中国科学院中国孢子植物志编辑委员会 编辑

# 中国真菌志

## 第四十二卷

## 革菌科（一）

戴玉成 熊红霞 主编

科学出版社

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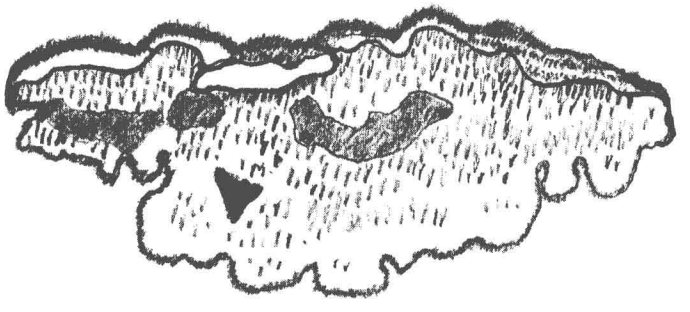
中国科学院知识创新工程重大项目
国家自然科学基金重大项目
(国家自然科学基金委员会　中国科学院　国家科学技术部　资助)



科　学　出　版　社
北　京

## 内 容 简 介

广义的革菌科是一大类木材腐朽菌，它是一个人为的分类单元，不是一个自然分类系统，是具有相似生活习性的一个真菌类群。该类真菌不但具有重要的生态学功能，同时也具有经济价值。本书阐述了该科真菌的分类地位、生物学特性、国内外研究历史与现状，并简要介绍了它们的生态习性。本书仍然按照广义的革菌科的概念，将目前所知的担孢子无色、薄壁、光滑，在梅试剂和棉蓝试剂中无变色反应的 8 属、109 种作为该科的第一卷。对每一种进行了详细的论述，包括形态特征、生境、分布、研究标本的产地及与相关种类的讨论，同时给出了每一个种的解剖结构图。

本书可供真菌学、林业、医药科研人员及大专院校相关专业的师生参考使用。

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## CORTICIACEAE S.L. (1)

REDACTORES PRINCIPALES
Dai Yucheng Xiong Hongxia

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# 革菌科(一)

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# 序

中国孢子植物志是非维管束孢子植物志，分《中国海藻志》、《中国淡水藻志》、《中国真菌志》、《中国地衣志》及《中国苔藓志》五部分。中国孢子植物志是在系统生物学原理与方法的指导下对中国孢子植物进行考察、收集和分类的研究成果；是生物多样性研究的主要内容；是物种保护的重要依据，对人类活动与环境甚至全球变化都有不可分割的联系。

中国孢子植物志是我国孢子植物物种数量、形态特征、生理生化性状、地理分布及其与人类关系等方面的综合信息库；是我国生物资源开发利用、科学研究与教学的重要参考文献。

我国气候条件复杂，山河纵横，湖泊星布，海域辽阔，陆生和水生孢子植物资源极其丰富。中国孢子植物分类工作的发展和中国孢子植物志的陆续出版，必将为我国开发利用孢子植物资源和促进学科发展发挥积极作用。

随着科学技术的进步，我国孢子植物分类工作在广度和深度方面将有更大的发展，对于这部著作也将不断补充、修订和提高。

中国科学院中国孢子植物志编辑委员会

1984 年 10 月 · 北京

# 中国孢子植物志总序

中国孢子植物志是由《中国海藻志》、《中国淡水藻志》、《中国真菌志》、《中国地衣志》及《中国苔藓志》所组成。至于维管束孢子植物蕨类未被包括在中国孢子植物志之内，是因为它早先已被纳入《中国植物志》计划之内。为了将上述未被纳入《中国植物志》计划之内的藻类、真菌、地衣及苔藓植物纳入中国生物志计划之内，出席1972年中国科学院计划工作会议的孢子植物学工作者提出筹建“中国孢子植物志编辑委员会”的倡议。该倡议经中国科学院领导批准后，“中国孢子植物志编辑委员会”的筹建工作随之启动，并于1973年在广州召开的《中国植物志》、《中国动物志》和中国孢子植物志工作会议上正式成立。自那时起，中国孢子植物志一直在“中国孢子植物志编辑委员会”统一主持下编辑出版。

孢子植物在系统演化上虽然并非单一的自然类群，但是，这并不妨碍在全国统一组织和协调下进行孢子植物志的编写和出版。

随着科学技术的飞速发展，人们关于真菌的知识日益深入的今天，黏菌与卵菌已被从真菌界中分出，分别归隶于原生动物界和管毛生物界。但是，长期以来，由于它们一直被当作真菌由国内外真菌学家进行研究；而且，在“中国孢子植物志编辑委员会”成立时已将黏菌与卵菌纳入中国孢子植物志之一的《中国真菌志》计划之内并陆续出版，因此，沿用包括黏菌与卵菌在内的《中国真菌志》广义名称是必要的。

自“中国孢子植物志编辑委员会”于1973年成立以后，作为“三志”的组成部分，中国孢子植物志的编研工作由中国科学院资助；自1982年起，国家自然科学基金委员会参与部分资助；自1993年以来，作为国家自然科学基金委员会重大项目，在国家基金委资助下，中国科学院及科技部参与部分资助，中国孢子植物志的编辑出版工作不断取得重要进展。

中国孢子植物志是记述我国孢子植物物种的形态、解剖、生态、地理分布及其与人类关系等方面的大型系列著作，是我国孢子植物物种多样性的重要研究成果，是我国孢子植物资源的综合信息库，是我国生物资源开发利用、科学研究与教学的重要参考文献。

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中国科学院中国孢子植物志编辑委员会

主编　曾呈奎

2000年3月　北京

# Foreword of the Cryptogamic Flora of China

Cryptogamic Flora of China is composed of *Flora Algarum Marinarum Sinicarum*, *Flora Algarum Sinicarum Aquae Dulcis*, *Flora Fungorum Sinicorum*, *Flora Lichenum Sinicorum*, and *Flora Bryophytorum Sinicorum*, edited and published under the direction of the Editorial Committee of the Cryptogamic Flora of China, Chinese Academy of Sciences (CAS). It also serves as a comprehensive information bank of Chinese cryptogamic resources.

Cryptogams are not a single natural group from a phylogenetic point of view which, however, does not present an obstacle to the editing and publication of the Cryptogamic Flora of China by a coordinated, nationwide organization.The Cryptogamic Flora of China is restricted to non-vascular cryptogams including the bryophytes, algae, fungi, and lichens.The ferns, a group of vascular cryptogams, were earlier included in the plan of *Flora of China*, and are not taken into consideration here.In order to bring the above groups into the plan of Fauna and Flora of China, some leading scientists on cryptogams, who were attending a working meeting of CAS in Beijing in July 1972, proposed to establish the Editorial Committee of the Cryptogamic Flora of China.The proposal was approved later by the CAS.The committee was formally established in the working conference of Fauna and Flora of China, including cryptogams, held by CAS in Guangzhou in March 1973.

Although myxomycetes and oomycetes do not belong to the Kingdom of Fungi in modern treatments, they have long been studied by mycologists. *Flora Fungorum Sinicorum* volumes including myxomycetes and oomycetes have been published, retaining for *Flora Fungorum Sinicorum* the traditional meaning of the term fungi.

Since the establishment of the editorial committee in 1973, compilation of Cryptogamic Flora of China and related studies have been supported financially by the CAS.The National Natural Science Foundation of China has taken an important part of the financial support since 1982.Under the direction of the committee, progress has been made in compilation and study of Cryptogamic Flora of China by organizing and coordinating the main research institutions and universities all over the country.Since 1993, study and compilation of the Chinese fauna, flora, and cryptogamic flora have become one of the key state projects of the National Natural Science Foundation with the combined support of the CAS and the National Science and Technology Ministry.

Cryptogamic Flora of China derives its results from the investigations, collections, and classification of Chinese cryptogams by using theories and methods of systematic and evolutionary biology as its guide.It is the summary of study on species diversity of cryptogams and provides important data for species protection.It is closely connected with human activities, environmental changes and even global changes.Cryptogamic Flora of China is a

comprehensive information bank concerning morqhology, anatomy, physiology, biochemistry, ecology, and phytogeographical distribution.It includes a series of special monographs for using the biological resources in China, for scientific research, and for teaching.

China has complicated weather conditions, with a crisscross network of mountains and rivers, lakes of all sizes, and an extensive sea area.China is rich in terrestrial and aquatic cryptogamic resources.The development of taxonomic studies of cryptogams and the publication of Cryptogamic Flora of China in concert will play an active role in exploration and utilization of the cryptogamic resources of China and in promoting the development of cryptogamic studies in China.

C. K. Tseng
Editor-in-Chief
The Editorial Committee of the Cryptogamic Flora of China
Chinese Academy of Sciences
March, 2000 in Beijing

# 《中国真菌志》序

《中国真菌志》是在系统生物学原理和方法指导下，对中国真菌，即真菌界的子囊菌、担子菌、壶菌及接合菌四个门以及不属于真菌界的卵菌等三个门和黏菌及其类似的菌类生物进行搜集、考察和研究的成果。本志所谓“真菌”系广义概念，涵盖上述三大菌类生物(地衣型真菌除外)，即当今所称“菌物”。

中国先民认识并利用真菌作为生活、生产资料，历史悠久，经验丰富，诸如酒、醋、酱、红曲、豆豉、豆腐乳、豆瓣酱等的酿制，蘑菇、木耳、荧白作食用，茯苓、虫草、灵芝等作药用，在制革、纺织、造纸工业中应用真菌进行发酵，以及利用具有抗癌作用和促进碳素循环的真菌，充分显示其经济价值和生态效益。此外，真菌又是多种植物和人畜病害的病原菌，危害甚大。因此，对真菌物种的形态特征、多样性、生理生化、亲缘关系、区系组成、地理分布、生态环境以及经济价值等进行研究和描述，非常必要。这是一项重要的基础科学研究，也是利用益菌、控制害菌、化害为利、变废为宝的应用科学的源泉和先导。

中国是具有悠久历史的文明古国，从远古到明代的4500年间，科学技术一直处于世界前沿，真菌学也不例外。酒是真菌的代谢产物，中国酒文化博大精深、源远流长，有六七千年历史。约在公元300年的晋代，江统在其《酒诰》诗中说：“酒之所兴，肇自上皇。或云仪狄，又曰杜康。有饭不尽，委之空桑。郁结成味，久蓄气芳。本出于此，不由奇方。”作者精辟地总结了我国酿酒历史和自然发酵方法，比之意大利学者雷蒂(Radi，1860)提出微生物自然发酵法的学说约早1500年。在仰韶文化时期(5000~3000 B. C.)，我国先民已懂得采食蘑菇。中国历代古籍中均有食用菇蕈的记载，如宋代陈仁玉在其《菌谱》(1245年)中记述浙江台州产鹅膏菌、松蕈等11种，并对其形态、生态、品级和食用方法等作了论述和分类，是中国第一部地方性食用蕈菌志。先民用真菌作药材也是一大创造，中国最早的药典《神农本草经》(成书于102~200 A. D.)所载365种药物中，有茯苓、雷丸、桑耳等10余种药用真菌的形态、色泽、性味和疗效的叙述。明代李时珍在《本草纲目》(1578)中，记载“三菌”、“五蕈”、“六芝”、“七耳”以及羊肚菜、桑黄、鸡纵、雪蚕等30多种药用真菌。李氏将菌、蕈、芝、耳集为一类论述，在当时尚无显微镜帮助的情况下，其认识颇为精深。该籍的真菌学知识，足可代表中国古代真菌学水平，堪与同时代欧洲人(如C. Clusius，1529~1609)的水平比拟而无逊色。

15世纪以后，居世界领先地位的中国科学技术，逐渐落后。从18世纪中叶到20世纪40年代，外国传教士、旅行家、科学工作者、外交官、军官、教师以及负有特殊任务者，纷纷来华考察，搜集资料，采集标本，研究鉴定，发表论文或专辑。如法国传教士西博特(P. M. Cibot)1759年首先来到中国，一住就是25年，对中国的植物(含真菌)写过不少文章，1775年他发表的五棱散尾菌(*Lysurus mokusin*)，是用现代科学方法研究发表的第一个中国真菌。继而，俄国的波塔宁(G. N. Potanin，1876)、意大利的吉拉迪(P. Giraldii，1890)、奥地利的汉德尔-马泽蒂(H. Handel Mazzetti，1913)、美国的梅里尔(E. D. Merrill，1916)、瑞典的史密斯(H. Smith，1921)等共27人次来我国采集标本。研究

发表中国真菌论著 114 篇册，作者多达 60 余人次，报道中国真菌 2040 种，其中含 10 新属、361 新种。东邻日本自 1894 年以来，特别是 1937 年以后，大批人员涌到中国，调查真菌资源及植物病害，采集标本，鉴定发表。据初步统计，发表论著 172 篇册，作者 67 人次以上，共报道中国真菌约 6000 种(有重复)，其中含 17 新属、1130 新种。其代表人物在华北有三宅市郎(1908)，东北有三浦道哉(1918)，台湾有泽田兼吉(1912)；此外，还有斋藤贤道、伊藤诚哉、平冢直秀、山本和太郎、逸见武雄等数十人。

国人用现代科学方法研究中国真菌始于 20 世纪初，最初工作多侧重于植物病害和工业发酵，纯真菌学研究较少。在一二十年代便有不少研究报告和学术论文发表在中外各种刊物上，如胡先骕 1915 年的“菌类鉴别法”，章祖纯 1916 年的“北京附近发生最盛之植物病害调查表”以及钱穟孙(1918)、邹钟琳(1919)、戴芳澜(1920)、李寅恭(1921)、朱凤美(1924)、孙豫寿(1925)、俞大绂(1926)、魏嗣寿(1928)等的论文。三四十年代有陈鸿康、邓叔群、魏景超、凌立、周宗璜、欧世璜、方心芳、王云章、裘维蕃等发表的论文，为数甚多。他们中有的人终生或大半生都从事中国真菌学的科教工作，如戴芳澜(1893~1973)著“江苏真菌名录”(1927)、“中国真菌杂记”(1932~1946)、《中国已知真菌名录》(1936，1937)、《中国真菌总汇》(1979)和《真菌的形态和分类》(1987)等，他发表的“三角枫上白粉菌一新种”(1930)，是国人用现代科学方法研究、发表的第一个中国真菌新种。邓叔群(1902~1970)著“南京真菌记载”(1932~1933)、“中国真菌续志”(1936~1938)、《中国高等真菌志》(1939)和《中国的真菌》(1963，1996)等，堪称《中国真菌志》的先导。上述学者以及其他许多真菌学工作者，为《中国真菌志》研编的起步奠定了基础。

在 20 世纪后半叶，特别是改革开放以来的 20 多年，中国真菌学有了迅猛的发展，如各类真菌学课程的开设，各级学位研究生的招收和培养，专业机构和学会的建立，专业刊物的创办和出版，地区真菌志的问世等，使真菌学人才辈出，为《中国真菌志》的研编输送了新鲜血液。1973 年中国科学院广州“三志”会议决定，《中国真菌志》的研编正式启动，1987 年由郑儒永、余永年等编辑出版了《中国真菌志》第 1 卷《白粉菌目》，至 2000 年已出版 14 卷。自第 2 卷开始实行主编负责制，2.《银耳目和花耳目》(刘波主编，1992)；3.《多孔菌科》(赵继鼎，1998)；4.《小煤炱目Ⅰ》(胡炎兴，1996)；5.《曲霉属及其相关有性型》(齐祖同，1997)；6.《霜霉目》(余永年，1998)；7.《层腹菌目》(刘波，1998)；8.《核盘菌科和地舌菌科》(庄文颖，1998)；9.《假尾孢属》(刘锡琎、郭英兰，1998)；10.《锈菌目Ⅰ》(王云章、庄剑云，1998)；11.《小煤炱目Ⅱ》(胡炎兴，1999)；12.《黑粉菌科》(郭林，2000)；13.《虫霉目》(李增智，2000)；14.《灵芝科》(赵继鼎、张小青，2000)。盛世出巨著，在国家“科教兴国”英明政策的指引下，《中国真菌志》的研编和出版，定将为中华灿烂文化做出新贡献。

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# Foreword of Flora Fungorum Sinicorum

*Flora Fungorum Sinicorum* summarizes the achievements of Chinese mycologists based on principles and methods of systematic biology in intensive studies on the organisms studied by mycologists, which include non-lichenized fungi of the Kingdom Fungi, some organisms of the Chromista, such as oomycetes etc., and some of the Protozoa, such as slime molds.In this series of volumes, results from extensive collections, field investigations, and taxonomic treatments reveal the fungal diversity of China.

Our Chinese ancestors were very experienced in the application of fungi in their daily life and production.Fungi have long been used in China as food, such as edible mushrooms, including jelly fungi, and the hypertrophic stems of water bamboo infected with *Ustilago esculenta*; as medicines, like *Cordyceps sinensis* (caterpillar fungus), *Poria cocos* (China root), and *Ganoderma* spp. (lingzhi); and in the fermentation industry, for example, manufacturing liquors, vinegar, soy-sauce, *Monascus*, fermented soya beans, fermented bean curd, and thick broad-bean sauce.Fungal fermentation is also applied in the tannery, paperma-king, and textile industries.The anti-cancer compounds produced by fungi and functions of saprophytic fungi in accelerating the carbon-cycle in nature are of economic value and ecological benefits to human beings.On the other hand, fungal pathogens of plants, animals and human cause a huge amount of damage each year.In order to utilize the beneficial fungi and to control the harmful ones, to turn the harmfulness into advantage, and to convert wastes into valuables, it is necessary to understand the morphology, diversity, physiology, biochemistry, relationship, geographical distribution, ecological environment, and economic value of different groups of fungi. *Flora Fungorum Sinicorum* plays an important role from precursor to fountainhead for the applied sciences.

China is a country with an ancient civilization of long standing.In the 4500 years from remote antiquity to the Ming Dynasty, her science and technology as well as knowledge of fungi stood in the leading position of the world.Wine is a metabolite of fungi.The Wine Culture history in China goes back 6000 to 7000 years ago, which has a distant source and a long stream of extensive knowledge and profound scholarship.In the Jin Dynasty (*ca.* 300 A.D.), JIANG Tong, the famous writer, gave a vivid account of the Chinese fermentation history and methods of wine processing in one of his poems entitled *Drinking Games* (Jiu Gao), 1500 years earlier than the theory of microbial fermentation in natural conditions raised by the Italian scholar, Radi (1860). During the period of the Yangshao Culture (5000—3000 B. C.), our Chinese ancestors knew how to eat mushrooms. There were a great number of records of edible mushrooms in Chinese ancient books. For example, back to the Song Dynasty, CHEN Ren-Yu (1245) published the *Mushroom Menu* (Jun Pu) in which he listed 11 species

of edible fungi including *Amanita* sp.and *Tricholoma matsutake* from Taizhou, Zhejiang Province, and described in detail their morphology, habitats, taxonomy, taste, and way of cooking. This was the first local flora of the Chinese edible mushrooms.Fungi used as medicines originated in ancient China. The earliest Chinese pharmacopocia, *Shen-Nong Materia Medica* (Shen Nong Ben Cao Jing), was published in 102—200 A. D. Among the 365 medicines recorded, more than 10 fungi, such as *Poria cocos* and *Polyporus mylittae*, were included. Their fruitbody shape, color, taste, and medical functions were provided.The great pharmacist of Ming Dynasty, LI Shi-Zhen (1578) published his eminent work *Compendium Materia Medica* (Ben Cao Gang Mu) in which more than thirty fungal species were accepted as medicines, including *Aecidium mori*, *Cordyceps sinensis*, *Morchella* spp., *Termitomyces* sp., etc.Before the invention of microscope, he managed to bring fungi of different classes together, which demonstrated his intelligence and profound knowledge of biology.

After the 15th century, development of science and technology in China slowed down.From middle of the 18th century to the 1940's, foreign missionaries, tourists, scientists, diplomats, officers, and other professional workers visited China.They collected specimens of plants and fungi, carried out taxonomic studies, and published papers, exsi ccatae, and monographs based on Chinese materials.The French missionary, P. M. Cibot, came to China in 1759 and stayed for 25 years to investigate plants including fungi in different regions of China.Many papers were written by him. *Lysurus mokusin*, identified with modern techniques and published in 1775, was probably the first Chinese fungal record by these visitors.Subsequently, around 27 man-times of foreigners attended field excursions in China, such as G. N. Potanin from Russia in 1876, P. Giraldii from Italy in 1890, H. Handel-Mazzetti from Austria in 1913, E. D. Merrill from the United States in 1916, and H. Smith from Sweden in 1921. Based on examinations of the Chinese collections obtained, 2040 species including 10 new genera and 361 new species were reported or described in 114 papers and books.Since 1894, especially after 1937, many Japanese entered China.They investigated the fungal resources and plant diseases, collected specimens, and published their identification results.According to incomplete information, some 6000 fungal names (with synonyms) including 17 new genera and 1130 new species appeared in 172 publications.The main workers were I. Miyake in the Northern China, M. Miura in the Northeast, K. Sawada in Taiwan, as well as K. Saito, S. Ito, N. Hiratsuka, W. Yamamoto, T. Hemmi, etc.

Research by Chinese mycologists started at the turn of the 20th century when plant diseases and fungal fermentation were emphasized with very little systematic work.Scientific papers or experimental reports were published in domestic and international journals during the 1910's to 1920's. The best-known are "Identification of the fungi" by H. H. Hu in 1915, "Plant disease report from Peking and the adjacent regions" by C. S. Chang in 1916, and papers by S. S. Chian (1918), C. L. Chou (1919), F. L. Tai (1920), Y. G. Li (1921), V. M. Chu (1924), Y. S. Sun (1925), T. F. Yu (1926), and N. S. Wei (1928). Mycologists who were active

at the 1930's to 1940's are H. K. Chen, S. C. Teng, C. T. Wei, L. Ling, C. H. Chow, S. H. Ou, S. F. Fang, Y. C. Wang, W. F. Chiu, and others.Some of them dedicated their lifetime to research and teaching in mycology. Prof. F. L. Tai (1893—1973) is one of them, whose representative works were "List of fungi from Jiangsu"(1927), "Notes on Chinese fungi"(1932—1946), *A List of Fungi Hitherto Known from China* (1936, 1937), *Sylloge Fungorum Sinicorum* (1979), *Morphology and Taxonomy of the Fungi* (1987), etc.His paper entitled "A new species of *Uncinula* on *Acer trifidum* Hook.& Arn."was the first new species described by a Chinese mycologist. Prof. S. C. Teng (1902—1970) is also an eminent teacher.He published "Notes on fungi from Nanking" in 1932—1933, "Notes on Chinese fungi" in 1936—1938, *A Contribution to Our Knowledge of the Higher Fungi of China* in 1939, and *Fungi of China* in 1963 and 1996.Work done by the above-mentioned scholars lays a foundation for our current project on *Flora Fungorum Sinicorum.*

In 1973, an important meeting organized by the Chinese Academy of Sciences was held in Guangzhou (Canton) and a decision was made, uniting the related scientists from all over China to initiate the long term project "Fauna, Flora, and Cryptogamic Flora of China".Work on *Flora Fungorum Sinicorum* thus started.Significant progress has been made in development of Chinese mycology since 1978.Many mycological institutions were founded in different areas of the country.The Mycological Society of China was established, the journals *Acta Mycological Sinica* and *Mycosystema* were published as well as local floras of the economically important fungi.A young generation in field of mycology grew up through postgraduate training programs in the graduate schools.The first volume of Chinese Mycoflora on the Erysiphales (edited by R. Y. Zheng & Y. N. Yu, 1987) appeared.Up to now, 14 volumes have been published: Tremellales and Dacrymycetales edited by B. Liu (1992), Polyporaceae by J. D. Zhao (1998), Meliolales Part I (Y. X. Hu, 1996), *Aspergillus* and its related teleomorphs (Z. T. Qi, 1997), Peronosporales (Y. N. Yu, 1998), Sclerotiniaceae and Geoglossaceae (W. Y. Zhuang, 1998), *Pseudocercospora* (X. J. Liu & Y. L. Guo, 1998), Uredinales Part I (Y. C. Wang & J. Y. Zhuang, 1998), Meliolales Part II (Y. X. Hu, 1999), Ustilaginaceae (L. Guo, 2000), Entomophthorales (Z. Z. Li, 2000), and Ganodermataceae (J. D. Zhao & X. Q. Zhang, 2000). We eagerly await the coming volumes and expect the completion of Flora *Fungorum Sinicorum* which will reflect the flourishing of Chinese culture.

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在本志编写过程中涉及一些传统分类系统与分子系统学不一致以及一些中文名修正的问题，得到了中国科学院微生物研究所魏江春院士的热情指导和帮助。

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由于作者业务水平和能力有限，本志中一定还存在诸多缺点和错误，谨请读者提出宝贵意见，以便再版时修改和订正。

# 目　录