

Ganoderma

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Ganoderma



Ganoderma applanatum

Scientific classification

Kingdom: [Fungi](#)
Division: [Basidiomycota](#)
Class: [Agaricomycetes](#)
Order: [Polyporales](#)
Family: [Ganodermataceae](#)
Genus: ***Ganoderma***
[P.Karst](#) (1881)

Type species

Ganoderma lucidum
([Curtis](#)) [P.Karst.](#) (1881)

Species

- [Ganoderma alba](#)
- [Ganoderma annularis](#)
- [Ganoderma atrum](#)
- [Ganoderma aurea](#)
- [Ganoderma australe](#)
- [Ganoderma amboinense](#)
- [Ganoderma applanatum](#)
- [Ganoderma boninense](#)
- [Ganoderma brownii](#)
- [Ganoderma colossus](#)
- [Ganoderma cupreum](#)
- [Ganoderma curtisii](#)
- [Ganoderma formosanum](#)
- [Ganoderma incrassatum](#)
- [Ganoderma lobatum](#)
- [Ganoderma lucidum](#)
- [Ganoderma meredithiae](#)

- [*Ganoderma miniatocinctum*](#)
- [*Ganoderma multipileum*](#)
- [*Ganoderma nigrolucidum*](#)
- [*Ganoderma orbiforme*](#)
- [*Ganoderma oregonense*](#)
- [*Ganoderma purpurea*](#)
- [*Ganoderma pfeifferi*](#)
- [*Ganoderma philippii*](#)
- [*Ganoderma pseudoferreum*](#)
- [*Ganoderma resinaceum*](#)
- [*Ganoderma rubra*](#)
- [*Ganoderma sichuanense*](#)
- [*Ganoderma sinense*](#)
- [*Ganoderma steyaertanum*](#)
- [*Ganoderma tornatum*](#)
- [*Ganoderma tsugae*](#)
- [*Ganoderma viridis*](#)
- [*Ganoderma weberianum*](#)
- [*Ganoderma zonatum*](#)

This list is [incomplete](#); you can help by [expanding it](#).

Ganoderma, a [genus](#) of [polypore](#) fungi in the family [Ganodermataceae](#), includes about 80 species, many from [tropical](#) regions.^[1] Because of their [genetic diversity](#), use in [traditional Asian medicines](#), and potential in [bioremediation](#), they are an important genus economically. *Ganoderma* can be differentiated from other polypores because they have a double-walled [basidiospore](#). They are sometimes called shelf mushrooms or [bracket fungi](#).



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Etymology

The name *Ganoderma* is derived from the [Greek](#) *ganos*/γανος "brightness, sheen", hence "shining" and *derma*/δερμα "skin".^[2]

History

The genus *Ganoderma* was established as a genus in 1881 by Karsten and included only one species, *G. lucidum* (Curtis) Karst ^[3]. Previously, this taxon was characterized as *Boletus lucidus* Curtis (1781) and then *Polyporus lucidus* (Curtis) Fr. (1821) (Karsten 1881). The species *P. lucidus* was characterized by having a laccate (shiny or polished) [pileus](#) and [stipe](#), and this is a character that [Murrill](#) suspected was the reason for Karsten's division because only one species was included, *G. lucidum*.^[4] Patouillard revised Karsten's genus *Ganoderma* to include all species with pigmented spores, adhering tubes and laccate crusted pilei, which resulted with a total of 48 species classified under the genus *Ganoderma* in his 1889 monograph.^{[5][4][6]} Until Murrill investigated *Ganoderma* in North America in 1902, previous work had focused solely on European species including, for example, *G. lucidum*, *G. resinaceum* Boud. (1890) and *G. valesiacum* Boud. (1895).^{[7][8][4]}

Description

Ganoderma are characterized by [basidiocarps](#) that are large, perennial, woody brackets also called "[conks](#)". They are [lignicolous](#) and [leathery](#) either with or without a stem. The fruit bodies typically grow in a fan-like or hoof-like form on the trunks of living or dead trees. They have double-walled, truncate [spores](#) with yellow to brown ornamented inner layers.

Phylogeny

The genus was named by [Karsten](#) in 1881.^[9] Members of the family Ganodermataceae were traditionally considered difficult to classify because of the lack of reliable [morphological](#) characteristics, the overabundance of [synonyms](#), and the widespread misuse of names.^{[10][11]} Until recently, the genus was divided into two sections – Section *Ganoderma* with a shiny cap surface (like [Ganoderma lucidum](#)) and *Elfvigia*, with a dull cap surface, like [Ganoderma applanatum](#).

[Phylogenetic](#) analysis using DNA sequence information have helped to clarify our understanding of the relationships amongst *Ganoderma* species.^{[12][13]} The genus may now be divided into six [monophyletic](#) groups:^[14]

- *G. colossus* group
- [G. applanatum](#) group
- [G. tsugae](#) group
- Asian [G. lucidum](#) group
- [G. meredithiae](#) group

- *G. resinaceum* group

With the rise of molecular phylogenies in the late 20th century, species concept hypotheses were tested to determine the relatedness amongst the nuanced morphological variabilities of the laccate *Ganoderma* taxa. In 1995, Moncalvo *et al* constructed a phylogeny of the rDNA, which was the universally accepted locus at that time, and found five major clades of the laccate species amongst the 29 isolates tested.^[15] It turned out that *G. lucidum* was not a monophyletic species, and further work needed to be done to clarify this taxonomic problem. They also found that *G. resinaceum* from Europe, and the North American '*G. lucidum*', which Adaskaveg and Gilbertson found to be biologically compatible *in vitro*, did not cluster together.^{[15][16]} Moncalvo *et al.* reject biological species complexes as a sole tool to distinguish a taxon, and suggested using a combination between biological and phylogenetic species concepts to define unique *Ganoderma* taxa.^{[16][15]}

In 1905, American mycologist [William Murrill](#) delineated the genus *Tomophagus* to accommodate the single species *G. colossus* (then known as *Polyporus colossus*) which had distinctive morphological features that did not fit in with the other species.^[17] Historically, however, *Tomophagus* has generally been regarded as a synonym for *Ganoderma*.^[18] Nearly a century later, phylogenetic analyses vindicated Murrill's original placement, as it has shown to be a taxonomically distinct appropriate genus.^[14]

Significance

Crop diseases

Some *Ganoderma* species can cause major long-term crop losses, especially with trees:

- *G. orbiforme* (= *G. boninense*), *G. zonatum* and *G. miniatocinctum* are responsible for basal stem rot disease in Asian [oil palm](#) plantations.^[19]
- *G. philippii* and *G. pseudoferreum* - Responsible for the root rot of [cacao](#), coffee, [rubber](#) and [tea trees](#).

Industry

Ganoderma are wood-decaying fungi with a [cosmopolitan distribution](#). They can grow on both coniferous and hardwood species. They are white-rot fungi with enzymes that allow them to break down wood components, such as [lignin](#) and [cellulose](#). There has been significant research interest on the wood-degrading enzymes of *Ganoderma* species for industrial applications, such as [biopulping](#).^{[20][21]} or [bioremediation](#).^[22]

Phytochemistry



Ganoderma lucidum

For centuries, *Ganoderma* species have been used in traditional medicine in many parts of Asia.^[23] These species are often mislabeled as '*G. lucidum*', although genetic testing has shown this to be multiple species such as *G. lingzhi*, *G. multipileum*, and *G. sichuanense*^{[24][25]}. Several species of *Ganoderma* contain diverse [phytochemicals](#) with undefined properties [in vivo](#), such as [triterpenoids](#) and [polysaccharides](#), an area of investigation under [basic research](#).^[23]

Although various *Ganoderma* species are used in folk medicine for supposed benefits and have been investigated for their potential effects in humans, there is no evidence from [high-quality clinical research](#) that *Ganoderma* phytochemicals have any effect in humans, such as in [cancer](#) research.^[26]

Other notable species

- [Ganoderma applanatum](#) - Also known as the **Artist's conk**. An infestation of this species was the main factor in the loss of the [Anne Frank Tree](#).^[27]
- [Ganoderma lucidum](#) - Also known as **Reishi** or **Lingzhi**.
- [Ganoderma multipileum](#)
- [Ganoderma tsugae](#) - A polypore which grows on [conifers](#), especially [hemlock](#), giving it its common name, **Hemlock varnish shelf**. Similar in appearance to *Ganoderma lucidum*, which typically grows on [hardwoods](#).^[28]

References

1.

- Kirk PM, Cannon PF, Minter DW, Stalpers JA (2008). *Dictionary of the Fungi* (10th ed.). Wallingford: CABI. p. 272. [ISBN 0-85199-826-7](#).
- • [Liddell, Henry George](#) & [Robert Scott](#) (1980). [A Greek-English Lexicon](#) (Abridged Edition). United Kingdom: [Oxford University Press](#). [ISBN 0-19-910207-4](#).
- • Karsten, P. 1881. Enumeratio Boletinarum et Polyporarum Fennicarum systemate novo dispositurum. Rev. Mycol. 3:16-18
- • Murrill, W. A. 1902. The Polyporaceae of North America, genus I *Ganoderma*. Bull. Torrey Bot. Club 29:599-608.
- • Patouillard, N. 1889. Le genre *Ganoderma*. Bull. Soc. mycol. Fr. 5:64-80.

- • Atkinson, G. F. 1908. Observations on *Polyporus lucidus* Leys and some of its Allies from Europe and North America. *Botanical Gazette* 46:321-338.
- • Adaskaveg, J. E. 1986. Studies of *Ganoderma lucidum* and *Ganoderma tsugae* (Delignification, Mating Systems, Root Rot, Cultural Morphology, Taxonomy). Dissertation. The University of Arizona.
- • Murrill, W. A. 1908. Agaricales (Polyporaceae). *North Amer. Flora* 9:73-131.
- • Karsten PA. (1881). "*Enumeratio Boletinearum et Polyporearum Fennicarum, systemate novo dispositarum*". *Revue mycologique, Toulouse (in Latin)*. **3** (9): 16–19.
- • Smith BJ, Sivasithamparam K (2003). "*Morphological studies of Ganoderma (Ganodermataceae) from the Australasian and Pacific regions*". *Australian Systematic Botany*. **16** (4): 487–503. doi:[10.1071/SB02001](https://doi.org/10.1071/SB02001).
- • Ryvarden L. (1985). "*Type studies in the Polyporaceae 17: species described by W. A. Murrill*". *Mycotaxon*. **23**: 169–198.
- • Hibbett DS, Donoghue MJ. (1995). Progress toward a phylogenetic classification of the Polyporaceae through parsimony analysis of mitochondrial ribosomal DNA sequences. *Can J Bot* 73(S1):S853–S861.
- • Hibbett DS, Thorn RG. (2001). Basidiomycota: Homobasidiomycetes. The Mycota VII Part B. In: McLaughlin DJ, McLaughlin EG, Lemke PA, eds. *Systematics and evolution*. Berlin-Heidelberg, Germany: Springer-Verlag. p 121–168.
- • Hong SG, Jung HS (2004). "*Phylogenetic analysis of Ganoderma based on nearly complete mitochondrial small-subunit ribosomal DNA sequences*". *Mycologia*. **96** (4): 742–55. CiteSeerX [10.1.1.552.9501](https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.552.9501) . doi:[10.2307/3762108](https://doi.org/10.2307/3762108). JSTOR [3762108](https://www.jstor.org/stable/3762108). PMID [21148895](https://pubmed.ncbi.nlm.nih.gov/21148895/).
- • Moncalvo, J.-M., Wang, H.-F., and Hseu, R.-S. 1995. Gene phylogeny of the *Ganoderma lucidum* complex based on ribosomal DNA sequences. Comparison with traditional taxonomic characters. *Mycological Research* 99:1489-1499.
- • Adaskaveg, J. E., and Gilbertson, R. L. 1986. Cultural studies and genetics of sexuality of *Ganoderma lucidum* and *G. tsugae* in relation to the taxonomy of the *G. lucidum* complex. *Mycologia*:694-705.
- • Murrill WA. (1905). "*Tomophagus for Dendrophagus*". *Torreyia*. **5**: 197.
- • Furtado JS. (1965). "*Ganoderma colossum and the status of Tomophagus*". *Mycologia*. **57** (6): 979–84. doi:[10.2307/3756901](https://doi.org/10.2307/3756901). JSTOR [3756901](https://www.jstor.org/stable/3756901).
- • Ling-Chie Wong, Choon-Fah J. Bong, A.S. Idris (2012) *Ganoderma* Species Associated with Basal Stem Rot Disease of Oil Palm. *American Journal of Applied Sciences* **9**(6): 879-885 (ISSN 1546-9239)
- • Loyd, A. L; Held, B. W; Linder, E. R; Smith, J. A; Blanchette, R. A (2018). "*Elucidating wood decomposition by four species of Ganoderma from the United States*". *Fungal Biology*. **122** (4): 254–263. doi:[10.1016/j.funbio.2018.01.006](https://doi.org/10.1016/j.funbio.2018.01.006). PMID [29551199](https://pubmed.ncbi.nlm.nih.gov/29551199/).
- • "*FBRI: New Enzymes for Biopulping*". Archived from [the original](#) on 2009-01-04. Retrieved 2008-11-15.
- • Matos AJ, Bezerra RM, Dias AA (September 2007). "*Screening of fungal isolates and properties of Ganoderma applanatum intended for olive mill wastewater decolourization and dephenolization*". *Lett. Appl. Microbiol*. **45** (3): 270–5. doi:[10.1111/j.1472-765X.2007.02181.x](https://doi.org/10.1111/j.1472-765X.2007.02181.x). PMID [17718838](https://pubmed.ncbi.nlm.nih.gov/17718838/).

- • Wachtel-Galor, Sissi (2011). [*"Chapter 9 Ganoderma lucidum \(Lingzhi or Reishi\)A Medicinal Mushroom". Herbal Medicine: Biomolecular and Clinical Aspects. 2nd edition.*](#) CRC Press Taylor and Francis. [ISBN 978-1-4398-0713-2](#). Retrieved 2017-02-22.
- • Hennicke, F., Z. Cheikh-Ali, T. Liebisch, J.G. Maciá-Vicente, H.B. Bode, and M. Piepenbring. 2016. "Distinguishing commercially grown *Ganoderma lucidum* from *Ganoderma lingzhi* from Europe and East Asia on the basis of morphology, molecular phylogeny, and triterpenic acid profiles." *Phytochemistry* 127:29–37.
- • Hapuarachchi, K., T. Wen, C. Deng, J. Kang, and K. Hyde. 2015. "Mycosphere Essays 1: Taxonomic Confusion in the *Ganoderma lucidum* Species Complex." *Mycosphere* 6:542–559.
- • Jin, X; Ruiz Beguerie, J; Sze, D. M; Chan, G. C (2016). [*"Ganoderma lucidum \(Reishi mushroom\) for cancer treatment"*](#). *Cochrane Database of Systematic Reviews*. **4**: CD007731. [doi:10.1002/14651858.CD007731.pub3](#). [PMID 27045603](#).
- • [*"Horse chestnut tree diseased"*](#) (Press release). The Anne Frank House. [Archived](#) from the original on 3 October 2006. Retrieved 2006-11-17.

28. • Kuo M., MushroomExpert.Com, [Ganoderma tsugae](#). (2004, February). Retrieved June 15, 2007.

Taxon identifiers

- [Wikidata: Q1799774](#)
- [Wikispecies: Ganoderma](#)
- [EoL: 16429](#)
- [EPPO: 1GANOG](#)
- [Fungorum: 17639](#)
- [GBIF: 2519220](#)
- [iNaturalist: 48475](#)
- [IRMNG: 1106042](#)
- [MycoBank: 17639](#)
- [NBN: NBNSYS0000037048](#)
- [NCBI: 5314](#)
- [NZOR: 8559321a-830b-4a8e-8ba3-e193ceb949e1](#)
- [uBio: 8328637](#)

Categories:

- [Ganodermataceae](#)
- [Polyporales genera](#)
- [Taxa named by Petter Adolf Karsten](#)

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