AGRI MAGAZINE
(International E-Magazine for Agricultural Articles)
Volume: 03, Issue: 08 (August, 2026)
Available online at http://www.agrimagazine.in

The Mushroom That Does It All - Ganoderma

*Shreya Brohma and Shivani Sharma
Lovely Professional University, Jalandhar-Delhi Grand Trunk Rd, Phagwara, Punjab-144411, India
*Corresponding Author's email: riyashreya1706@gmail.com

Ganoderma lucidum, is recognized as an important medicinal mushroom rich in diverse bioactive compounds, among which triterpenoids have attracted considerable attention for their potential anticancer properties. *Ganoderma* triterpenoids, including ganoderic acids, lucidimols, ganoderiol F and ganodermanontriol, have demonstrated cytotoxic and antiproliferative effects against various cancer cells in experimental studies. These compounds may exert their antitumor effects through multiple mechanisms, including inhibition of tumor cell proliferation, induction of apoptosis, and interference with tumor development. The diverse pharmacological activities of *Ganoderma* triterpenoids highlight their potential as promising natural compounds for cancer research and therapeutic development. However, further mechanistic investigations and well-designed in vivo and clinical studies are required to establish their efficacy, safety, and therapeutic applicability.

Introduction

For over 2000 years, Reishi mushroom (*Ganoderma lucidum*) or "mushroom of immortality" has been used in the traditional medicine, citing its benefits in several ancient scripts. Originally called as "Lingzhi" in Chinese, "Tyeongji" in Korean, "Mannentake or Reishiin" in Japanese, and Jarh-Phorh, Satpatra, or Hirdo in India. The mushroom has been long known to represent a combination of spiritual potency and essence of immortality, and was regarded as the "herb of spiritual potency," symbolizing success, well-being, divine power, and longevity. It has a firm, corky texture and a flat, kidney-shaped cap that can be shiny red, yellow, or light/dark brown, with pore colours ranging from white to dull brown depending on its age. Earlier it was believed that a fungus so sacred could only grow in the home of the immortals and therefore could be afforded only by the nobles. But with the development of scientific studies and better availability of resources, this sacred fungus became available to the general public. The production technology is different than other mushrooms that are cultivated. It is highly adaptable and grows well in both temperate and subtropical climates. It is commonly found in the forested regions of Asia, Europe, North America, and South America. Owing to its remarkable medicinal properties and ability to thrive under diverse environmental conditions, *G. lucidum* has attracted considerable research interest, particularly in tropical Asian countries.

Classification

Kingdom: Fungi
Phylum: Basidiomycota
Class: Agaricomycetes
Order: Aphyllophorales
Family: Ganodermataceae
Genus: *Ganoderma*
Species: *lucidum*

Fig.1. *Ganoderma lucidum* fruiting bodies

G. lucidum fruiting bodies are kidney-shaped to irregular in form, with a thick margin and a long, hard, corky stipe that is dark brown in colour. The pileus is red to reddish-brown, with or without distinct bright yellow and white margins at maturity. The tube layer is up to 2 cm deep, comprising white pores approximately 0.1 cm in diameter that turn brown when bruised. The stipe measures 3-12 cm in length and 1-2 cm in thickness and is smooth, cylindrical, and covered by a dark red to black crust. The spore print is brown. This mushroom consists of approximately 90% water, with the remaining 10% representing nutrient-rich dry matter. The dry matter contains proteins (10-40%), fats (2-8%), carbohydrates (3-28%), dietary fibre (3-32%), and ash (8-10%) on a fresh weight basis. Furthermore, it also provides significant amounts of essential minerals such as Calcium, Phosphorus, Potassium, Copper, Iron, Zinc, Magnesium and Selenium, contributing to its high nutritional value.

Ganoderma lucidum- A Storehouse of Essential Bioactive Compounds

G. lucidum is a storehouse of several important bioactive compounds that have been known to possess several pharmaceutical and medicinal properties. From a nutritional perspective, fresh mushrooms are a valuable source of both soluble and insoluble dietary fibres. The soluble fiber fraction primarily consists of β-glucan polysaccharides and chitosans. It possesses a diverse nutritional profile that contributes to its considerable functional and therapeutic potential. The mushroom contains approximately 19.5 g of water-soluble proteins per 100 g of mushroom (w/w), with about 18 amino acids having been identified. Among these, leucine is reported to be one of the most abundant amino acids and has been associated with hypoglycemic and antioxidant activities. In addition to proteins and amino acids, *G. lucidum* provides dietary fiber, with approximately 3.5 g of fiber reported per 100 g of mushroom (dry weight basis). The fiber fraction, together with other nutritional constituents, may contribute to the overall health-promoting properties of the mushroom. The mineral composition of *G. lucidum* is also noteworthy, as it contains appreciable quantities of essential macrominerals, including phosphorus and sulfur, along with trace elements such as copper (Cu), magnesium (Mg), and iron (Fe). Furthermore, the mushroom is a source of several vitamins, particularly B-group vitamins such as thiamine (B1), riboflavin (B2), and niacin. Other vitamins and vitamin-related compounds, including vitamin B6, β-carotene, and vitamins C, D, and E, have also been reported in *G. lucidum*. Collectively, these nutritional constituents contribute to the high nutrient potential of *G. lucidum* and may complement its pharmacological and health-promoting effects.

Beyond its nutritional value, *G. lucidum* is particularly recognized for its rich repertoire of biologically active secondary metabolites. More than 400 bioactive compounds have been reported from this mushroom, encompassing polysaccharides, triterpenoids, steroids, fatty acids, amino acids, nucleosides, proteins, alkaloids, and other phytochemically relevant constituents. The synergistic or individual activities of these compounds are believed to underlie many of the biological and therapeutic properties attributed to *G. lucidum*. Consequently, the mushroom has attracted increasing attention as a promising natural resource for the development of pharmaceutical, nutraceutical, and cosmeceutical products. Understanding the relationship between its diverse bioactive constituents and their associated biological activities is therefore essential for elucidating the therapeutic potential of *G. lucidum*.

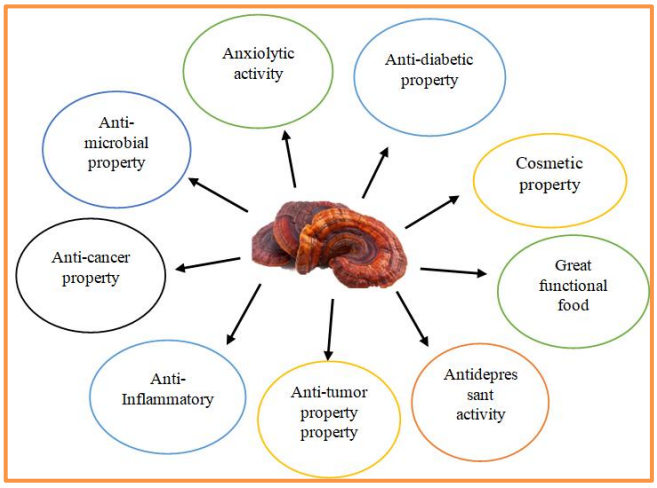

Fig. 2. *Ganoderma lucidum* and its various benefits in cosmetic and medicinal field

Polysaccharides, including Ganoderans, are structurally diverse biological macromolecules that exhibit a wide spectrum of biological activities. These bioactive constituents, particularly sugars, glycoproteins, and polysaccharides derived from its fruiting bodies, exhibit a broad spectrum of biological activities, including antioxidant, antitumor, and antibacterial effects. Polysaccharides isolated from *G. lucidum* have also been reported to possess diverse pharmacological properties, such as anti-inflammatory, hypoglycemic, antitumor, and immunostimulatory activities. Furthermore, the antioxidant potential of these polysaccharides is associated with their ability to scavenge free radicals, enhance reducing power, and chelate ferrous ions, thereby contributing to their overall antioxidant capacity. Terpenoids, particularly triterpenoids found in *Ganoderma* and other medicinal mushrooms, have attracted considerable attention for their potential anticancer and antitumor activities. These compounds may interfere with tumor development and inhibit the proliferation of malignant cells. Among the major triterpenoids identified in *Ganoderma*, ganoderic acids, lucidimols, ganoderiol F, and ganodermanontriol have demonstrated cytotoxic and antiproliferative effects against cancer cells in experimental studies. Such findings highlight the potential of *Ganoderma* triterpenoids as promising bioactive compounds for cancer-related research.

Table 1. Major bioactive compounds in *G. lucidum* and their important activity

S.No.	Bioactive compound	Identified chemical constituents	Activity/ Importance in human health
1.	Triterpenoids	Ganoderic Acids (A, B, C, E, H, J, R, T, Y)	Anti-cancer, Cytotoxic, Anti-inflammatory, Immunomodulation, Cardiovascular and cerebrovascular protectant
2.	Polysaccharides	β- Glucans	Tumor inhibition, Liver protection, Immunomodulatory, Anti-oxidant, Anti-angiogenic
3.	Proteins	LZ-8	Anti-oxidant, Immune regulation
4.	Alkaloids	Cholines, betaines	Neuroprotectant, Anti-inflammatory, Anti-aging
5.	Lectins	Ganoderma lucidum lectin (GLL)	Anti-oxidant, Anti-cancer
6.	Nucleosides, Nucleotides, RNAs, Fatty acids	Linoleic Acid	Immunomodulatory, Cardioprotectant, Anti-oxidant
7.	Phenolic compounds	Flavonoids	Anti-oxidant, Anti-cancer
8.	Sterols	Ergosterol	Anti-tumor promoter, bone/ immune health
9.	Minerals	Germanium	Immuno-stimulation, Anti-oxidant defense
10.	Vitamins	Niacin, Ergocalciferol	Metabolic support, Immune/calcium homeostasis

Different Cultivation Techniques of *Ganoderma lucidum*

The artificial cultivation of *Ganoderma* has advanced considerably with the development of improved cultivation techniques and optimized growing conditions. Accurate identification and classification of *Ganoderma* species, along with the selection of appropriate cultivation substrates and sources, are essential for large-scale industrial and commercial production. The yield and quality of cultivated *Ganoderma* are influenced by various environmental conditions and the geographical location of cultivation. Continuous advancements in cultivation practices and production technologies have further enhanced the efficiency, consistency, and economic viability of *Ganoderma* cultivation, thereby increasing its potential for commercial exploitation. It's usually grown on hardwood trees, either on logs or in saw dust.

Substrate-Based Cultivation of *Ganoderma*

Substrate-based cultivation is one of the most widely adopted approaches for the production of *Ganoderma*, as it provides suitable conditions for mycelial colonization and subsequent development of fruiting bodies. A diverse range of substrates can be utilized for *Ganoderma* cultivation, including hardwood logs, sawdust, grasses such as silver grass, and various agricultural and agro-industrial residues. Among these, wood logs are extensively used because they closely mimic the fungus's natural growing environment while providing an adequate source of nutrients. Hardwood species such as oak, poplar, and eucalyptus are commonly employed as cultivation logs. Prior to inoculation, the logs are generally sterilized or pasteurized to reduce competing microorganisms and establish favorable conditions for fungal colonization and growth. Sawdust-based substrates have also gained considerable importance due to their relatively uniform particle size, ease of handling, and availability of nutrients. To improve their nutritional composition and support vigorous mycelial development, sawdust is often supplemented with nutrient-rich materials such as wheat bran or rice bran. The choice and formulation of the substrate play a critical role in determining mycelial growth, colonization rate, fruiting-body development, yield, and ultimately the quality of cultivated *Ganoderma*.

Fig.3. Substrate based cultivation of *G. lucidum*

Liquid Culture Fermentation of *Ganoderma*

Liquid culture fermentation is another important cultivation technique in which *Ganoderma* mycelium is grown in a nutrient-rich liquid medium. This method promotes rapid mycelial growth while allowing greater control over important cultivation parameters. Agitation of the culture is commonly employed to improve oxygen transfer, enhance nutrient distribution, and facilitate uniform mycelial development. Compared with conventional solid-substrate cultivation, liquid fermentation offers several advantages, including controlled growth conditions, relatively high biomass production, reproducibility, and ease of scale-up. Continuous optimization of fermentation parameters has further improved the production of *Ganoderma* biomass and its valuable bioactive compounds, increasing the potential of liquid culture systems for industrial applications. The selection of an appropriate liquid culture medium is a critical factor in achieving efficient *Ganoderma* fermentation. Various culture medium formulations have been developed to optimize mycelial growth, biomass production, and the synthesis of bioactive metabolites. Optimizing key fermentation parameters, including temperature, pH, aeration, and agitation, is essential for maximizing mycelial growth and enhancing the production of bioactive metabolites in *Ganoderma* liquid cultures.

Fig.4. Liquid culture fermentation of Ganoderma

Conclusion

Ganoderma lucidum is a nutritionally valuable and pharmacologically important mushroom, widely recognized as a powerhouse of diverse bioactive compounds, including polysaccharides, triterpenoids, proteins, phenolics, and other metabolites. These constituents contribute to its reported antioxidant, antimicrobial, anti-inflammatory, immunomodulatory, antitumor, and other health-promoting properties. Advances in cultivation strategies, including substrate-based cultivation and liquid fermentation, have enhanced its production efficiency and commercial potential. With appropriate cultivation technologies and value-added processing, *G. lucidum* offers promising opportunities for farmers to diversify their production, utilize agricultural residues, and generate additional income. Thus, the integration of *G. lucidum* cultivation into sustainable agricultural systems could contribute to both farm profitability and the growing nutraceutical and pharmaceutical industries.