INTERNATIONAL SOCIETY FOR MEDICINAL MUSHROOMS

国际药用菌学会

International Society for Medicinal Mushrooms （ISMM）was founded in Vancouver, Canada. As a global non-profit organization, ISMM promotes the development of research, education, production, transportation, marketing and cultivation of medicinal mushrooms to have people to work towards common aspirations and goals. The integration will increase the impact of the international medicinal mushroom industry and benefit the health of people in the world.

Honorable President: Prof. S.T.Chang, Prof.S.P. Wasser
President: Academician Li Yu
Executive President: Mr. Chen Hui
Secretary General: Mr. Liu Ziqiang

国际药用菌学会（International Society for Medicinal Mushrooms），简称ISMM，在加拿大温哥华注册成立，由从事药用菌产业的科研、教学、生产、流通、市场、文化及相关产业链的单位、团体和个人自愿组成的为实现共同意愿的非营利性国际组织。本学会致力于促进国际药用菌产业各个领域的融合与发展，以提升药用菌行业在全球的影响力，造福人类健康。

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News Reports

2025 Asian Mycological Congress Concludes Successfully

The 2025 Asian Mycological Congress held successfully in Guangzhou, China, from November 23rd to 26th. It co-hosted by the Asian Mycological Congress (AMC), the Mycological Society of China (MSC) and Zhongkai University of Agriculture and Engineering, with the theme "Innovative Mycology: Pioneering Sustainable Green Development". The congress brought together experts, scholars, researchers and industry representatives from China, the United States, Germany, Japan, Canada and other countries and regions around the world. It aims to build a high-end platform for academic exchange, achievement sharing and international cooperation, injecting new vitality into global mycology research and green development.

The closing ceremony was presided over by Bai Fengyan, Vice President and Secretary-General of the Mycological Society of China, and Professor at the Institute of Microbiology, Chinese Academy of Sciences. Cai Lei, Vice President of the Asian Mycological Congress and Professor at the Institute of Microbiology, Chinese Academy of Sciences, and Cheng Ping, Member of the Standing Committee of the National Committee of the Chinese People's Political Consultative Conference (CPPCC), President of the Guangdong Provincial Committee of the Revolutionary Committee of the Chinese Kuomintang (RCCK), and Director of the Key Laboratory of Green Prevention and Control of Southern Horticultural Crops, Ministry of Agriculture and Rural Affairs, delivered speeches successively.

Cai Lei, Vice President of the Asian Mycological Congress (AMC) and Professor at the Institute of Microbiology, Chinese Academy of Sciences, pointed out that the successful holding of this congress in China—home to the world's richest fungal biodiversity and a profound mycology tradition—has demonstrated to the globe why Asia has emerged as a hotspot for mycology research and application.

He emphasized that the grand event brought together experts and scholars from over 30 countries, not only showcasing remarkable innovation capacity and in-depth scientific research that drive disciplinary development but also promoting ideological exchanges among researchers, educators, and industry experts, laying a solid foundation for future cooperation. He firmly believed that the insights gained at the congress would inspire future research, and the connections established would lead to significant new research progress in the years to come. He revealed that the new AMC Council would soon launch the call for the host venue of the next congress and looked forward to reuniting with colleagues in the academic community.

Cheng Ping, Member of the Standing Committee of the National Committee of the Chinese People's Political Consultative Conference (CPPCC) and Director of the Key Laboratory of Green Prevention and Control of Southern Horticultural Crops, Ministry of Agriculture and Rural Affairs, pointed out that as a top-tier academic event in the field of mycology, this congress, successfully held in Guangzhou for the first time, marks a milestone. She emphasized that the conference assembled more than 400 experts and scholars from 32 countries and regions worldwide.

Through 4 plenary lectures, 23 thematic symposia, 81 posters, and 170 oral presentations, it comprehensively showcased the latest research achievements in areas such as fungal biodiversity, systematics, edible fungi, and medicinal fungi, fully demonstrating the vigorous vitality and innovation capacity of Asian mycology research. The congress received a total of 350 submission abstracts, and the academic presentations selected through rigorous screening not only reflected high academic standards but also provided a valuable exchange platform for global mycologists. She expressed the hope that everyone would revisit Guangzhou, the "Flower City," and Zhongkai University of Agriculture and Engineering for guidance and exchanges, carrying the academic gains and wonderful

memories from this congress. She believed that with the joint efforts of all parties, mycology research would embrace a more brilliant development prospect.

During the congress, the "Excellent Student Presentation Award" was established. Seven students from Zhongkai University of Agriculture and Engineering, Mae Fah Luang University (Thailand), Kunming Institute of Botany, Chinese Academy of Sciences, University of Santo Tomas (Philippines), National Autonomous University of Mexico, Thammasat University (Thailand), and Guizhou University were honored with this award. Guo Liangdong, President of the Mycological Society of China, presented the awards to the winners. The award aims to recognize outstanding young students for their academic research and presentation performance, highlighting the congress's emphasis on nurturing reserve talents in mycology.

In addition, the congress also set up the "Excellent Poster Award." After rigorous evaluation by the review committee based on three aspects—academic originality, research value, and poster presentation effect—10 winners were finally selected. Guo Liangdong presented the awards to the recipients.

The "Excellent Organizer Award" was also conferred at the congress. Xu Biao, Vice Dean and Professor of the College of Agriculture and Biology, Zhongkai University of Agriculture and Engineering, and Ishara S. Manawasinghe, Associate

Professor at the Beijing Academy of Agriculture and Forestry Sciences, were honored with this award for their pivotal roles in the conference preparation. Nguyen Duc Hoang Pham, Secretary-General of the Asian Mycological Congress, presented the awards to the winners.

Upon the successful conclusion of the congress, special tribute was paid to the groups that made silent contributions behind the scenes. A volunteer recognition session was specially arranged, where Zhou Xinhua, Director of the Development Planning Department of Zhongkai University of Agriculture and Engineering, Yu Guohui, Dean of the College of Agriculture and Biology, Zhongkai University of Agriculture and Engineering, and Deng Wangqiu, Researcher at the Institute of Microbiology, Guangdong Academy of Sciences, jointly presented honorary certificates to volunteer representatives, expressing sincere gratitude to this dynamic and dedicated team.

The successful holding of this congress is not only a victory for academic exchange but also a result of the joint efforts of all parties. From the careful preparation by the hosts and organizers, to the active participation of experts and scholars, and the selfless dedication of volunteers, every link is closely connected and indispensable. It has not only promoted research and cooperation in the field of Asian mycology but also injected new vitality into the global development of mycology. In the future, it is believed that with the continuous efforts of all parties, mycology research will make constant new breakthroughs, contributing more to human health, agricultural development, and ecological environment protection.

Source: emushroom

New Era, New Future – The 2025 International Black Bolete Technological Innovation Conference Successfully Held

On December 16, 2025, the "New Era, New Future – 2025 International Black Bolete Technological Innovation Conference" grandly held in Xishuangbanna, Yunnan, under the theme of "Breaking New Ground, Forging a New Path". The conference is dedicated to building a high-standard, landmark international exchange platform for China's edible mushroom industry. It attracted over 300 participants, including leaders from relevant ministries and commissions, academicians from the Chinese Academy of Sciences and Chinese Academy of Engineering, representatives from top domestic and international universities and research institutions, leading enterprises, and industry guests from nearly ten major consumer countries and regions worldwide. The attendees engaged in in-depth discussions and experience sharing on key topics across the entire industrial chain, such as variety breeding, smart factories, deep processing, culinary applications, and market expansion, jointly charting a new chapter for industrial innovation and global collaborative development.

The journey of domesticating Black Bolete is one of exploration, moving from technological breakthroughs to industry leadership. It powerfully demonstrates that only by developing new quality productive forces through technological innovation can we break the constraints of low-level competition; only by building a symbiotic and mutually prosperous industrial ecosystem can we achieve sustainable, high-quality development. As an important co-organizer and technical practitioner of this conference, Hongzhen Biotechnology Group has forged a highly representative development path—breaking ground with "Seed Industry Revitalization" by being the first to complete the artificial domestication of wild Black Bolete, firmly grasping the industry's "Chinese Core"; using "Planting Factories" as the carrier to achieve standardized, intelligent, and year-round production, where technological transformation redefines modern agricultural productivity; being guided by the "Concept of a Greater Food Approach" to expand new frontiers of food sources, contributing to diversified food supply and security; and ultimately, with "New Quality Agricultural Productive Forces" as the core driving force, continuously advancing technological iteration and industrial upgrading. The Hongzhen Model is a vivid practice and resolute response to the nation's series of strategic directives, including "Modernization of

Agricultural Science and Technology", "Seed Industry Revitalization", "Concept of a Greater Food Approach", and "Developing New Quality Agricultural Productive Forces".

Opening Ceremony speeches were delivered by Mr. Xu Xiaohu, Vice President of the China Chamber of Commerce of I/E of Foodstuffs, Native Produce and Animal By-products (CFNA); Mr. Zhao Gang, Deputy Secretary of the Xishuangbanna Prefectural Party Committee and Secretary of the Jinghong Municipal Party Committee; Professor Zhu Youyong, Academician of the Chinese Academy of Engineering, Honorary President of Yunnan Agricultural University, and Chairman of the Yunnan Association for Science and Technology; Professor Li Yu, Academician of the Chinese Academy of Engineering, National Model in Poverty Alleviation, Chairman of the International Society for Medicinal Mushrooms, and Director of the Academic Committee of Jilin Agricultural University; and Mr. Qian Keming, Standing Committee Member of the 14th National Committee of the Chinese People's Political Consultative Conference, Vice Chairman of its Education, Science, Culture, Health and Sports Committee, and former Vice Minister of Commerce.

In his speech, Professor Li Yu highly affirmed the development potential of the Black Bolete industry. He stated that the edible mushroom industry is a typical example of "small mushrooms, big industry, benefiting people's livelihood." As a distinctive variety within it, Black Bolete holds significant importance in assisting rural revitalization, ensuring food safety, and promoting the Healthy China initiative.

The "Black Bolete Global Dining Table Initiative" was officially launched at the conference venue, with the simultaneous awarding of "Black Bolete Global Promotion Ambassador" certificates. Distinguished representatives from various fields were specially invited to assume these roles. The Promotion Ambassadors will shoulder the mission of disseminating the health value of Black Bolete and Chinese mycological culture, linking global resources, assisting in the output of industrial standards and overseas market expansion, and practicing the concept of openness and mutual benefit, allowing Chinese Black Bolete to grace dining tables worldwide.

The 2025 International Black Bolete Technological Innovation Conference released an industrial development initiative on-site, calling on industry peers to join hands and forge ahead together. The initiative aims to unite industry efforts, break through development bottlenecks, enhance core industrial competitiveness, and jointly propel the Black Bolete industry towards internationalization, high-end development, and standardization.

The conference also featured a plaque awarding ceremony. Mr. Chen Hui, Executive Chairman of the International Society for Medicinal Mushrooms, Part-time Vice President of CFNA, Chairman of the Edible Fungi and Products Branch of CFNA, Chairman of Jiangsu Alphay Biological Technology Co., Ltd., served as the awarding guest, formally bestowing the honorary title of "Global Black Bolete Industrial Innovation Leadership Hub" upon Hongzhen Biotechnology (including its 'Niu Fu Ren' Black Bolete brand).

The opening ceremony also unveiled three major lists: the "2025 'Niu Fu Ren' Brand Value Evaluation," the "2025 Popular Chinese Black Bolete Dishes List," and the "2025 Popular Western Black Bolete Dishes List." The release of these three lists provides guidance for the brand building path and product innovation directions of the Black Bolete industry.

During the "Collaborative Innovation, Mutual Benefit" Key Cooperation Project Signing Ceremony at the 2025 International Black Bolete Technological Innovation Conference, Mr. Shi Wei, Chairman of Hongzhen Biotechnology Group, and Mr. Wang Tao, General Manager of GuoNong Robot Industry Innovation Research Institute (Jiangsu) Co., Ltd., signed a strategic cooperation agreement on behalf of their respective companies.

Mr. Xu Guiyuan, Deputy General Manager of Guangzhou Hengyun Holdings Group Co., Ltd. and Chairman of Guangzhou Suikai Power Energy Corporation, and Mr. Zhang Wen, General Manager of Hongzhen Biotechnology Group, signed a comprehensive energy cooperation framework agreement on behalf of their respective companies.

Keynote Speeches: Authoritative Insights, Outlining the Blueprint for Industrial Innovation and Development

Following the above segments, several top industry experts, scholars, and leading figures delivered keynote speeches, offering suggestions for the development of the Black Bolete industry from multiple dimensions including technological innovation, market trends, and industrial integration.

Professor Li Tianlai, Academician of the Chinese Academy of Engineering and former Vice President of Shenyang Agricultural University, joined via video link. Focusing on the theme "Innovation and Application of High-Efficiency Cultivation Technologies for Facility-Grown Edible Mushrooms," he deeply analyzed the application prospects of facility agriculture technology in Black Bolete cultivation. Through specific cases, he demonstrated how technologies like intelligent climate control and integrated water-fertilizer systems can improve cultivation efficiency and product quality, providing important technical references for the large-scale, standardized cultivation of Black Bolete.

Professor Ren Fazheng, Academician of the Chinese Academy of Engineering from the College of Food Science and Nutritional Engineering at China Agricultural University, shared insights on "Nutritional Health Value and Deep Processing Technological Innovation of Black Bolete." He pointed out that Black Bolete is rich in nutrients such as protein

and polysaccharides, holding vast potential for deep processing. In the future, it can be developed into diversified products like ready-to-eat foods, health supplements, and condiments, extending the industrial chain and increasing added value.

Mr. Cui Yehan, Vice President of the China Seed Association, delivered a presentation, offering an in-depth interpretation of the establishment and implementation of the Essentially Derived Variety (EDV) system, laying an institutional foundation for original innovation in the edible mushroom seed industry.

Researcher Huang Chenyang, Chief Scientist of the National Edible Fungi Industrial Technology System from the Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, outlined the directions for technological breakthroughs in the Black Bolete industry, covering areas such as variety improvement, green pest and disease control, and post-harvest processing. He emphasized the core supporting role of technological innovation for high-quality industrial development.

Mr. Shi Wei, Chairman of Hongzhen Biotechnology Group, shared the company's practical experience and future plans in deeply cultivating the Black Bolete industry.

Thematic Seminars: Whole-Chain Focus, Addressing Industry Pain Points and Difficulties

The conference will also feature eight thematic seminars, precisely covering industrial technological innovation, new chapters for high-quality development, international tasting of Black Bolete, industrial value and market expansion, shaping a core market position, culinary applications and health value, deep processing development of Black Bolete, and new technologies for factory cultivation. Representatives from government, industry, academia, and research will be invited for "brainstorming" sessions to address industry development challenges.

Special Activities: On-site Experience + Achievement Showcase, Deepening Industry Understanding

Concurrently, a Black Bolete Industry Achievement Exhibition and a Smart Factory Site Visit were organized, allowing participants to fully experience the industry's development achievements. At the Industry Achievement Exhibition,

Hongzhen Biotechnology showcased its core achievements, including superior Black Bolete varieties, intelligent equipment, and deep-processed products, attracting numerous guests for exchanges and collaboration discussions.

During the conference, the organizing committee arranged for participants to visit the Hongzhen Biotechnology Black Bolete Smart Factory for a field inspection. Guests successively visited the variety breeding laboratory, intelligent cultivation workshops, and deep processing production lines, gaining a detailed understanding of the standardized production process "from strain to product." They highly praised the company's technological innovation capabilities and industrial scale.

Communication and Collaboration: Breaking Spatiotemporal Boundaries, Gathering Industry Synergy

To promote international exchange and information sharing, the conference was equipped with full-time Chinese-English simultaneous interpretation. It was also live-streamed simultaneously through mainstream domestic and international platforms such as WeChat Channels, Facebook, and TikTok, cumulatively attracting over 50,000 online and offline viewers. This effectively broke geographical restrictions, allowing global edible mushroom professionals to share the conference's cutting-edge insights and innovative achievements.

The conference was jointly organized by the CFNA, the International Joint Research Center for Creation of New Germplasm Resources of Edible Mushrooms, the Mycological Society of China, and the National Engineering Research Center of Edible Fungi. It was co-organized by the Edible Fungi and Products Branch of CFNA, Hongzhen Biotechnology Group, Xishuangbanna Niu Fu Ren Trading Co., Ltd., and Guizhou Niu Fu Ren Trading Co., Ltd. The in-depth collaboration of multiple institutions provided a solid guarantee for the successful hosting of the conference and also reflected the shared determination of all sectors of the industry to jointly promote technological innovation and global development for Black Bolete.

From Mushrooms to New Architecture: The Rise of Living, Self-Healing Buildings

By Anthony King

EU-funded researchers are cultivating fungi on agricultural waste to create smarter and greener construction materials able to adapt and react to their environment, and even repair themselves.

Researchers are using the splitgill mushroom's network of thin fungal strands to create new 'living' materials for construction. © iwciagr, Shutterstock.com

In his office in the Netherlands, Professor Han Wösten holds up a hard sponge-like block for show. It is a material he made in 2012 using the intricate rooting network of fungi. He has bold predictions about the potential of this stuff. "Ten years from now, we should have the first fungal buildings," said Wösten, a professor of molecular biology at Utrecht University. He is not talking about mouldy walls, but something far more exciting – materials that are alive, sustainable, and full of potential.

Wösten studies how different fungi operate within a mycelium – nature's internet, a living network of threads that nourishes fungi and connects plants by sharing resources and information. He is now engineering fungal "threads" into sustainable, biodegradable alternatives to plastic, wood and leather – materials already sparking new uses in fashion, furniture and construction.

Future-proof "living" buildings

Wösten is part of a team of researchers from Belgium, Denmark, Greece, the Netherlands, Norway and the UK who are exploring a radical idea: what if the materials we build with could grow, repair themselves, and even sense their environment?

This EU-funded research initiative, called Fungateria, is developing engineered living materials (ELMs) by fusing fungal mycelia with bacteria – creating adaptable, self-healing materials that do what conventional products cannot. Unlike traditional materials like concrete or plastic, ELMs can grow, repair themselves, sense changes in their environment, and sometimes even adapt over time.

The researchers aim to design these materials so that they combine the strength of natural growth with the functionality of engineering. For example, walls that fix their own cracks, building blocks that absorb CO_2, or surfaces that can clean the air. The goal is to create sustainable, low-waste materials that work with nature instead of against it, opening the door to smarter, greener architecture and products.

“Already we can make leather-like materials or insulation panels from these extended fungal networks,” said Wösten. “Now we want to go to the next stage and grow buildings, but in a controlled way.”

Low waste, high efficiency

There are considerable savings to be made. The construction sector generates more than one third of the EU’s total waste. Greenhouse gas emissions from material extraction and manufacturing construction products, as well as construction and renovation of buildings, contribute an estimated 5% to 12% of the total national emissions of EU Member States. Greater material efficiency could save 80% of those emissions. Crucially, while manufacturing concrete emits very large quantities of CO_2 into the atmosphere, contributing to climate change, fungal-composite buildings could upcycle agricultural waste into building material while reducing carbon emissions. The idea of living organisms in buildings may unsettle some people. But for Professor Phil Ayres, a pioneer in the field of biohybrid architecture at the Royal Danish Academy of Architecture, Design and Conservation in Copenhagen, this is a social adaptation that will happen over time.

“We’ve eaten foods with living organisms for hundreds of years. We have only been looking at the potential applications of these organisms in the building sector for the last 20 years.” Ayres, who coordinates the work of the Fungateria research team, wants to overturn the dogma of his fellow architects that materials are controllable and have fixed properties. “All constructions change over time in quite dramatic ways. If we began to think about buildings more like organisms in a continuous state, we might create architecture that is more ecologically connected,” he said. Bridging fields from microbiology to architecture and ethics, the researchers are also engaging the public through exhibitions like the Venice Biennale and workshops that challenge traditional ideas of what buildings can be.

Growth control

A mushroom in the forest is just the tip – hidden below it is a massive mycelium network, sometimes weighing tonnes.

“If we began to think about buildings more like organisms in a continuous state, we might create architecture that is more ecologically connected.” Phil Ayres, Fungateria said.

For construction, the fungal hyphae – the thread-like filaments – can be encouraged to feed on agricultural waste to form a strong, lightweight and insulating composite. But controlling this growth is key to making safe, durable structures.

The fungal species being used by the researchers is the splitgill mushroom, or *Schizophyllum commune.* It primarily grows on dead wood, which poses a potential risk. The growth of the mycelium needs to be stopped when the structure is completed so that it does not begin eating through wood supports. One method uses nature’s own signals: light and temperature can cue the fungus to grow or stop. Another involves bacteria genetically engineered at the University of Ghent in Belgium. These bacteria feed the fungus essential nutrients. Therefore, killing the bacteria halts fungal growth. The same bacteria can even be programmed to release antifungal compounds on command, providing an extra safety layer.

Future proof

Already, the Fungateria researchers, who will continue their collaboration until late-2026, have shown that the fungus can grow and survive under stressful conditions such as drought and high temperatures. That means it is resilient to the possible impact of changing climatic conditions. The research team is already envisioning a time when buildings are made from wood and fungus matter grown on agricultural waste in a living process of construction.

“In the future, I can imagine that we will grow complete buildings where the wood will be the supporting structure and the fungus grows along and between the wood frames,” said Wösten.

As global demand for sustainable solutions intensifies, this research points to a future where architecture is not just inspired by nature, but made of it – alive, adaptive and intertwined with the ecosystems around it.

Research in this article was funded by the European Innovation Council (EIC). The views of the interviewees don’t necessarily reflect those of the European Commission. If you liked this article, please consider sharing it on social media.

Source: Horizon, the EU Research E-Innovation Magazine

Up-coming Events

Dutch Mushroom Days

Block the calendar

The Board of the Mushroomdays Foundation is pleased to inform you that the date of the next edition of the Mushroom Days has been set for **April 22-24, 2026**. The event will again take place in the **Brabanthallen** in **'s-Hertogenbosch**. This meets the preference of the exhibitors for a frequency of "*every 3 years*". Also, for the same reason, the Mushroomdays Foundation has placed an option with the Brabanthallen for an edition on June 13-15, 2029.

After a very successful edition in 2023, there is no reason for the Mushroom Days Committee to opt for a substantially different format for the event, but (as always) to look for further optimization on a detailed level.

The Mushroom Days Committee plans to send out the first mailing for participation and registration in the 2nd quarter of 2025. We are very much looking forward to welcoming you all again in order to shape together this great global trade fair. We will keep you informed via our website www.mushroomdays.com.

Kind regards,
Piet Lempens
Chairman Mushroomdays Foundation.

Source: https://champignondagen.nl/home-eng/

27th North American Mushroom Conference

The 27th edition of the North American Mushroom Conference will take place in Montreal, Canada, from June 4 to 6, 2026.

Start your engines! The 27th North American Mushroom Conference is racing to Montréal. This year's program is set to deliver two days of high-powered insights and connections. Join us as we explore the leading edge of mushroom cultivation, connecting with industry peers, and driving the future of our industry.

LOCATION

Immerse yourself in the vibrant culture of Montréal, a city renowned for its culinary scene and rich history. Our host venue, Le Centre Sheraton, is centrally located, offering easy access to all the conference activities and the city's attractions.

Le Centre Sheraton, 1201 René-Lévesque Blvd W, Montréal, Quebec H3B 2L7

WHY ATTEND?

Expert Insights: Learn from the best in the business. Our lineup of speakers includes industry leaders and experts sharing their knowledge on the latest trends and innovations.

Networking Powerhouse: Connect with colleagues, customers, and potential partners from across North America and beyond. This is your chance to build valuable relationships that will propel your business forward.

Innovation Showcase: Discover the latest technologies and advancements in mushroom cultivation in our EXPO hall.

THE 2026 EXPO WILL INCLUDE:

- 10' x 8' booth includes electrical service, pipe and drape, table, chairs, sign, and trash can
- Each EXPO space includes one (1) full Business Program Member Registration, valued at $1,100 USD
- EXPO Opening in conjunction with the Welcome Reception
- Breakfast and lunch buffets are served in the same ballroom as the EXPO
- Dedicated EXPO hours separate from the Business Program
- Light refreshments in the EXPO hall during EXPO hours

REGISTRATION

Registration Includes:

- **Access to all business sessions and keynote presentations**
- **Admission to the trade show expo hall**

- **Networking opportunities with industry professionals**
- **All scheduled meals**
- **Welcome reception and closing party**

Registration fee:

- Member ($1,100.00)
- Non-Member ($1,600.00)
- Companion Member ($700.00)
- Companion Non-Member ($800.00)

Website: https://www.mushroomconference.org/

Save the Date - 13th International Medicinal Mushroom Conference (IMMC13)

Dear colleagues,

We are delighted to announce that the **13th International Medicinal Mushroom Conference (IMMC13)** will be held in **Bragança, Portugal**, from **22 to 25 September 2026!**

Hosted by **IPB–CIMO**, this edition will explore the transformative role of **medicinal mushrooms** in building a more **sustainable, healthy, and resilient future**.

Following the success of IMMC12, IMMC13 will once again bring together scientists, researchers, industry professionals, policymakers, and traditional knowledge holders from around the world to share the latest advances in this vibrant field.

IMMC13 will offer an inspiring scientific programme, opportunities for collaboration, and the chance to experience the unique culture and hospitality of Bragança — a beautiful city in the northeast of Portugal, surrounded by the **Montesinho Natural Park**.

🗓️ **Save the date:** 22–25 September 2026

📍 **Location:** Bragança, Portugal

Further details, including the **first circular** and **conference website**, will be shared soon.

We look forward to welcoming you to Bragança for an exciting and memorable IMMC13!

With best regards,

The Organizing Committee

13th International Medicinal Mushroom Conference – IMMC13

Bragança, Portugal | 22–25 September 2026

Second Announcement of the 11th ICMBMP Oct. 13-17, 2026, Accra, Ghana

Second Announcement

The 11th International Conference on Mushroom Biology and Mushroom Products

Oct. 13-17, 2026

Accra, Ghana.

We are pleased to invite you to join us in Accra, Ghana, from October 13–17, 2026, for the 11th International Conference on Mushroom Biology and Mushroom Products (11th ICMBMP 2026). This milestone conference hosted for the first time on African soil will take place in Accra, Ghana under the theme ***"Fungal Frontiers: Mushrooms for Food Security, Health, and Sustainability."***

The 11th ICMBMP offers a unique opportunity for global experts to share the latest research and innovations in fungal biology, mushroom cultivation, functional food development, and sustainability. The conference will feature keynote lectures, scientific sessions, technical presentations, posters, exhibitions, and field visits, complemented by rich cultural programming.

The 11th ICMBMP meetings will foster vibrant scientific exchange and multi-sectoral collaboration among researchers, entrepreneurs, educators, policymakers, and development partners. This edition will showcase Africa's growing contributions to mushroom science and catalyze cross-continental partnerships for transformation.

Organizers of the 11th ICMBMP 2026

World Society for Mushroom Biology and Mushroom Products (WSMBMP)

CSIR-Food Research Institute (CSIR-FRI), Ghana

Accra Technical University (ATU), Ghana

Ho Technical University (HTU), Ghana

Co-organizers

Ministry of Environment Science and Technology (MEST), Ghana

Ministry of Food and Agriculture (MoFA), Ghana

University of Ghana, Institute for Environment and Sanitation Studies (IESS), Ghana

Institute of Edible Fungi, Shanghai Academy of Agricultural Sciences (SAAS), China

National Engineering Research Center of Edible Fungi, China

Mushroom Branch of the Chinese Agricultural Society (MBCAS), China

International Society for Mushroom Science (ISMS)

Organizing Committees of the 11th ICMBMP

WSMBMP Executive Committee

Qi Tan (China)

András Geösel (Hungary)

Manjit Singh (India)

Jingsong Zhang (China)

Johan Baars (Netherlands)

Yoichi Honda (Japan)

Mary Obodai (Ghana)

Hui Chen (China)

Local Organizing Committees:

Scientific Committee

Finance and Sponsorship Committee

Technical and Logistics Committee

Publicity and Marketing Committee

Social Committee

Secretariat

Language

Working languages for the conference are English, French and Chinese. Simultaneous translation will be provided for conference oral presentations.

Scientific Program

The 11th ICMBMP will incorporate the latest advances in mushroom biology and mushroom products through keynote lectures, oral presentations, poster displays, and technical workshops.

Panel topics will include:

1) Biodiversity, Systematics, and Taxonomy;

2) Omics and Bioinformatics;

3) Genetics, Breeding and Engineering;

4) Physiology, Developmental Biology and Mushroom Cultivation;

5) Myco-Molecules: Nutritional and Therapeutic Potential;

6) Processing Technologies;

7) Pest and Disease Management;

8) Product Quality, Safety, and Regulation;

9) Mushroom Economics, Culture, and Policy

Registration

All registered participants will have access to the full scientific program, the mushroom innovation expo, field excursions, conference materials, and networking events. Registration includes the conference kit, program booklet (E copy), book of abstracts, and access to proceedings.

Online registration will be available at https://icmbmp11.foodresearchgh.org.

Registration rates are as follows:

Regular Participant: 500 USD before (including) July 31, 2026; 600 USD after July 31, 2026

Student*: 300 USD before (including) July 31, 2026; 400 USD after July 31, 2026

Accompanying Guest#: 400 USD

* Proof of student status is required upon registration

Accompanying Guest registration includes access to cultural events and the exhibition hall.

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Call for Abstracts and Papers

Participants are invited to submit abstracts for oral or poster presentations. Full papers may also be submitted for consideration in the conference proceedings.

Abstracts should include the title, authors, affiliations, and a 300–350 words summary of the research. Full manuscripts should follow standard scientific format.

Submission Timeline:

- 1st Call for Abstracts & Papers: November 1, 2025
- 2nd Call for Abstracts & Papers: February 1, 2026

- Abstract Submission Deadline: April 30, 2026
- Notification of Acceptance (Oral/Poster): May 31, 2026
- Full Paper Submission Deadline (for Proceedings): June 30, 2026
- Late-Breaking Abstracts (selected sessions only): August 15, 2026

Submissions should be made online via the Abstract Submission Portal.

For formatting guidelines, please refer to **"Directions for Abstract and Research Article"** at [https://icmbmp11.foodresearchgh.org].

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Special conference rates will be available through the official registration portal at [https://icmbmp11.foodresearchgh.org]. Early booking is strongly encouraged due to limited availability.

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World Society for Mushroom Biology and Mushroom Products (WSMBMP)

Conference Announcement Date: October 2025

Research progress

Food safety implications of microbial communities in enoki mushrooms: Impact of farm environments and distribution channels

Ga-Hee Ban [a], Bo-Kyeong Kim [a], Min Suk Rhee [b], Se-Ri Kim [c], Sun Ae Kim [a]

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[b]*Department of Biotechnology, Korea University, Seoul, South Korea*

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Abstract: The consumption of raw enoki mushrooms (*Flammulina filiformis*) has been associated with multiple international foodborne outbreaks and product recalls, highlighting their significance as a global food safety concern. This study aimed to characterize bacterial communities in enoki mushrooms (*n* = 50) distributed in South Korea, with a focus on the influence of farm environments and distribution channels (supermarkets versus outdoor markets). A combined approach utilizing culture-dependent methods and 16S rRNA amplicon sequencing was employed to profile microbial consortia. The average aerobic plate counts (APCs) and coliform counts in enoki mushrooms were 7.9 ± 1.0 and 5.1 ± 2.2 log CFU/g, respectively, obtained from enoki mushroom samples collected from supermarkets (*n* = 29) and outdoor markets (*n* = 21) in Seoul and Jeonju. Noticeable differences in APCs and coliform counts were observed among farms, while no substantial variations were found between enoki mushrooms across distribution channels. The dominant bacterial phylum and family identified in enoki mushrooms were Proteobacteria (63.1 %) and Enterobacteriaceae (59.8 %), respectively. The genera *Lactococcus* (17.8 %) and *Leuconostoc* (7.2 %) were most abundant, followed by *Pseudomonas* (2.7 %) and *Staphylococcus* (0.2 %). The farm environment had a stronger influence on the alpha and beta diversity of the enoki mushroom microbiome compared to distribution channels. The high similarity in microbial diversity observed within mushrooms from the same farm suggests that the characteristic microbiome of postharvest enoki mushrooms may be established before distribution. These findings provide a comprehensive framework for understanding the microbial ecology of postharvest enoki mushrooms and offer critical insights for developing effective safety management strategies to mitigate potential food safety risks and ensure safe consumption.

Food Control, Volume 181, March 2026, 111806

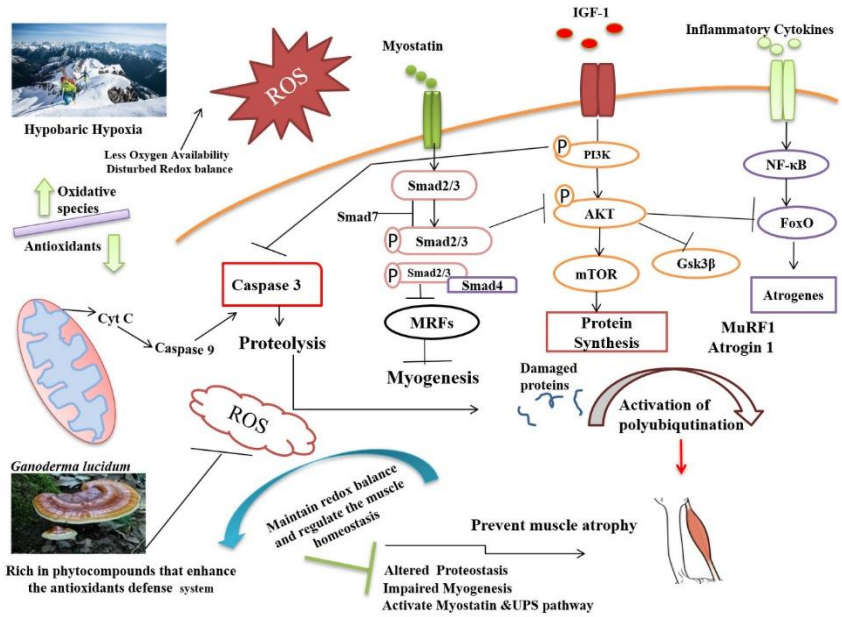
https://doi.org/10.1016/j.foodcont.2025.111806

Lingzhi or Reishi Medicinal Mushroom, *Ganoderma lucidum* (Agaricomycetes), Restores Redox Homeostasis and Modulates Myogenesis, Myostatin, and Muscle Atrophy Markers in Hypobaric Hypoxia Induced Muscle Loss in Rats

Arti Jatwani, Rajkumar Tulsawani

Defence Institute of Physiology and Allied Sciences, Lucknow Road, Timarpur, Delhi 110054, India

Abstract: The present study aimed to see the pharmacological effects of the aqueous extract of *Ganoderma lucidum* in amelioration of hypobaric hypoxia (HH) mediated muscle wastage. Male Sprague-Dawley rats (200–220 g) were allocated into five groups (25 total, *n* = 5 in each group): unexposed control (Group 1), 7-d HH exposed (Group 2), and 7-d HH administered with *G. lucidum* orally at 50 mg/kg BW (Group 3), 100 mg/kg BW (Group 4), and 200 mg/kg BW (Group 5). All groups were kept in a simulated decompression chamber (maintained at 282 mmHg pressure, nearly 7620 m altitude, and 8% oxygen) except Group 1. After completion of HH exposure, the gastrocnemius muscle was collected for studying regulatory mechanism of muscle homeostasis at morphological, biochemical, and molecular level. HH-induced oxidative stress deteriorated physical parameters and dysregulated regulatory proteins of muscle mass. Treatment with *G. lucidum* improved physical parameters (bodyweight, muscle mass weight, and its relative change with tibia length), restored oxidative stress (ROS, MDA, and reduced GSH), AOPP levels, and LDH activity at an intended dose of 100 mg/kg BW. Furthermore, muscle mass regulatory proteins P-Akt, GSK-3β, Caspase3, Murf-1 and Atrogin1 were restored in the treatment groups. *G. lucidum* also elevated the Myf5, MyoD, MyoG, MRF and MHC expression, and restored the expression of myostatin and its canonical mediators' proteins. Histological assessment of myofibers showed polygonal shape, intact sarcoplasm, and peripheral nuclei. The present study indicates that *G. lucidum* extract showed pharmacological potential to modulate the regulatory mechanism of muscle homeostasis in HH environment.



Keywords: *Ganoderma lucidum*, hypobaric hypoxia, oxidative stress, muscle loss, molecular mechanism, medicinal mushrooms

International Journal of Medicinal Mushrooms, Volume 27, Issue 12, 2025, pp. 25-42

DOI: 10.1615/IntJMedMushrooms.2025060092

Mechanical properties and water absorption of shiitake mushroom-based films with natural rubber latex

Jeroen G. van den Brandhof, Antonio d'Errico, Marco F. Cagnoni, Han A.B. Wösten

Microbiology, Department of Biology, Utrecht University, Padualaan 8, Utrecht 3584 CH, the Netherlands

Abstract: Mechanical properties and water absorption were determined of films produced from powdered *Lentinula edodes* (shiitake) mushrooms with and without the addition of natural rubber latex using 80:20, 60:40, and 40:60 (w/w) mushroom-latex ratios. Pure mushroom material showed a maximum tensile strength of 7.3 ± 0.5 MPa, an elongation at break of 8.2 ± 0.4 %, and a tear strength of 0.65 ± 0.32 N mm^{-1}, while the 40:60 mushroom-latex blend showed values of 2.7 ± 0.1 MPa, 189.3 ± 4.4 % and 4.46 ± 0.98 N mm^{-1}, respectively. Pure latex showed the lowest water uptake after 24 h (6.8 ±4.0 %), which increased with higher mushroom powder content with a maximum of 127.1 ± 9.7 % in the case of the 80:20 mushroom powder-latex blend. Notably, the pure mushroom films demonstrated poor integrity during water absorption tests by gradually falling apart. Together, latex can be used to enhance the integrity, ductility and tear strength of shiitake mushroom-based films, while it reduces the water sorption and maximum tensile strength.

Keywords: Mycelium material, Mushroom, *Lentinula edodes*, Natural rubber latex, Biocomposite

New Biotechnology,Volume 91, 25 March 2026, Pages 1-6

https://doi.org/10.1016/j.nbt.2025.11.001

A critical review of dehydrated edible mushroom: Effects of drying methods on the nutritional composition, sensorial quality, and health benefits

Jiachi Duan [a], Lixia Wang [a], Yueting Dai [b], Changtian Li [b], Hongwei Xiao [c], Jun Wang [a]

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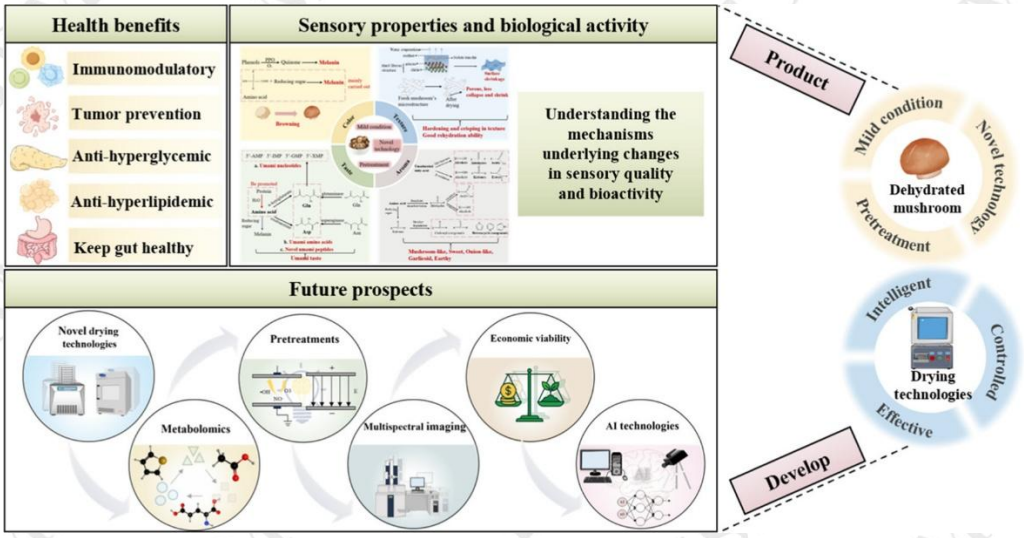
Abstract: Dehydration is a key processing method for extending mushroom shelf life and increasing commercial value. However, most existing reviews discuss drying only briefly among various processing methods and lack comprehensive research on the mechanisms by which different drying and pretreatment technologies affect the quality and bioactivity of dehydrated mushrooms. Therefore, this review offers a multidimensional assessment of dehydrated edible mushroom quality from sensory, nutritional, and bioactive perspectives, and elucidates how various drying methods, processing parameters, and pretreatments affect these quality attributes. This review highlights that drying methods and conditions can alter the microstructure of mushrooms and influence the physical changes and metabolic activities occurring during dehydration, thereby markedly affecting final products quality. The application of pretreatment technologies and innovative drying processes can effectively suppress quality deterioration reactions and help preserve sensory attributes and bioactive compounds, while emerging thermal technologies may also enhance the formation of

characteristic flavor substances. Future research should apply omics-based approaches to elucidate the molecular mechanisms governing quality evolution during drying, and integrate spectroscopic techniques with artificial intelligence to achieve visual, automated, and intelligent control of the drying process. Overall, this review establishes a theoretical framework for understanding quality evolution in mushroom drying and offers guidance for producing dehydrated mushrooms with superior sensory quality and bioactivity, as well as for developing advanced drying and pretreatment technologies.

Graphical Abstract



Keywords: Edible Fungi, Drying Conditions, Quality Characteristics, Flavor; Metabolism

Future Foods, Available online 1 December 2025, 100861

https://doi.org/10.1016/j.fufo.2025.100861

Interactions between Medicinal Mushrooms and Established Drugs: Molecular Basis, Examples, Practical Consequences, and Tasks for the Future

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Abstract: Interactions between pharmaceuticals and natural products, including medicinal mushrooms, can negatively or positively affect the efficacy of drugs, especially those with a narrow therapeutic index. The article describes the mechanisms of possible interactions, presents examples of the influence of several medicinal mushroom species or their components on the pharmacodynamics and pharmacokinetics of certain drugs, and discusses possible practical consequences and future tasks.

Keywords: medicinal mushrooms, drugs, interactions, pharmacodynamics, pharmacokinetics

International Journal of Medicinal Mushrooms, Volume 28, Issue 1, 2026, pp. 1-12

DOI: 10.1615/IntJMedMushrooms.2025061467

Eco-friendly production of xylanase and laccase from sawdust grown *Ganoderma lucidum* for sustainable paper and dye industries

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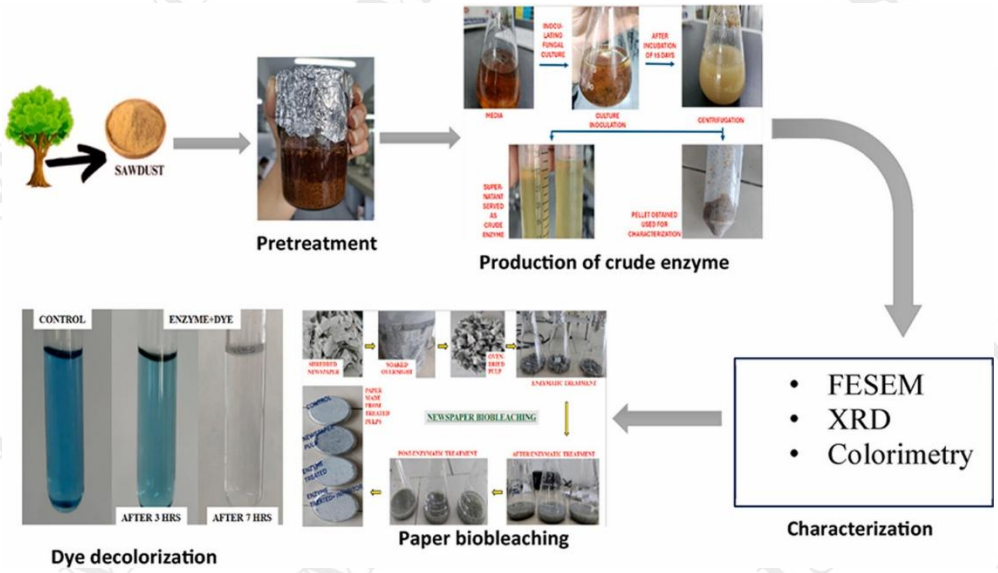
Abstract: The research presented in this study focuses on the utilization of lignocellulosic waste, with a specific focus on sawdust, as a valuable resource for enzyme production with subsequent applications in various industrial processes. Sodium hydroxide pretreatment was employed to enhance substrate accessibility reducing the lignin content from 28 % in untreated sawdust to 25 % after treatment. The optimization of xylanase and laccase production by *Ganoderma lucidum* was explored, yielding activities of 2.43 U/ml and 2.96 U/ml, respectively. Optimal enzyme activity was achieved at pH 7 and 55 °C for xylanase and pH 5 and 40 °C for laccase. Characterization of the substrate was performed using FESEM and XRD analysis. The produced enzymes demonstrated significant industrial applicability, including efficient delignification of newspaper pulp and decolorization of indigo carmine dye. Specifically, enzymatic treatment improved the brightness and whiteness of newspaper pulp by 24.5 % and 372.9 %, respectively, while achieving 72.54 % dye decolorization within 7 h of incubation. These results underscore the potential of *Ganoderma lucidum* as a sustainable biocatalyst platform, leveraging agricultural waste as a renewable substrate. In relation to previous studies, the observed enzymatic activities and their efficiency in delignification and dye decolorization demonstrate an enhanced biocatalytic potential. These findings highlight its viability as an alternative to conventional chemical methods, offering a more sustainable and eco-friendly solution for biobleaching and wastewater treatment, thereby addressing the critical demand for environmentally responsible processes across diverse sectors.

Graphical abstract



Journal of the Indian Chemical Society, Volume 102, Issue 12, December 2025, 102288

https://doi.org/10.1016/j.jics.2025.102288

A mixed mushroom poisoning in humans associated with the ingestion of *Collybiopsis orientisubnuda*

Xiu-Juan Li [a b], Chang Xu [a b], Wen-Hao Zhang [a b], Jing Ma [a b], Han-Chi Lei [a b], Jia Li [a b], Yu-Xian Gao [a b], Xing Xia [a b], Ping Wei [c], Yi Liu [d], Li-Ping Tang [a b]

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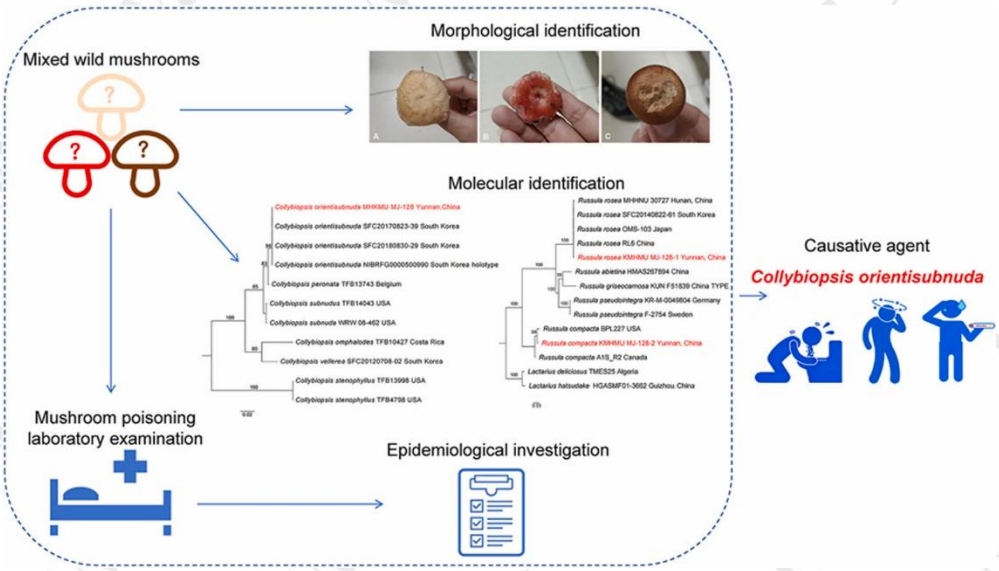
Abstract: Mushroom poisoning is the leading foodborne illness in China. However, accurate identification of the causative species remains challenging, particularly in cases involving several species. In July 2022, a mushroom poisoning incident involving six individuals occurred in Yunnan Province, China, after consuming a meal of mixed wild mushrooms. Five of them developed poisoning symptoms, including nausea, vomiting, dizziness, and fever. Laboratory examination revealed abnormalities in one female patient's blood biochemistry parameters and coagulation profiles, although these specific tests were not performed on the other patients. Morphological and phylogenetic analyses identified the implicated mushrooms as three species: *Collybiopsis orientisubnuda* (Omphalotaceae), *Russula compacta* and *Russula rosea* (Russulaceae). While both *Russula* species are widely documented as edible, *C. orientisubnuda* has been implicated in a prior mixed-sample poisoning case. Based on the identification results, clinical investigations, and literature review, we conclude that *C. orientisubnuda* was the most likely causative agent of this poisoning event. This study provides the first detailed report of the poisoning syndrome and clinical manifestations associated with *C. orientisubnuda*.

Graphical abstract



Toxicon, Volume 270, 1 February 2026, 108937

https://doi.org/10.1016/j.toxicon.2025.108937

Inhibitory mechanism of tyrosinase-induced browning in Agaricus bisporus by garlic-derived H2S: Nucleophilic attack leading to catalytic-cu flexible loop collapse and thiol-persulfidation

Meiyi Du [a], Dandan Shi [a], Kai Zhao [a], Zhaoliang Hu [b], Qian Zhou [a], Zhaoxia Wu [a], Bing Bai [a]

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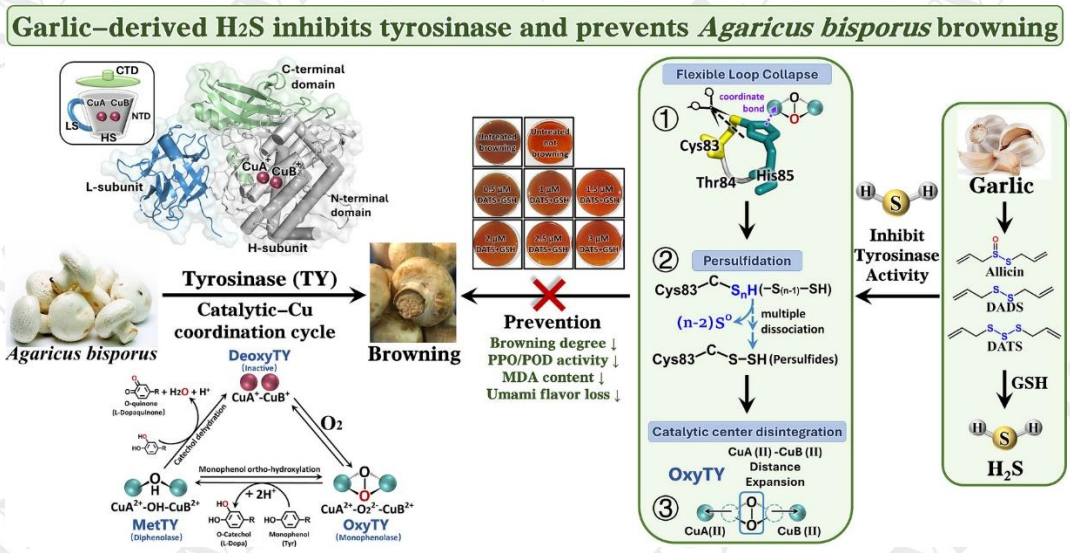
[b] *Department of Surgical Oncology, First Affiliated Hospital, China Medical University, Shenyang 110001, China*

Abstract: Tyrosinase (TY) drives melanin accumulation and enzymatic browning in produce. This study explored the inhibition mechanism of garlic-derived H_2S on TY and its feasibility in preventing Agaricus bisporus browning. Garlic sulfides, including diallyl trisulfide (DATS), diallyl disulfide (DADS), and diallylthiosulfinate (Allicin), all inhibited TY activity via reduced glutathione (GSH)-induced H_2S release, with DATS exhibiting the strongest effect due to its high Sn^0 content. H_2S bound TY at a single site, disrupted hydrogen bonds and hydrophobic interactions, reducing α-helix content, weakening van der Waals forces, inducing Cys83 persulfidation, destabilized the flexible loop, and increased the CuA-CuB distance. The "Nucleophilic attack leading to flexible loop collapse and persulfidation" mechanism enriches the biochemical theory of H_2S as enzyme inhibitors. Additionally, garlic-derived H_2S effectively reduced browning, malondialdehyde levels, PPO/POD activity, and volatile flavor deterioration in Agaricus bisporus homogenate, providing a novel strategy for natural TY inhibitors and fresh-produce preservation.

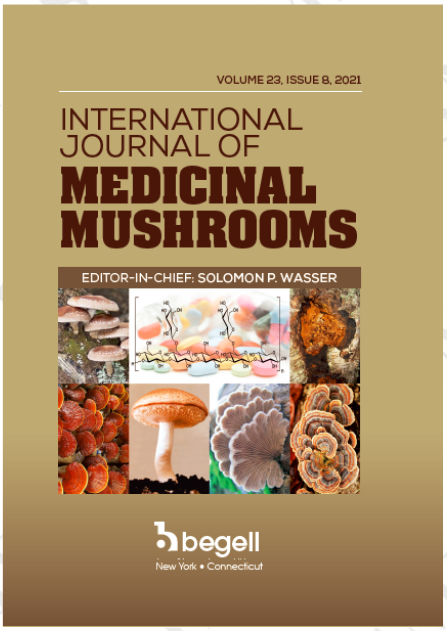
Graphical abstract



Food Chemistry, Volume 492, Part 1, 15 November 2025, 145372

https://doi.org/10.1016/j.foodchem.2025.145372

International Journal of Medicinal Mushrooms Call for Papers



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International Journal of
Medicinal Mushrooms

2025, Vol. 27, Issue no.12

The Role of Medicinal Mushrooms in Cancer Treatment: Bioactive Compounds and Therapeutic Potential
Mustafa Sevindik, Emre Cem Eraslan, Tetiana A. Krupodorova, Maxim Krakhmalnyi, Imran Uysal, Celal Bal, Solomon P. Wasser

Lingzhi or Reishi Medicinal Mushroom, *Ganoderma lucidum* (Agaricomycetes), Restores Redox Homeostasis and Modulates Myogenesis, Myostatin, and Muscle Atrophy Markers in Hypobaric Hypoxia Induced Muscle Loss in Rats
Arti Jatwani, Rajkumar Tulsawani

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An Ethanolic Extract of Sulfur Polypore Mushroom *Laetiporus sulphureus* (Agaricomycetes) Mycelium Inhibits Cell Cycle Progression, Survival, and Migration in Human Hepatocarcinoma Cell Lines
Martina De Mattheis, Alberto Massimi, Lara Lizzi, Marco Leonardi, Mirco Iotti, Mara Massimi

Analysis of Antioxidant and Anticancer Activities of Selected *Trametes* Species (Agaricomycetes) from Iran
Pardis Irankhahi, Somayeh Keypour, Hossein Riahi

***Medicinal Lichens: Traditional Knowledge and Modern Pharmacology* by Robert Dale Rogers Published by Healing Arts Press February 2025**
Solomon P. Wasser

International Journal of
Medicinal Mushrooms

2026, Vol. 28, Issue no.1

Interactions between Medicinal Mushrooms and Established Drugs: Molecular Basis, Examples, Practical Consequences, and Tasks for the Future
Ulrike Lindequist, Beate Haertel

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Quantitative Screening of Vitamins, Minerals, and Proximate Compositions of the Elm Oyster Mushroom *Hysizygus ulmarius* (Agaricomycetes) Cultivated in Nigeria
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Points and Reviews

The Role of Medicinal Mushrooms in Cancer Treatment: Bioactive Compounds and Therapeutic Potential (Part I)

Mustafa Sevindik,[a,*] Emre Cem Eraslan,[a] Tetiana Krupodorova,[b] Maxim Krakhmalnyi,[c] Imran Uysal,[d] Celal Bal,[e] & Solomon P. Wasser[f]

[a]Department of Biology, Faculty of Engineering and Natural Sciences, Osmaniye Korkut Ata University, Osmaniye 80-000, Türkiye; [b]Institute of Food Biotechnology and Genomics of National Academy of Sciences of Ukraine, Department of Plant Food Products and Biofortification, Kyiv 04123, Ukraine; [c]Department of Phytoecology, Institute of Evolutionary Ecology of NAS of Ukraine, Kyiv 03143, Ukraine; [d]Department of Food Processing, Bahçe Vocational School, Osmaniye Korkut Ata University, Osmaniye 80-000, Türkiye; [e]Oguzeli Vocational School, Gaziantep University, Gaziantep 27-000, Türkiye; [f]International Centre for Biotechnology and Biodiversity of Fungi, Institute of Evolution and Faculty of Natural Sciences, University of Haifa, Mt. Carmel, Haifa 31905, Israel

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Orgainal Published on International Journal of Medicinal Mushrooms, 2025, Vol. 27, Issue no.12

ABSTRACT: In recent years, research on the therapeutic potential of mushroom species has notably expanded, and the effects of these organisms on cancer treatment have come to the forefront. The present review examines the anticancer and antitumor effects of various edible and medicinal mushroom species on different human cancer cell lines and summarizes the biological mechanisms underlying these effects. The reviewed studies show that polysaccharides (particularly β-glucans), triterpenoids, phenolic compounds, protein-polysaccharide complexes and other bioactive components contained in mushrooms are effective on apoptosis induction, cell cycle arrest, activation of the immune system, reduction of oxidative stress, inhibition of metastasis and angiogenesis. *In vitro* and *in vivo* studies, especially on species such as *Ganoderma lucidum*, *Cordyceps militaris*, *Lentinula edodes*, *Hericium erinaceus*, and *Grifola frondosa*, have shown that these mushrooms exhibit significant cytotoxic, antiproliferative, and immunomodulatory effects against various types of cancer (including breast, colon, lung, liver, prostate, cervical, etc.). These findings indicate that mushroom-derived natural products should be evaluated not only as adjunctive therapies, but also as potential pharmaceutical agents. However, most of the available data are at the preclinical level, and more comprehensive toxicological and pharmacokinetic studies are needed to ensure clinical applicability.

KEY WORDS: medicinal mushrooms, bioactive compounds, anticancer activity, immunomodulation, apoptosis, cancer cell lines

ABBREVIATIONS: ACP, *Agrocybe cylindracea* fucoglucogalactan; **AR**, androgen receptor; **A549, H-1299**, lung carcinoma; **BEAS-2B**, human bronchial epithelial cells; **BEP**, purified acidic polysaccharide; **BRMs**, biological response modifiers; **Caco-2, HCT 116**, colon carcinoma; **CCD 841 CoTr**, colon epithelial cells; **CH72**, murine skin carcinoma; **CMPs**, *C. militaris* polysaccharides; **CTSD**, cathepsin D; **DHT**, dihydrotestosterone; **EAC**, Ehrlich ascites carcinoma; **EPS**, extracellular polysaccharide; **ET**, Ehrlich tumor; **GR**, glucocorticoid receptor; **GSSG/GSH**, total glutathione; **G6PD**, glucose-6-phosphate dehydrogenase; **HCC**, hepatocellular carcinoma; **HeLa, SiHa, CaSki**, cervical carcinoma; **HepG2**, human liver hepatoblastoma; **Hep3B, HUH-7**, human hepatoma; **HEP-2**, larynx carcinoma; **HL-60, T-4**, leukemia; **HPAF-II, PL45**, human pancreatic adenocarcinoma; **HT-29, LS180, SW948**, human colorectal cancer; **IL-2**, interleukin-2; **IMR-32**, human neuroblastoma; **IPS**, intracellular polysaccharide; **iNOS**, inducible nitric oxidesynthase; **Jurkat**, human acute T-cell leukemia; **KB**, oral cavity cancer; **MCF-7, MDA-MB231, MDA-MB468, BT-20, KAIMRC1**, breast adenocarcinoma; **MDR**, multidrug resistance; **MDSCs**, myeloid-derived suppressor cells; **MHH-ES1, S-180**, sarcoma; **MMPs**, matrix metalloproteinases; **MT-1, 4T1, ZR-75-30**, breast cancer; **NCI-H187**, small lung cancer; **NK**, natural killer; **NO**, nitric oxide; **PC-3, DU-145, LNCaP**, human prostate cancer; **PD-L1**, programmed death-ligand 1; **P-gb**, P-glycoprotein; **PRDX1**, peroxiredoxin 1; **PSK**, polysaccharide-K; **PSP**, polysaccharide peptide; **RNA**, ribonucleic acid; **ROS**, reactive oxygen species; **SOD**, superoxide dismutase; **SPR**, surface plasmon resonance; **SPS**, sulfated polysaccharides; **SW-480, LS174, HCT-15, COLO-205**, colon cancer; **TFPS**, high-molecular-weight polysaccharides; **TNF—α**, tumor necrosis factor-α; **U87, SF-295**, glioblastoma; **U937**, monocytic cell line

I. INTRODUCTION

Cancer is a complex and life-threatening disease characterized by the uncontrolled proliferation of abnormal cells. Anticancer activity refers to a range of biological processes that inhibit, delay, or destroy cancer cell growth.[1] Herbal components, antioxidants, certain drugs, and immune-modulating agents may possess anticancer activity.[2] For instance, polyphenols found in green tea may help prevent carcinogenesis by reducing free radicals. Likewise, bioactive compounds present in commonly consumed foods such as broccoli, garlic, and turmeric play a role in fighting cancer by exerting protective effects against cellular damage.[3–5] Additionally, lifestyle habits including regular exercise and a healthy diet have been shown to generate anticancer effects. Physical activity can lower the risk of cancer by potentiating the immune system and reducing inflammation.[6] Avoiding smoking and excessive alcohol consumption, staying away from processed foods, and getting enough sleep also enhance the body's capacity to fight cancer.[6] Scientific evidence indicates that natural compounds that support immune function and promote cellular repair can help in cancer prevention and therapy. Therefore, adopting a healthy lifestyle and consuming cancer-preventing nutrients can be beneficial in reducing the risk of cancer.[7]

Mushrooms, in particular, exhibit anticancer effects via immune system modulation and regulation of cellular mechanisms mediated by their diverse natural bioactive compounds.[8] Their key components, such as β-glucans, phenolic compounds, and antioxidants, can prevent cell mutations by reducing free radical damage in the body. These molecules can activate immune cells, enhancing their capacity to recognize and eliminate malignant cells.[9] Furthermore, certain mushroom-derived polysaccharides can prevent cancer cells development by enabling the

immune system to work more effectively.[10,11]

Studies show that certain mushroom extracts can induce programmed cell death (apoptosis) in cancer cells and can prevent tumors from forming blood vessels (angiogenesis).[12] In addition, it is reported that some mushroom compounds can complement conventional protocols, such as chemotherapy and radiotherapy, making the treatment process more effective and tolerable by reducing side effects. Due to their anti-inflammatory properties, mushrooms can prevent negative cellular changes that can initiate carcinogenesis by reducing inflammation.[13]

Taken together, regular consumption of medicinal mushrooms or mushroom-based supplements can potentiate the immune system and contribute to general health maintenance. However, conscious use is important to benefit from the anticancer effects and optimize therapeutic outcomes. Incorporating mushrooms into the diet, along with healthy eating habits, can be an effective strategy in reducing the risk of cancer.[14,15] In our study, data from the scientific literature on mushroom species reported to be effective against various cancer cell lines were compiled.

II. MATERIALS AND METHODS

A. Methodology (Literature Search Strategy)

This review is based on a comprehensive search and analysis of peer-reviewed literature across scientific databases, including PubMed, Scopus, and Web of Science, using keywords such as “medicinal mushrooms," “anticancer activity," “bioactive compounds," “apoptosis," and “cancer cell lines." Both *in vitro* and *in vivo* studies were considered. Articles not available in English or lacking original data were excluded from the analysis. The current taxonomic names and systematic categories of fungal species were arranged using the Index Fungorum online database (https://www.indexfungorum.org).

III. ANTICANCER PROPERTIES OF MEDICINAL MUSHROOMS

Literature studies have demonstrated the anticancer effects of various mushroom species on different cancer cell lines. These studies report that such fungi exhibit cytotoxic, antiproliferative, and proapoptotic effects on a wide range of human and animal cancer cell lines, including: liver hepatoblastoma (HepG2), oral cavity cancer (KB), small cell lung cancer (NCI-H187), colon carcinoma (Caco-2, HCT 116), leukemia (HL-60, T-4), human neuroblastoma (IMR-32), sarcoma (MHH-ES1, S-180), human prostate cancer (PC-3, DU-145, LNCaP), human hepatoma (Hep3B, HUH-7), larynx carcinoma (HEP-2), monocytic leukemia (U937), human pancreatic adenocarcinoma (HPAF-II, PL45), murine skin carcinoma (CH72), colon cancer (SW-480, LS174, HCT-15, COLO-205), human colorectal cancer (HT-29, LS180, SW948), cervical carcinoma (HeLa, SiHa, CaSki), human acute T-cell leukemia (Jurkat), glioblastoma (U87, SF-295), lung carcinoma (A549, H-1299), breast cancer (MT-1, 4T1, ZR-75-30), and breast adenocarcinoma (MCF-7, MDA-MB231, MDA-MB4 8, BT-20, KAIMRC1). As illustrated in Fig. 1, medicinal mushrooms exert their anticancer effects through multiple mechanisms, including induction of apoptosis and modulation of the immune system.

These studies show that mushroom-derived compounds can suppress cancer cell proliferation, induce cell cycle arrest, activate apoptotic pathways, and trigger cancer cell death by affecting oxidative stress mechanisms. It has also been reported that certain mushroom species can increase sensitivity to chemotherapy and offer a potential complementary treatment option, exhibiting minimal toxicity toward healthy cells. The most commonly studied fungal species and

cancer cell lines associated with anticancer activity are summarized in Table 1.

A. *Cordyceps militaris* (L.) Fr.

Cordyceps militaris (Family: Cordycipitaceae) is a widely recognized medicinal fungus traditionally usedin Eastern medicine and has recently gained scientific interest due to its potent anticancer properties. These effects are largely attributed to cordycepin (3'-deoxyadenosine) and *C. militaris* polysaccharides (CMPs). In a 2022 study, CMPs were shown to inhibit the proliferation and induce apoptosis in human cancer cell lines, including: MGC803 (gastric), HCT-116(colorectal), and HepG2 (liver). The observedcytotoxic effects were mediated by elevated intracellular reactive oxygen species (ROS) levels and activation of the intrinsic apoptotic pathway, involving mitochondrial membrane depolarization and caspase activation.[16] Cordycepin, one of *C. militaris* primary bioactive compounds, has demonstrated broad-spectrum antitumor activity. According to a 2018 review, cordycepin was effective in suppressing proliferation, halting cell cycle progression, inducing apoptosis, and inhibiting metastasis in various cancer types, such as hepatocellular carcinoma (HepG2), lung cancer (A549), breast cancer (MCF-7), bladder cancer (T24), and prostate cancer cells. These effects were mediated via key signaling pathways, including PI3K/Akt, MAPK, and caspase cascades.[17] In addition to direct cytotoxicity, CMPs have shown immunostimulatory effects, such as enhancing monocyte and T-cell proliferation, which may help mitigate the immunosuppressive side effects of chemotherapy.[18] Taken together, *C. militaris* demonstrates strong anticancer activity through a dual mechanism, which involves both the direct induction of apoptosis and the modulation of immune responses, thereby supporting its potential application in integrative cancer therapies.

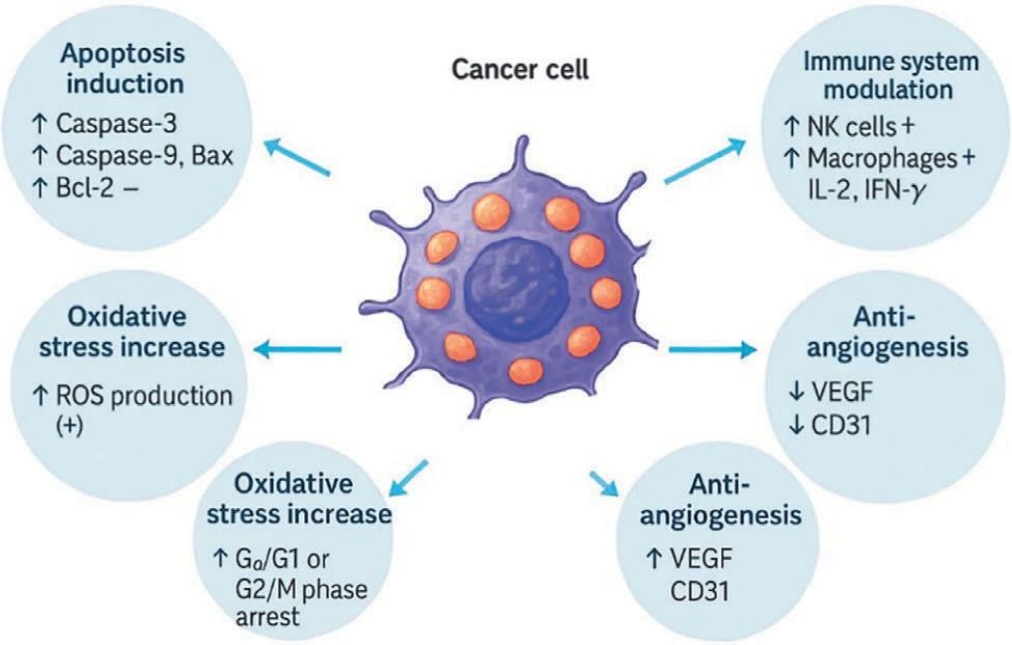

FIG. 1: *General mechanisms of anticancer activity of medicinal mushrooms*

TABLE 1: Activities of the most extensively studied fungal species against various cancer cell lines

Species	Cell lines	Effects	Extract/ substance	Refs.
C. militaris	MCF-7, 5637, A549	The cytotoxicity of protein concentration called CMP from *C. militaris* was evaluated against MCF-7, 5637, and A549 cancer cell lines using the CCK assay. Doses of 15, 5, 1.7, and 0.6 µM were applied. CMP at 15 µM strongly inhibited the viability of MCF-7 cells with an IC_{50} of 9.3 µM and the viability of 5637 cells with an IC_{50} of 8.1 µM, while CMP was less effective against A549 cells.	Protein	96
C. comatus	U87MG, LN-18, SVGp12	The anti-glioma potential of *C. comatus* strain was tested using water, 70% ethanol and 95% ethanol extracts obtained from the fungus. Ethanol extracts showed stronger activity compared with the aqueous extract. The anti-glioma mechanism involved inhibition of cancer cell proliferation and induction of apoptosis associated with cell cycle arrest in subG1 or G2/M phase, along with inhibition of metalloproteinase activity. As a result, *C. comatus* demonstrated high anti-glioma potential.	Aqueous and ethanol	19
M. procera	LS174, HeLa, A549	Methanol extracts from *M. procera* were tested on three different cancer cell lines. According to the data, IC_{50} values indicated stronger anticancer effects against A549 and LS174 cells compared with HeLa cells.	Methanol	97
L. edodes	MCF-7	Water and methanol extracts obtained from the fruiting bodies and mycelia of *L. edodes* were tested on the MCF-7 cell line. Fruiting body water extracts showed higher cytotoxicity than mycelial aqueous extracts, while methanolic extracts of either basidiocarp or mycelium did not exhibit any inhibitory (cytostatic) effects on MCF-7 cells.	Fruit body and mycelial aqueous and methanolic	98
P. ostreatus	MCF-7 v	The study demonstrated that certain compounds can strongly interact with biomarkers (EGFR, PR and NF-kB) of MCF-7 breast cancer cells and change their structures. In particular, linoleic acid ethyl ester was found to be the best match with these target proteins. It was stated that overexpression of EGFR promotes breast cancer progression by activating PR, and certain bioactive compounds can suppress this interaction by binding with EGFR and PR. As a result, it was emphasized that the anticancer effects of linoleic acid ethyl ester and other high-affinity compounds require further investigation.	Ethanol	99
Sch. commune	A549	A well-soluble, highly branched glucomannan (SCP-1) was isolated from the fruiting body of *Sch. commune* and its structural and antitumor properties were investigated. Monosaccharide analysis revealed fucose, glucosamine hydrochloride, galactose, glucose and mannose. SCP-1 significantly inhibited the growth of A549 cells. According to these data, SCP-1 may act as a potential antitumor agent for the treatment of lung cancer.	Polysaccharide	100
A. cylindracea	S-180	It was reported that the polysaccharide termed 'cylindan' exhibited approximately 70% tumor inhibition against the solid form of sarcoma 180 in ICR mice, when administered intraperitoneally at a dose of 30 mg/kg/day.	Aqueous	36
	MGC-803	Two polysaccharide solutions – ACP dissolved in cold water and ACAP dissolved in the supernatant of ethanol – were compared. It was stated that ACP can effectively inhibit the proliferation of MGC-803 cells by arresting the cell cycle in G1 and S phases, and also can induce tumor cells apoptosis through mitochondrial signaling, whereas ACAP showed no antitumor effect *in vitro*.	Polysaccharide	101
Ph. adiposa	HeLa	Two acid-extracted polysaccharides, SPAP2-1 and SPAP2-2, were found to exhibit antitumor activity. Both fractions contained mannose, glucose, and galactose. *In vitro* assays indicated that SPAP2-1 had a stronger inhibitory effect on HeLa cell growth compared with SPAP2-2.	Polysaccharide	40
A. auricula-judae	NCI H358, SNU1	Various ethanol extract fractions (dichloromethane, ethyl acetate, and butanol) derived from *A. auricula-judae* were tested on bronchioloalveolar and gastric carcinoma cell lines. It was reported that ethanol solvent fractions inhibited the proliferation of tumor cells in a dose-dependent manner, with DCMF showing the strongest cytotoxic activity.	Ethanol and fractions	46
A. polytricha	S-180	*In vivo* antitumor activity tests of the polysaccharide obtained from *A. polytricha*, called AAFRC, were performed on the S180-carrying mouse model. It was determined that transplantable Sarcoma-180 growth in mice was also significantly inhibited (43.61%) by AAFRC compared with model controls.	Polysaccharide	102
B. edulis	CaCo-2	It was found that *B. edulis* hydroethanolic extracts contained a large amount of bioactive compounds such as sugars (i.e. trehalose), phenolic compounds (flavonoids and phenolic acids) and minerals, and among these, selenium and zinc were of particular interest due to their bioactive capacity. The presence of these compounds in the extract may have antioxidant activity, which may indicate their potential as anticancer or chemopreventive agents. The data demonstrated that *B. edulis* extracts inhibited the proliferation of human colon carcinoma cells (Caco-2) by inducing cell cycle arrest at the G0/G1 phase and cell death through apoptosis and autophagy.	Hydroethanolic	50
R. flava	BGC-803, NCI-H520, MDA-MB-231	*In vitro* growth inhibitory activity of *R. flava*, it was analyzed in 3 human cancer cell lines and it was determined that it showed inhibitory activity in all three human cancer cell lines. However, the strongest growth inhibitory activity was detected in the human breast cancer cell line MDA-MB-231.	Ethanol	103
F. pinicola	HepG2	The anticancer potential of *F. pinicola* ethyl acetate fractions (EMFP) was tested on HepG2 cell line. The proliferation of HepG2 cells treated with EMFP was significantly decreased. In addition, 2 phenolic compounds and 14 triterpenes were identified, which are thought to be the primary contributors to the anticancer capacity of *F. pinicola*.	Ethyl acetate fractions	104

TABLE 1: (*continued*)

Species	Cell lines	Effects	Extract/ substance	Refs.
F. officinalis	HepG2	A previously unidentified homogeneous polysaccharide (FOP80-1) was obtained from *F. officinalis* and significant inhibitory effects on the proliferation, invasion and metastasis of HepG2 cells and the formation of tumor vessels were reported. It was also concluded that the high content of β-d-Glcp glycosidic bond in FOP80-1 may be responsible for the significant antitumor effects of FOP80-1.	Polysaccharide extract	62
G. frondosa	HepG2	In order to obtain high yield polysaccharide from *G. frondosa*, they analyzed by applying single factor assay and orthogonal assay to optimize the best extraction conditions. The obtained polysaccharide has anti-tumor activity by inhibiting the proliferation of HepG2 cells.	Polysaccharide extract	105
L. sulphureus	MDA-MB-231	To explain the structural and biological differences between two different polysaccharides (PS and SPS) isolated from the fruit bodies of *L. sulphureus*. It was determined that SPS has a more diverse monosaccharide composition with higher sulfate and protein content, thus exhibiting stronger cytotoxicity than PS against MDA-MB-231 breast cancer cells.	Polysaccharide extract	68
A. rude	MB-231, MT-1, MB-468, MCF-7, 4T-1, BEAS-2B, A549, U87, Jurcat, HepG2, DU-145, HeLa	The antitumor activity of *A. rude* and 13 other mushroom species, in total 12 cell lines, comparing it with *Ganoderma lucidum*, which has been studied for its most anticancer activity, and determined that *A. rude* had significantly higher activity than *G. lucidum* in killing cancer cells. It was found that *A. rude* could inhibit cancer cell survival and induce apoptosis at low concentrations on breast cancer cells.	Boiling water	71
C. versicolor	MCF-7, HT-29, HUH-7	AgNPs were prepared using *C. versicolor* mushroom extract based on microwave-assisted method and their anticancer activities were investigated and it was stated that it caused a striking decrease in breast, liver and colon cancer cell proliferation in a time and dose dependent manner.	AgNP (Silver nanoparticle)	106
F. trogii	LNCaP, PC3, HT-29, MCF-7, MDA-MB231	The water extract obtained from the mycelia of *F. trogii* was tested for its effects on various cancer cell lines, non-cancer cell lines and *in vivo* tumor models, and it was determined that the extract contained laccase and was responsible for the anticancer activity. LNCaP and MCF-7 were the most affected by the fungal extract among the cell lines in which the anticancer activity was tested, and it completely eliminated the cells in the PC3 cell line.	Mycelial aqueous extract	75
G. lucidum	MCF-7	Hot water and ethanol extracts of *G. lucidum* were obtained by 2 different methods [Soxhlet and Ultrasonic Assisted Extraction (UAE)] and their anticancer properties against breast cancer cells were evaluated. The 80% Soxhlet ethanol was reported to have the highest anticancer activity with an IC_{50} value of 4.795 ug/mL.	Hot water, Ethanol	107

B. *Coprinus comatus* (O.F. Müll.) Pers.

Coprinus comatus (Family: Agaricaceae), commonly known as the ink cap mushroom, is an ediblespecies that has attracted increasing scientific interest for its anticancer and antitumor activities in recent years. Multiple studies have demonstrated its efficacy across a range of cancer cell lines through mechanisms involving cell cycle arrest, apoptosis induction, and inhibition of tumor invasion. A 2021study investigated the effects of *C. comatus* ethanolic extracts on U87MG and LN-18 glioblastomacells. The extract significantly reduced cell viability, inhibited DNA synthesis, and induced cell cyclearrest in the sub-G1 and G2/M phases, leading to apoptosis. Moreover, the extract was found to suppress metalloproteinase activity, suggesting a potential to limit tumor invasion and metastasis.[19] Earlier,in 2015, the ethyl acetate extract of *C. comatus* was shown to induce apoptosis in ES-2 human ovariancancer cells. Treatment with 100 µg/mL for 48 and 72 hours increased the sub-G1 cell population, aswell as the proportion of Annexinv V-positive and TUNEL-positive cells, confirming apoptosis. Theextract activated both intrinsic and extrinsic apoptotic pathways via caspase-3, -8, and -9, highlightingits ability to engage multiple cell death mechanisms.[20] In a 2008 study, *C. comatus* ethanol extract inhibited viability of LNCaP prostate cancer cells in a dose-dependent manner, particularly when stimulatedwith dihydrotestosterone (DHT). This inhibitory effect was specific to androgen-sensitive LNCaP cells,as it was not observed in androgen-independent DU145 or PC-3 cells. The extract also suppressed PSA secretion, induced G1 phase arrest, and reduced androgen receptor (AR) and glucocorticoid receptor(GR) transcriptional activity in MDA-kb2 breast cancer cells, indicating action via both AR-dependentand independent pathways.[21] Collectively, these findings confirm that *C. comatus* exhibits anticancer activity mediated by cell cycle regulation, apoptosis induction, and modulation of hormone receptoractivity, making it a promising candidate for further research in both hormone-sensitive and aggressivetumor models.

C. *Macrolepiota procera* (Scop.) Singer

Macrolepiota procera (Family: Agaricaceae), commonly known as the umbrella mushroom, is an edible and medicinal species that has recently attracted scientific attention due to its anticancer and antitumor properties. Various studies have demonstrated that its extracts inhibit tumor cell proliferation, induce apoptosis, and interfere with cellular metabolism in multiple cancer models. In a 2022 study, extracts from *M. procera* exhibited significant antiproliferative effects on A549 human lung cancer cells by targeting glucose-6-phosphate dehydrogenase (G6PD) - a key enzyme in the pentose phosphate pathway. Inhibitionof G6PD disrupted energy metabolism, thereby impairing tumor cell proliferation.[22] Earlier, a 2018 study showed that *M. procera* extract, applied at a concentration of 2 mg/mL for 72 hours, induced apoptosis and inhibited proliferation in A549 cells. Gene expression analysis revealed an upregulation of pro-apoptotic markers, including Bax, Caspase-3, Caspase-9, PTEN, p21, p53, and PUMA, as well as a downregulation of cell cycle and survival-related genes, such as Cyclin D1, CDK4, CDK6, Bcl-2, Akt, and NOXA. TUNEL assays confirmed that approximately 28% of cells underwent apoptosis, and the extract also reduced cell invasiveness.[23] In a separate study, aqueous extracts of *M. procera* inhibited proliferation of COLO-205 colon cancer cells, induced G0/G1 cell cycle arrest, and triggered apoptosis via the mitochondrial pathway. This was evidenced by increased expression of Bax, caspase-9, and caspase-3, alongside reduced Bcl-2 expression.[24] Taken together, *M. procera* demonstrates significant anticancer activity via cell cycle arrest, mitochondria-mediated apoptosis, and disruption of cancer cell metabolism, making it a promising natural candidate for further oncological research.

D. *Lentinula edodes* (Berk.) Pegler (= *Lentinus edodes* (Berk.) Singer)

Lentinula edodes (Family: Omphalotaceae), commonly referred to as shiitake, is a well-known edible and medicinal mushroom with a long history of use in traditional medicine for immune modulation and general health promotion. In recent years, it has been extensively investigated for its anticancer and antitumor properties, which are primarily attributed to polysaccharides such as lentinan and other bioactive β-glucans. In a 2020 study, a water-extracted polysaccharide named WEP1 significantly inhibited tumor growth and induced apoptosis in mice bearing H22 hepatoma tumors. These effects were associated with G2/M phase cell cycle arrest, increased intracellular reactive oxygen species (ROS), upregulation of Bax, downregulation of Bcl-2, and enhanced caspase-3 activation.[25] In another study, the polysaccharide SLNT, also extracted from *L. edodes*, was found to inhibit proliferation and trigger apoptosis in HT-29 human colon cancer cells in a dose-dependent manner. SLNT induced apoptosis through both the intrinsic (mitochondrial) and extrinsic pathways, evidenced by the activation of caspase-9, cytochrome c release,increased Bax/Bcl-2 ratio, as well as caspase-8 activation and TNF-α elevation. ROS production was also significantly increased, reinforcing the role of oxidative stress in its cytotoxic mechanism.[26] Additionally, β -glucan isolated from *L. edodes* demonstrated strong antitumor activity in S-180 tumor-bearing mice, leading to suppressed tumor growth and enhanced apoptosis. These effects were mediated by increased expression of p53, p21, and Bax; decreased Bcl-2 expression; and activation of caspase-9, caspase-3, and PARP1 cleavage, indicating mitochondria-mediated apoptosis.[27] Altogether, polysaccharides derived from *L. edodes*, particularly lentinan, exert anticancer effects through activation of both intrinsic and extrinsic apoptotic pathways, ROS generation, cell cycle arrest, and immunomodulatory activities, supporting itsuse in integrative cancer therapies.

E. *Pleurotus ostreatus* (Jacq.) P. Kumm.

Pleurotus ostreatus (Family: Pleurotaceae), the oyster mushroom, is a widely consumed edible fungus traditionally valued for its health-promoting properties. In recent years, accumulating evidence has supported its anticancer and antitumor activities, particularly due to its diverse array of bioactive polysaccharides. A 2024 study demonstrated that

POP, a polysaccharide isolated from *P. ostreatus*, exerted potent anticancer activity against Ehrlich ascites carcinoma (EAC) cells. The extract induced G0/G1 cell cycle arrest and promoted apoptosis, associated with increased expression of p53, decreased levels of Cyclin D and CDK4, and the presence of DNA fragmentation, indicating activation of intrinsic apoptotic mechanisms.[28] In an earlier study, a mycelial polysaccharide termed POMP2 significantly inhibited proliferation and migration of BGC-823 human gastric cancer cells, also reducing tumor volume and weight in murine xenograft models.[29] A 2014 investigation into polysaccharide fractions derived from *P. ostreatus* mycelial biomass showed remarkable tumor inhibition rates - ～ 70% in Ehrlich tumor (ET) and ～ 90% in Sarcoma-180 (S-180) models - without evident toxicity in healthy tissues.[30] Additionally, a 200 study reported that low molecular weight α-glucans extracted from *P. ostreatus* mycelium suppressed proliferation and induced dose-dependent apoptosis in HT-29 colon cancer cells. The mechanism involved increased expression of Bax and cytosolic cytochrome c, highlighting the activation of mitochondria-mediated apoptosis.[31] Collectively, polysaccharides from *P. ostreatus* exhibit strong antitumor potential by arresting the cell cycle, upregulating pro-apoptotic markers, and modulating gene expression related to cell death and survival, supporting their application in functional cancer therapeutics.

F. *Schizophyllum commune* Fr.

Schizophyllum commune (Family: Schizophyllaceae) is a globally distributed macrofungus with significant medicinal value, particularly due to its well-studied β-D-glucan polysaccharide known as schizophyllan. Schizophyllan has been extensively investigated for its anticancer and antitumor properties, primarily attributed to its role in immune system modulation. Schizophyllan exerts its effects by activating key immune cells, such as natural killer (NK) cells, T lymphocytes, B cells, neutrophils, and macrophages, which collectively contribute to the inhibition of tumor growth and metastasis.[32] Its immunomodulatory properties have been further supported by preclinical evidence showing that combined administration of schizophyllan with tamoxifen enhances tumor suppression in breast cancer and induces apoptosis in hepatic carcinoma models.[33] In a 2017 study conducted in TUrkiye, ethanol extracts derived from the mycelial and dried forms of *Sch. commune* collected in the Mugla region were evaluated for cytotoxic activity. The results demonstrated selective cytotoxicity against PC-3 (prostate) and HeLa (cervical) cancer cells, especially at low concentrations, with minimal impact on non-cancerous cells.[34] In parallel, exopolysaccharides derived from submerged mycelial cultures of *Sch. commune* were shown to possess significant anti-inflammatory activity, primarily by inhibiting nitric oxide (NO) production and suppressing the expression of inducible nitric oxide synthase (iNOS) in macrophages. These effects suggest a possible role in modulating inflammation-driven tumorigenesis.[35] Taken together, *Sch. commune* exhibits anticancer effects through immune activation, apoptosis induction, and suppression of inflammatory mediators. While schizophyllan remains the most well-characterized compound, further research is warranted to explore its full clinical potential in inflammation-associated and immunologically modulated cancers.

G. *Agrocybe cylindracea* (DC.) Maire (Current Name: *Cyclocybe cylindracea* (DC.) Vizzini & Angelini)

Agrocybe cylindracea (Family: Strophariaceae) is a medicinal mushroom recognized for its immuno- modulatory and anticancer properties, primarily attributed to its polysaccharide content. Among the key compounds, cylindan - a polysaccharide isolated from the basidiocarps, has shown significant effects in preclinical tumor models. Although not directly cytotoxic, cylindan was reported to extend survival in mice bearing sarcoma 180 and Lewis lung carcinoma tumors. Its proposed mechanism of action involves enhancement of the host immune response, including increased numbers of bone marrow stem cells and peritoneal exudate cells, elevated macrophage phagocytic activity, and

stimulation of natural killer (NK) cell function.[36,37] More recently, a fucoglucogalactan (ACP) polysaccharide extracted from *A. cylindracea* demonstrated potent antiproliferative activity against colorectal cancer cell lines (HCT-116 and HT-29). This compound induced apoptosis via lysosomal dysfunction, and upregulated the expression of cathepsin D (CTSD) through histone H3K27 acetylation (H3K27ac), suggesting an epigenetic regulatory mechanism.[38] Additional studies on heteroglycans, such as SACP-80, have further supported the anticancer potential of *Agrocybe* species, showing marked inhibition of tumor growth in colorectal cancer cells.[39] Collectively, these findings suggest that *A. cylindracea* exerts its anticancer effects primarily through immune system modulation and apoptosis induction, mediated by its diverse polysaccharide fractions.

H. *Pholiota adiposa* (Batsch) P. Kumm.

Pholiota adiposa (Family: Strophariaceae) is an edible and medicinal mushroom traditionally recognized for its health-promoting properties, and more recently investigated for its anticancer and immunomodulatory effects. Studies have identified several polysaccharides and extract fractions from this species that exhibit cell cycle-regulatory, pro-apoptotic, and immune-stimulatory properties against various cancer models. In a 2022 study, two acidic polysaccharide fractions (SPAP2-1 and SPAP2-2) isolated from *Ph. adiposa* were shown to significantly inhibit the proliferation of HeLa cervical cancer cells by inducing G0/ G1 phase cell cycle arrest and triggering apoptosis. These effects were associated with the modulation of cell cycle-regulating proteins and activation of caspase-dependent apoptotic pathways.[40] In the same year, the polysaccharide PAP-1a was evaluated for its effects on hepatocellular carcinoma cell lines HepG2, Hep3B, and Huh7. PAP-1a was found to activate macrophages and increase the secretion of NO, TNF-α, IL-6, and IL-12p70, which contributed to growth inhibition in cancer cells. It also induced G0/G1 arrest and activated intrinsic apoptotic pathways, highlighting its dual immune and cytotoxic mechanisms.[41] Another 2022 study investigated the ethanol extract (EPA) of *Ph. adiposa* in mice bearing H22 tumors. The extract suppressed tumor growth, promoted apoptosis, and inhibited angiogenesis. Interestingly, it also modulated the gut microbiota, increasing beneficial bacterial populations and reducing harmful ones, suggesting an additional mechanism through microbiome-immune axis modulation.[42] Previously, the structural characterization and bioactivity of PAP80-2a, a polysaccharide obtained via ultrasonic extraction, revealed that it is composed of glucose, rhamnose, xylose, and galactose, and exhibits strong antitumor activity. This activity is believed to be driven by immune system enhancement and apoptosis induction.[43] In conclusion, *Ph. adiposa* exerts potent anticancer effects through cell cycle arrest, immune modulation, apoptosis induction, and even gut microbiota regulation, offering significant promise as a functional food-derived antitumor agent.

I. *Auricularia auricula-judae* (Bull.) Quél.

Auricularia auricula-judae (Family: Auriculariaceae) is an edible mushroom widely consumed in Asian cuisine and used in traditional medicine, with growing evidence that supports its anticancer potential. The bioactivity of this species is linked to its diverse range of compounds, including lectins, polysaccharides, and low molecular weight secondary metabolites. A novel lectin termed AAL, isolated from *A. auricula-judae*, was shown to inhibit the proliferation of A549 human lung cancer cells with an IC_{50} of 28.19 ± 1.92 μg/mL.

RNA-sequencing analysis revealed that AAL exerts its antitumor effect by regulating genes associated with immune signaling and inflammation, including JUN, TLR4, and MYD88.[44] In hepatocellular carcinoma (HCC) models, *A. auricula-*

judae induced apoptosis by downregulating peroxiredoxin 1 (PRDX1) and reducing intracellular antioxidant defenses such as total glutathione (GSSG/GSH) and superoxide dismutase (SOD) levels.[45] These findings suggest the involvement of oxidative stress and mitochondrial dysfunction in the cytotoxic mechanism. Additional studies have demonstrated antiproliferative activity of *A. auricula-judae* extracts against bronchoalveolar and gastric cancer cells. Chemical analysis of a dichloromethane extract revealed the presence of diazane, although the antitumor activity was determined to result from a synergistic effect of multiple compounds.[46] Earlier research also identified polysaccharides such as partially O-acetylated (1→3)-α-D-mannan (T-2-HN), (1→3)- β -D-glucans (T-4-N, T-5-N), and glucuronoxyloglucomannan (U-3-A), with significant antitumor activity against sarcoma 180 tumors in murine models.[47] Together, these findings indicate that *A. auricula-judae* possesses antitumor activity through apoptosis induction, immune cell activation, oxidative stress modulation, and proliferation inhibition, making it a promising candidate for anticancer research.

J. *Auricularia polytricha* (Mont.) Sacc. (Current Name: *Auricularia nigricans* (Sw.) Birkebak, Looney & Sánchez-García)

Auricularia polytricha (Family: Auriculariaceae) is an edible mushroom widely used in traditional medicine, which has recently attracted attention due to its immunomodulatory and anticancer activities, primarily linked to its polysaccharide fractions. In a 2024 study, crude polysaccharides extracted from *A. polytricha* (APW-CP) were shown to polarize macrophages toward the M1 phenotype, enhancing the secretion of pro-inflammatory cytokines, such as IL-6, IL-1B, and TNF-α via activation of the NF-KB pathway. These activated macrophages inhibited the invasion of human breast cancer cells and promoted apoptosis, indicating a strong indirect antitumor effect through immune system activation.[48] Earlier, a purified polysaccharide termed APPIIA was reported to suppress tumor growth in mice bearing sarcoma 180 tumors. APPIIA enhanced macrophage activity by increasing phagocytosis and upregulating the production of NO, TNF-α, IL-1B, and IL-6 in a dose-dependent manner, further supporting the role of immune system modulation in its anticancer mechanism.[49] These findings suggest that the anticancer activity of *A. polytricha* is primarily mediated by activation of macrophages, which in turn regulate cytokine production and induce apoptosis in cancer cells. Thus, *A. polytricha* represents a promising natural source of immune-targeted antitumor agents.

K. *Boletus edulis* Bull.

Boletus edulis (Family: Boletaceae), commonly known as the porcini mushroom, is a globally consumed edible species that has attracted growing interest for its anticancer and antitumor properties. Recent studies have highlighted the role of its biopolymer fractions, particularly acidic polysaccharides and RNA-rich extracts, in inducing apoptosis and regulating the cell cycle in various human cancer cell lines. A 2024 study demonstrated that hydroethanolic extracts of *B. edulis* significantly suppressed the proliferation of Caco-2 colon cancer cells by inducing G0/G1 phase arrest, as well as triggering both apoptosis and autophagy. These effects were associated with mitochondrial membrane potential disruption and caspase-3 activation, indicating engagement of intrinsic apoptotic pathways.[50] In another study, a purified acidic polysaccharide (BEP) inhibited the growth of MDA-MB-231 and Ca7 1 breast cancer cells. Its mechanism involved Bax/ Bcl-2 ratio modulation, cytochrome c release, and activation of caspase-3 and -9, all consistent with mitochondrial apoptosis.[51] Several investigations have focused on a biopolymer fraction known as BE3, which has demonstrated potent antiproliferative effects in HT-29 and LS180 colon cancer cell lines. BE3 induced S-phase arrest, downregulated key regulators such as Cyclin D1, Cyclin A, and upregulated p21 and p27, along with suppression of the MAPK/Erk pathway.[52] Earlier research also reported that BE3 contains over 59% ribonucleic acid (RNA) and induces

apoptosis through caspase activation, DNA fragmentation, and modulation of genes such as BAX, BCL2, TP53, and CDKN1A in a p53-dependent manner, with variable responses observed across different cell lines.[53] Furthermore, BE3 was shown to significantly inhibit proliferation in LS180 cells via G0/G1 arrest, mediated through the p1 /cyclin D1/CDK4-6 /pRb axis, whileexhibiting no cytotoxic effects on normal colon epithelial cells (CCD 841 CoTr), suggesting selective tumor targeting.[54] In summary, *B. edulis* exerts its anticancer effects through a combination of cell cycle arrest, apoptosis induction, and regulation of gene expression and signaling pathways, with BEP and BE3 fractions emerging as particularly promising biotherapeutic candidates.

L. *Ramaria flava* (Schaeff.) Quél.

Ramaria flava (Family: Gomphaceae) is an edible mushroom species that has recently garnered attention for its anticancer and antitumor properties, driven by its diverse array of bioactive compounds, includingpolysaccharides and phenolic constituents. In a 2021 study, ethanol extracts of *R. flava* exhibited significant cytotoxic activity against multiple human cancer cell lines, including BGC-803 (gastric), NCI-H520(lung squamous), and MDA-MB-231 (triple-negative breast cancer). At a concentration of 200 μg/mL,cell growth inhibition rates reached 33.83%, 54.63%, and 71.66%, respectively. These effects were attributed to the presence of phenolic compounds and other bioactive metabolites in the mushroom extract.[55] Further investigation into the polysaccharide content of *R. flava* revealed additional antitumor activity. A 2020 *in vivo* study evaluated the effect of RF-1, a purified polysaccharide, in mice bearing S180 sarcoma tumors. At a dosage of 20 mg/kg, RF-1 inhibited tumor growth by 48.4%. Structural analysis showed that RF-1 is composed of glucose and galactose residues, with a backbone of (1→6,2)-α-D-galactopyranoseand (1→6,4)-α-D-glucopyranose units, suggesting a branched α-glucan structure that may contributeto its bioactivity.[56] Together, these findings indicate that both phenolic compounds and polysaccharidesderived from *R. flava* contribute to its anticancer effects by inhibiting cell proliferation and suppressing tumor growth, making it a valuable candidate for further exploration in natural product-based cancertherapies.

(To be continued)

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Aiming to build the relationship between the members and the Society, the publication of the newsletters was proposed before the launching of the Society. The newsletters represent one of the key official publications from the Society. Contents of the newsletters will include notifications of the decisions made by the committee board, reviews or comments contributed by ISMM committee members, conferences or activities to be organized, and the status updated in research, industrialization, and marketing for medicinal mushrooms. The newsletters will be released quarterly, by the first Monday of every January, April, July, and October, with possible supplementary issues as well. The Newsletter is open to organizations or professionals to submit news, comments, or scientific papers relating to medicinal mushroom research, marketing, or industry.

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