. (2013)
	PPE	*Porodaedalea pini*	Zhang et al. (2022)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
	PPI	*Phellinus igniarius*	Zhang et al. (2022)
	PPW-1	*Porodaedalea pini*	Zhang et al. (2022)
	PRG	*Phylloporia ribis*	He et al. (2021)
	PRP	*Phylloporia ribis*	He et al. (2021)
	PSeP	*Phellinus igniarius*	Zhang et al. (2022)
	PV-B	*Sanghuangporus vaninii*	Zhang et al. (2022)
	PV-W	*Sanghuangporus vaninii*	Zhang et al. (2022)
	R1	*Tropicoporus linteus*	He et al. (2021)
	SePSP	*Sanghuangporus lonicericola*	Zhang et al. (2022)
	SHIP-1 and 2	*Phellinus* sp.	Zhang et al. (2022)
	SHP-2	*Sanghuangporus sanghuang*	Zhang et al. (2022)
	SS-1	*Sanghuangporus sanghuang*	Zhang et al. (2022)
	SSEPS2	*Sanghuangporus sanghuang*	Zhang et al. (2022)
	SSIPS1	*Sanghuangporus sanghuang*	Zhang et al. (2022)
	SSPS1	*Sanghuangporus sanghuang*	Zhang et al. (2022)
	galactan	*Inocutis levis*	Vinogradov & Wasser (2005)
	α-glucans	*Mensularia radiata*	Girometta et al. (2020)
	β-glucans	*Inonotus hispidus*, *Inonotus obliquus*, *Mensularia radiata*, *Nothophellinus andinopatagonicus*, *Sanghuangporus baumii*	Khojimatov et al. (2023)
	cellulose	*Inonotus obliquus*	Khojimatov et al. (2023)
	hemicellulose	*Inonotus obliquus*	Khojimatov et al. (2023)
Chlorine-containing compounds	chloromethane (methyl chloride)	*Hydnoporia corrugata*, *Inocutis rheades*, *Inonotus andersonii*, *Inonotus cuticularis*, *Inonotus hispidus*, *Inonotus obliquus*, *Onnia leporina*, *Phellinus pomaceus*	Watling & Harper (1998)
	chloroneb	*Phylloporia boldo*	Riquelme et al. (2020)
	chrysophanic acid	*Phylloporia* sp.	Cheng et al. (2023)
	chlorophellins A–C	*Phylloporia ribis*, *Phylloporia* sp.	Lee et al. (2008)

Supplementary Table 1 Continued.

Compound groups		Compounds	Species	Selected citing Ref.
		drosophilin A	*Fulvifomes fastuosus*, *Phylloporia boldo*, *Phylloporia ribis*, *Phylloporia* sp.	Hsu et al. (1971)
		drosophilin A methyl ether (DAME)	*Fulvifomes fastuosus*, *Fulvifomes robiniae*, *Phellinus yucatanensis*, *Phylloporia boldo*	Singh & Rangaswami (1966)
		hymenoquinone	*Hymenochaete cruenta*, *Hymenochaete pinnatifida*	Fiasson (1982)
		3,5-dichloro-p-anisyl alcohol	*Fuscoporia torulosa*, *Phylloporia ribis*	Swarts et al. (1997)
Nitrogen-containing compounds		cerebroside B	*Tropicoporus linteus*	He et al. (2021)
		ergothionein	*Inonotus obliquus*, *Tropicoporus linteus*	Zhang et al. (2022)
		gammaaminobutyric acid (GABA)	*Tropicoporus linteus*	
		lectins	*Inonotus obliquus*	Khojimatov et al. (2023)
		lauramidopropyl betaine	*Inonotus hispidus*	Angelini et al. (2019)
		melanin	*Fomitiporia robusta*, *Inonotus obliquus*	Khojimatov et al. (2023)
		muscimol	*Fuscoporia ferruginosa*	Chaharmiri-Dokhaharani et al. (2021)
		tryptamine	*Fomitiporia robusta*, *Phellinus igniarius*, *Phellinus pomaceus*	Khojimatov et al. (2023)
		L-tryptophan	*Fomitiporia robusta*, *Phellinus igniarius*, *Phellinus pomaceus*	Khojimatov et al. (2023)
		pterins	*Inonotus hispidus*	Khojimatov et al. (2023)
		7-methoxyindole-3-carboxylic acid methyl ester	*Tropicoporus linteus*	Samchai et al. (2011)
		7-methoxy-2-methylisoquinoline-3,5,8-trione,	*Inonotus cuticularis*	Chaharmiri-Dokhaharani et al. (2024)
		1-methyindole-3-carboxaldehyde	*Tropicoporus linteus*	Samchai et al. (2011)
		N-acetyltyramine	*Tropicoporus linteus*	He et al. (2021)
		N-butylbenzenesulfonamide	*Inonotus hispidus*	Angelini et al. (2019)
		N-(4-chlorophenyl)-N-(phenylmethyl)-benzenemethanamine	*Inocutis levis*	Chaharmiri-Dokhaharani et al. (2024)
		N-(2'-hydroxynonacosanoyl)-D-erythro-1,3,4-trihydroxy-2-aminooctadecane	*Porodaedalea pini*	Lourenço et al. (1996)
		N-(2'-hydroxytriacontanoyl)-D-erythro-l,3,4-trihydroxy-2-aminooctadecane	*Porodaedalea pini*	Lourenço et al. (1996)
Other	*Furans and furanones*	fomitiporiaester A	*Phellinus ellipsoideus*	Li et al. (2017)
		phellinone	*Tropicoporus linteus*	He et al. (2021)
		phellinsin A	*Phellinus igniarius*	He et al. (2021)

Supplementary Table 1 Continued.

Compound groups		Compounds	Species	Selected citing Ref.
		phellinusfurans A and B	*Phellinus igniarius*, *Tropicoporus linteus*	He et al. (2021)
		psoralen	*Inonotus hispidus*	Liu et al. (2024)
		2-furanglycolic acid	*Inonotus cuticularis*	Chaharmiri-Dokhaharani et al. (2024)
		2-hydroxymethyl-5-methoxymethylfuran	*Phellinus igniarius*	He et al. (2021)
		2,5-dihydroxymethylfuran	*Phellinus igniarius*	He et al. (2021)
		5-hydroxymethyl-2-furaldehyde	*Phellinus igniarius*	He et al. (2021)
	Alkanes and alkenes	citropremide	*Inonotus nidus-pici*	Garádi et al. (2021)
		colisiderin A	*Inonotus sideroides*	Hu et al. (2015)
		pentaenone	*Porodaedalea pini*	Ayer et al. (1999)
		1-ethyl-1-methylcyclohexane	*Inonotus cuticularis*	Chaharmiri-Dokhaharani et al. (2024)
		1-ethyl-2-methylcyclohexane	*Inocutis levis*	Chaharmiri-Dokhaharani et al. (2024)
		1-methyl-1-ethylcyclohexane	*Inocutis levis*	Chaharmiri-Dokhaharani et al. (2024)
		2,4,6-triphenylhex-l-ene	*Porodaedalea pini*	He et al. (2021)
		7(E),9(E)-undecandiene-2,4,5-triol	*Inonotus sideroides*	Hu et al. (2015)
		8-methyl-13-phenyltrideca-4,6,8,10,12-pentaene-3-one	*Porodaedalea pini*	He et al. (2021)
	Cyclitol compound	cyclophellitol	*Phellinus* sp.	Atsumi et al. (1990)
	-	uplandicine	*Inonotus hispidus*	Angelini et al. (2019)
	-	nepetidin	*Phellinus igniarius*	He et al. (2021)
	-	serotonin	*Phellinus pomaceus*	Khojimatov et al. (2023)
	-	(4S,5S)-4-hydroxy-3,5-dimethoxycyclohex-2-enone (HDE)	*Inonotus hispidus*	Yang et al. (2019)
	-	2-(3,4-hydroxy-2-methoxyphenyl)-1,3-benzodioxole-5-carbaldehyde	*Phellinus noxius*	Zhang et al. (2022)
	-	4-(3,4-hydroxyphenyl)-3-buten-2-one	*Phellinus noxius*	Zhang et al. (2022)
	-	quinines of oxyphenolcarboxylic acids	*Inonotus hispidus*	Khojimatov et al. (2023)
	-	2-farnesyl-5-methylbenzoquinone	*Porodaedalea pini*	He et al. (2021)
	-	vitamin A	*Mensularia radiata*	Titilawo et al. (2020)
	-	vitamin C (ascorbic acid)	*Inocutis levis*, *Mensularia radiata*, *Sanghuangporus alpinus*, *Sanghuangporus baumii*, *Sanghuangporus lonicericola*, *Sanghuangporus quercicola*, *Sanghuangporus sanghuang*, *Sanghuangporus*	Wang et al. (2023b)

Supplementary Table 1 Continued.

Compound groups	Compounds	Species	Selected citing Ref.
		vaninii, *Sanghuangporus weigelae*, *Sanghuangporus zonatus*	
-	vitamin niacin	*Phylloporia* sp.	Cheng et al. (2023)

Supplementary Table 2 Various biological properties in Hymenochaetaceae.

Biological properties		Species
Type	Subtypes	
Antioxidant	-	*Flaviporellus splitgerberi*, *Fomitiporella badia*, *Fomitiporia hartigii*, *Fomitiporia hippophaeicola*, *Fomitiporia punctate*, *Fomitiporia robusta*, *Fulvifomes crocatus*, *Fulvifomes merrillii*, *Fulvifomes rimosus*, *Fuscoporia contigua*, *Fuscoporia ferruginosa*, *Fuscoporia gilva*, *Fuscoporia rhabarbarina*, *Fuscoporia torulosa*, *Hymenochaete rubiginosa*, *Hymenochaete setipora*, *Hymenochaete xerantica*, *Inocutis levis*, *Inocutis rheades*, *Inocutis tamaricis*, *Inonotus andersonii*, *Inonotus clemensiae*, *Inonotus hispidus*, *Inonotus nidus-pici*, *Inonotus obliquus*, *Inonotus rickii*, *Meganotus everhartii*, *Mensularia radiata*, *Nothophellinus andinopatagonicus*, *Phellinopsis conchata*, *Phellinus ellipsoideus*, *Phellinus igniarius*, *Phellinus mori*, *Phellinus nigricans*, *Phellinus orientoasiaticus*, *Phellinus pomaceus*, *Phellinus tremulae*, *Phellinus* sp., *Phellopilus nigrolimitatus*, *Phylloporia* sp., *Porodaedalea chrysoloma*, *Porodaedalea pini*, *Pseudoinonotus dryadeus*, *Pyrrhoderma adamantinum*, *Pyrrhoderma noxium*, *Pyrrhoderma* sp., *Sanghuangporus alpinus*, *Sanghuangporus baumii*, *Sanghuangporus lonicericola*, *Sanghuangporus quercicola*, *Sanghuangporus sanghuang*, *Sanghuangporus vaninii*, *Sanghuangporus weigelae*, *Tropicoporus linteus*
Biocidal	antimicrobial	*Fomitiporella badia*, *Fulvifomes aureobrunneus*, *Fulvifomes coffeatoporus*, *Fulvifomes fastuosus*, *Fulvifomes grenadensis*, *Fulvifomes luteoumbrinus*, *Fulvifomes minutiporus*, *Fulvifomes swieteniae*, *Fuscoporia griseopora*, *Inonotus nidus-pici*, *Inonotus obliquus*, *Onnia tomentosa*, *Phellinus igniarius*, *Phylloporia* sp., *Pyrrhoderma adamantinum*, *Pyrrhoderma noxium*, *Sanghuangporus sanghuang*, *Sanghuangporus* sp., *Tropicoporus linteus*
	antibacterial	*Coltricia perennis*, *Fomitiporia hartigii*, *Fomitiporia hippophaeicola*, *Fomitiporia*

Supplementary Table 2 Continued.

Biological properties		Species
Type	Subtypes	
		robusta, *Fulvifomes aureobrunneus*, *Fulvifomes crocatus*, *Fulvifomes lloydii*, *Fulvifomes merrillii*, *Fulvifomes rimosus*, *Fulvifomes swieteniae*, *Fuscoporia ferruginosa*, *Fuscoporia gilva*, *Fuscoporia torulosa*, *Hymenochaete rubiginosa*, *Hymenochaete setipora*, *Hymenochaete* sp., *Inocutis levis*, *Inonotus andersonii*, *Inonotus clemensiae*, *Inonotus cuticularis*, *Inonotus hispidus*, *Inonotus* sp., *Meganotus everhartii*, *Phellinopsis conchata*, *Phellinus igniarius*, *Phellinus nigricans*, *Phellinus pomaceus*, *Phellopilus nigrolimitatus*, *Porodaedalea chrysoloma*, *Pseudoinonotus dryadeus*, *Pyrrhoderma adamantinum*, *Pyrrhoderma noxium*, *Pyrrhoderma* sp., *Sanghuangporus baumii*, *Tropicoporus linteus*
	antifungal	*Fomitiporella badia*, *Fulvifomes aureobrunneus*, *Fulvifomes crocatus*, *Fulvifomes lloydii*, *Fulvifomes merrillii*, *Fulvifomes rimosus*, *Fuscoporia gilva*, *Fuscoporia torulosa*, *Hymenochaete rubiginosa*, *Inonotus hispidus*, *Nothophellinus andinopatagonicus*, *Porodaedalea pini*, *Sanghuangporus baumii*
	antiviral	*Fomitiporia punctata*, *Inonotus hispidus*, *Inonotus* sp., *Phellinus igniarius*, *Phellinus* sp., *Porodaedalea pini*, *Sanghuangporus vaninii*, *Tropicoporus linteus*
	anti blue stain and wood decay fungi	*Porodaedalea pini*
	antiparasitic	*Fulvifomes rimosus*, *Hymenochaete rheicolor*
	antimalarial	*Fulvifomes xylocarpicola*, *Tropicoporus linteus*
	antitubercular	*Fulvifomes xylocarpicola*
	antiplasmodial	*Phellinus igniarius*
	nematicidal	*Sanghuangporus* sp.
Cancer treatment	anticancer	*Coltricia perennis*, *Fulvifomes merrillii*, *Fuscoporia gilva*, *Inonotus obliquus*, *Phellinus igniarius*, *Sanghuangporus lonicerinus*, *Tropicoporus linteus*
	antitumor	*Cylindrosporus flavidus*, *Fomitiporia alpina*, *Fomitiporia erecta*, *Fomitiporia gaoligongensis*, *Fomitiporia hartigii*, *Fomitiporia norbulingka*, *Fomitiporia pentaphylacis*, *Fomitiporia punctata*, *Fomitiporia punicata*, *Fomitiporia rhamnoides*, *Fomitiporia robusta*, *Fomitiporia subhippophaeicola*, *Fomitiporia subrobusta*, *Fomitiporia tenuitubus*, *Fomitiporia texana*, *Fulvifomes mcgregorii*, *Fulvifomes rimosus*, *Fuscoporia gilva*, *Fuscoporia rhabarbarina*, *Hymenochaete microcycla*, *Inocutis levis*, *Inocutis rheades*, *Inocutis tamaricis*, *Inonotus cuticularis*, *Inonotus hispidus*, *Inonotus obliquus*, *Mensularia radiata*, *Onnia vallata*, *Phellinopsis conchata*, *Phellinus ellipsoideus*, *Phellinus igniarius*, *Phellinus laevigatus*,

Supplementary Table 2 Continued.

Biological properties		Species
Type	**Subtypes**	
		Phellinus lundellii, *Phellinus monticola*, *Phellinus orientoasiaticus*, *Phellinus padicola*, *Phellinus parmastoi*, *Phellinus piceicola*, *Phellinus pomaceus*, *Phellinus setulosus*, *Phellinus tremulae*, *Phylloporia lonicerae*, *Phylloporia ribis*, *Phylloporia* sp., *Porodaedalea alpicola*, *Porodaedalea chinensis*, *Porodaedalea chrysoloma*, *Porodaedalea himalayensis*, *Porodaedalea laricis*, *Porodaedalea pini*, *Porodaedalea yamanoi*, *Pyrrhoderma lamaoense*, *Sanghuangporus alpinus*, *Sanghuangporus baumii*, *Sanghuangporus lonicericola*, *Sanghuangporus lonicerinus*, *Sanghuangporus quercicola*, *Sanghuangporus sanghuang*, *Sanghuangporus vaninii*, *Sanghuangporus weigelae*, *Sanghuangporus zonatus*, *Sanghuangporus* sp., *Tropicoporus linteus*
	cytotoxic effects against various human cancer cell lines	*Fomitiporia aethiopica*
	cytotoxic	*Fomitiporia aethiopica*, *Fomitiporia robusta*, *Fuscoporia torulosa*, *Inonotus obliquus*, *Inonotus rickii*, *Inonotus sideroides*, *Nothophellinus andinopatagonicus*, *Phellinus igniarius*, *Tropicoporus linteus*
	antiproliferative	*Inonotus hispidus*, *Inonotus nidus-pici*, *Inonotus obliquus*, *Phellinus nigricans*, *Sanghuangporus baumii*, *Sanghuangporus sanghuang*, *Sanghuangporus vaninii*, *Tropicoporus linteus*
	activity on human colon cancer cells	*Inonotus rickii*
	cytotoxic and/or apoptotic	*Inonotus obliquus*
	anticarcinogenic/no cytotoxic effects on normal human fibroblast cells	*Phellinus pomaceus*, *Nothophellinus andinopatagonicus*
	antimetastatic	*Tropicoporus linteus*
	pro-apoptotic activities	*Tropicoporus linteus*
	genoprotective	*Fomitiporia robusta*
	antineoplastic	*Fulvifomes rimosus*, *Hymenochaete rheicolor*
	antiangiogenic	*Tropicoporus linteus*
	treating acute leukemia	*Ochrosporellus taiwanensis*
Cardiovascular disease treatment	cardioprotective	*Phellinus igniarius*, *Porodaedalea pini*
	ameliorating endothelial and vascular dysfunction	*Sanghuangporus baumii*
	activating the circulation to remove blood stasis	*Inonotus hispidus*
	haemostasis	*Inocutis rheades*, *Inocutis tamaricis*, *Inonotus cuticularis*, *Inonotus hispidus*, *Phellinus igniarius*, *Phellinus monticola*, *Phellinus padicola*, *Phellinus piceicola*
	preventing and treating cardiovascular diseases	*Fomitiporia punctata*
	promoting blood circulation	*Phellinopsis conchata*, *Phellinus igniarius*
	replenishing the blood	*Fulvifomes rimosus*
	vasodilating	*Fuscoporia gilva*, *Phellinus igniarius*
	vascular-relaxing	*Phellinus igniarius*
	treating coronary artery disease	*Fomitiporia bannaensis*, *Fomitiporia hainaniana*, *Fomitiporia pseudopunctata*,

Supplementary Table 2 Continued.

Biological properties		**Species**
Type	**Subtypes**	
		Fomitiporia punctata, *Fomitiporia subtropica*, *Fomitiporia torreyae*
Digestive system disease treatment	promoting digestion	*Fuscoporia gilva*
	treating gastropathy	*Pyrrhoderma adamantinum*
	treating hemorrhoids	*Inocutis rheades*, *Inocutis tamaricis*
	hepatoprotective	*Fulvifomes merrillii*, *Fulvifomes rimosus*, *Fuscoporia gilva*, *Phellinus igniarius*, *Sanghuangporus baumii*, *Tropicoporus linteus*
Enzyme inhibitory	angiotensin-converting enzyme (ACE) inhibitory	*Fuscoporia gilva*, *Inonotus andersonii*, *Phellinopsis conchata*
	α-glucosidase inhibitory	*Fulvifomes merrillii*, *Inocutis rheades*, *Inonotus obliquus*
	β-glucosidase inhibitory	*Phellinus* sp.
	xanthine oxidase inhibitory	*Fomitiporia hartigii*, *Fomitiporia punctata*, *Fomitiporia robusta*, *Fuscoporia torulosa*, *Phellinopsis conchata*, *Phellinus igniarius*, *Phellinus pomaceus*, *Phellinus tremulae*, *Phellopilus nigrolimitatus*, *Porodaedalea chrysoloma*, *Porodaedalea pini*
	anticholinesterase	*Fuscoporia torulosa*, *Hymenochaete rubiginosa*, *Mensularia radiata*, *Phellinus igniarius*
	aldose reductase inhibitory	*Fulvifomes merrillii*
	human neutrophil elastase (HNE) inhibitory	*Tropicoporus linteus*
	neuraminidase inhibitory	*Tropicoporus linteus*
	elastase inhibitory	*Phellinus igniarius*
	prolyl endopeptidase inhibitory	*Tropicoporus linteus*
	HIV-1 integrase inhibitory	*Phellinus* sp.
	enoyl-acyl carrier protein (ACP) reductase inhibitory	*Tropicoporus linteus*
	tyrosinase inhibitory	*Fuscoporia torulosa*, *Sanghuangporus baumii*
Immune system treatment	immunostimulatory	*Fomitiporia robusta*, *Inonotus hispidus*, *Phellinus nigricans*, *Sanghuangporus baumii*
	immunomodulatory	*Fulvifomes rimosus*, *Hymenochaete rheicolor*, *Inonotus hispidus*, *Phellinus igniarius*, *Phellinus* sp., *Phylloporia ribis*, *Phylloporia* sp., *Porodaedalea pini*, *Sanghuangporus baumii*, *Sanghuangporus sanghuang*, *Sanghuangporus vaninii*, *Tropicoporus linteus*
	reinforcing the spleen	*Fuscoporia gilva*, *Phellinus igniarius*
	anti-inflammatory	*Fomitiporia robusta*, *Fulvifomes rimosus*, *Fuscoporia gilva*, *Fuscoporia rhabarbarina*, *Inonotus hispidus*, *Inonotus obliquus*, *Phellinus igniarius*, *Phellinus nigricans*, *Phellinus* sp., *Phylloporia fontanesiae*, *Phylloporia lonicerae*, *Phylloporia* sp., *Porodaedalea pini*, *Sanghuangporus baumii*, *Sanghuangporus lonicericola*, *Sanghuangporus sanghuang*, *Sanghuangporus vaninii*, *Tropicoporus linteus*
	improving immunity	*Fulvifomes mcgregorii*, *Fulvifomes rimosus*, *Fuscoporia gilva*, *Inonotus obliquus*, *Phellinopsis conchata*, *Phellinus laevigatus*,

Supplementary Table 2 Continued.

Biological properties		Species
Type	**Subtypes**	
		Phellinus lundellii, *Phellinus orientoasiaticus*, *Phellinus parmastoi*, *Phellinus pomaceus*, *Phellinus setulosus*, *Phellinus tremulae*, *Porodaedalea alpicola*, *Porodaedalea chinensis*, *Porodaedalea himalayensis*, *Porodaedalea laricis*, *Porodaedalea pini*, *Porodaedalea yamanoi*, *Sanghuangporus lonicericola*, *Sanghuangporus vaninii*
	strengthening immunity	*Phellinus igniarius*
	preventing and treating autoimmune joint inflammation	*Sanghuangporus baumii*
	stimulate the synthesis of γ-interferon	*Phellinus igniarius*
	inhibiting the nuclear factor-κB (NF-κB)	*Phellinus igniarius*
Joint disease treatment	anti-arthritis	*Phellinus igniarius*
	treating rheumatism	*Fuscoporia gilva*
	anti-gout	*Phellinus igniarius*, *Sanghuangporus vaninii*
Metabolism regulation	antidiabetic	*Fomitiporella badia*, *Fulvifomes merrillii*, *Inocutis levis*, *Inonotus obliquus*, *Mensularia radiata*, *Phellinus igniarius*, *Phylloporia ribis*, *Phylloporia* sp., *Sanghuangporus baumii*, *Tropicoporus linteus*
	anti-obesity	*Fulvifomes rimosus*, *Sanghuangporus baumii*
	hypolipidemic	*Fulvifomes rimosus*, *Inonotus hispidus*
	improving insulin resistance and glucose tolerance	*Inocutis levis*
	potential to control hypertriglyceridemia	*Inocutis levis*
	anti-hyperglycemic	*Inonotus hispidus*
	hypoglycemic	*Inonotus obliquus*, *Phellinus igniarius*, *Porodaedalea pini*, *Sanghuangporus baumii*, *Sanghuangporus sanghuang*, *Tropicoporus linteus*
	reduces hyperglycemia and normalizes insulin levels	*Phellinus igniarius*
	lowering serum lipids	*Sanghuangporus alpinus*, *Sanghuangporus baumii*, *Sanghuangporus quercicola*, *Sanghuangporus weigelae*, *Sanghuangporus zonatus*
	low-density lipoprotein (LDL) antioxidant	*Phellinus igniarius*
	PPAR-γ agonistic	*Phylloporia ribis*
	hypouricemic	*Sanghuangporus vaninii*
Neural system disease treatment	neurotrophic	*Inonotus hispidus*, *Inonotus rickii*, *Phylloporia ribis*
	neuroprotective	*Inonotus hispidus*, *Inonotus obliquus*, *Phylloporia ribis*, *Phylloporia* sp.
	anti-Alzheimer	*Phylloporia ribis*, *Tropicoporus linteus*
	central nervous system (CNS) activity	*Tropicoporus linteus*
	sedative effects	*Inonotus hispidus*
	increasing motor activity of smooth muscles and stimulating synapses	*Inonotus rickii*
Systemic infection treatment	treating pneumonia	*Sanghuangporus alpinus*, *Sanghuangporus baumii*, *Sanghuangporus quercicola*, *Sanghuangporus weigelae*, *Sanghuangporus zonatus*
	treatment of candidiasis	*Inonotus hispidus*

Supplementary Table 2 Continued.

Biological properties		Species
Type	**Subtypes**	
	alleviating septic shock	*Sanghuangporus baumii*
Other bioactivities	analgesic	*Inocutis rheades*, *Inocutis tamaricis*
	anti-aging	*Sanghuangporus baumii*
	antiallergic	*Tropicoporus linteus*
	anti-fatigue	*Phellinus igniarius*
	estrogenic	*Sanghuangporus lonicerinus*
	invigorating qi	*Fulvifomes rimosus*
	treating anemia	*Fuscoporia torulosa*
	eliminating dampness	*Fuscoporia gilva*
	detoxification	*Fuscoporia torulosa*, *Phellinopsis conchata*
	anti-complement	*Tropicoporus linteus*
	effect on in vitro fertilization of pigs	*Sanghuangporus baumii*
	nitric oxide (NO) production inhibitory	*Porodaedalea pini*
	prevention of peroxynitrite-induced DNA damage	*Tropicoporus linteus*
	protein glycation inhibitory	*Tropicoporus linteus*
	skin protective	*Pseudoinonotus dryadeus*
	anti-melanogenic	*Sanghuangporus vaninii*
	anti-wrinkle	*Sanghuangporus vaninii*
	synergistic	*Fuscoporia torulosa*