

Species Diversity of Discomycetes in China*

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ABSTRACT

Four hundred and ninety-five species of Discomycetes (cup-fungi) belonging to 136 genera are currently known in China. Studies of the Chinese cup-fungi during 1983~1993 are briefly reviewed. Two fifths of the known species were discovered in this period of time. There is a high potential of finding a huge number of species in the near future. Although significant progress has been made, compared with the world record of Discomycetes the Chinese mycologists have a long way to go. Investigation and exploration of unknown and undescribed species are our urgent tasks.

Key words Discomycetes, species diversity, exploration, China

1 Introduction

The Discomycetes, a class in the Ascomycotina, includes a fairly large group of fungi. They are commonly called "cup-fungi" and characterized by the production of asci within an apothecium (a cup-shaped fruitbody) in which asci are arranged typically in a palisade layer and are usually interspersed with paraphyses (sterile filaments). Six orders are recognized in this class. According to Eriksson et al. (1991) and Korf (1991) and estimating from information provided in the 6th and 7th editions of Ainsworth and Bisby's Dictionary of the Fungi (Ainsworth et al., 1971; Hawksworth et al., 1983), at least 3800 species of 549 genera in 37 families are currently known in the world. Korf (1991) stated that there are vast areas that have been virtually unexplored and predicted that "at least half, and probably more than two thirds, of the Discomycete species that occur remain undescribed, particularly those that have small fruitbodies (3 mm or less in diam)." He pointed out, at the same time, that the traditional alpha-taxonomy for the group is still the first priority of the mycologists who work on Discomycetes today and is the basis of molecular study or cladistic analysis of the group, which means that a great number of species are waiting for our investigation.

2 Situation of Discomycete studies in China before 1983

Compared with the studies of plants and animals, our knowledge of fungi is far be-

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hind and the research history is relatively short. This is especially true in China. The earliest records of Discomycetes dated back to 1886 when the French pharmacist Patouillard reported a few fungi from Yunnan Province. The Chinese mycologists started their work at the beginning of this century. Tai (1937, 1944), Teng (1939) and some other early mycologists made great contributions to the taxonomy of Discomycetes in China. Attention was drawn first to the plant pathogenic and large-sized members of the group. Later achievements were shown in two eminent works, "Fungi of China" by Teng (1963) and "Sylloge Fungorum Sinicorum" by Tai (1979) in which a wide range of species were accumulated. Plant pathogenic Discomycetes were recorded in the plant disease flora of different provinces, such as "Fungal Diseases of Cultivated Plants in Jilin Province" (Qi et al., 1966). A total of 292 species of Discomycetes belonging to 81 genera were discovered in China during 1886~1982 (Tai, 1979; Zang, 1979).

3 Studies of Discomycetes after 1983

Significant progress has been made on the investigation, taxonomy and biology of Discomycetes since 1983. The number of species increased rapidly in the previously known genera. Many genera and species formerly unknown to China were continuously recognized. New genera and quite a number of new species were nominated based on the Chinese material. A team of scientists specialized in different taxonomic groups have grown up. The current Chinese Discomycete record is 495 species of 136 genera in 4 orders. More species are expected to be found by the end of this century.

3.1 Increase in species of some common genera known before 1983

It is unnecessary, in this paper, to provide details about the current status of all genera listed by Tai (1979). Evidences of increase in species can be shown in the following examples. *Helvella* L.: Fr. (saddle fungi) is a common genus found on the forest floor. Tai (1979) recorded 11 species of a *Helvella*. Later studies (Liu et al., 1985; Cao, 1988; Cao et al., 1990; Cao et al., 1990b; Liu, 1991) reported 16 additional taxa of the genus. *Otidea* Pers. contains species with medium-sized and ear-shaped apothecia. Most of them are easy to find in the fields. Three taxa were recorded before 1983 (Tai, 1979). Cao et al. (1990c) reviewed some species of *Otidea* in China and recorded 15 taxa including 4 new species, which is 5 times of the old records. *Scutellinia* (Cooke) Lamb, possesses fungi with apothecia measured 0.5~25 mm in diam, hymenium of red-orange color, and apothecial margin covered by brown hair (Schumacher, 1990). Most members are easy to notice and to collect in moist areas because of their bright color. Although 8 species under *Scutellinia* appeared in *Sylloge Fungorum Sinicorum* (Tai, 1979), only 5 species really belong to the genus. Later investigations and observations (Korf et al., 1985; Zhuang et al., 1989; Zhuang, 1991, 1994) indicated that 16 species have so far been found in China. *Lophodermium* Chev. is associated with conifer needles. Work done by He et al. (1985, 1986), Lin et al. (1988), Hou et al. (1992), and Lin et al. (1992, 1993a, 1993b) renovated the Chinese records dramatically by adding 15 species, including 8 new species, to the 8 species formerly listed by Tai (1979) (Table 1).

3.2 Increase of genera and species during 1983~1993

In the past 10 years, 203 species and 55 genera were newly found. Two new gener-

a, 54 new species and 4 new infraspecific taxa were published based on the Chinese collections. *Otideaopsis* (Liu et al., 1987) and *Calycellinopsis* (Zhuang, 1990) are the genera nominated from collections of Yunnan Province. New species and infraspecific taxa published are from Anhui, Beijing, Fujian, Gansu, Guangxi, Guizhou, Heilongjiang, Hubei, Jiangsu, Jilin, Liaoning, Shaanxi, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan, and Zhejiang.

Table 1 Comparisons of species number in some Discomycete genera before and after 1983.

Genus	Number of known spp. in 1886~1982	Number of species found in 1983~1993
<i>Botryotinia</i> Whetzel	2	2
<i>Coccomyces</i> de Not.	3	4
<i>Ciboria</i> Fuckel	3	3
<i>Helvella</i> L.	11	16
<i>Lophodermium</i> Chev.	8	15
<i>Otidea</i> Pers.	3	12
<i>Scutellinia</i> (Cooke) Lamb.	5	11
<i>Sarcoscypha</i> (Fr.) Boud.	2	2

There was no record on many Discomycete genera in China before 1983. Current studies provide useful information on species diversity, geographical distribution and ecological characters of the group, as well as interrelationships among some members. *Acervus* Kanouse is a very small genus containing only 2 species in the world. *A. episparti* (Berk. et al.) Pfister was found in Sichuan Province (Korf et al., 1985) and a new form was nominated later from a Yunnan collection (Zhuang et al., 1989). *Geneosperma* Rifai carries only 2 known species. One of them, *G. geneosporum* (Berk.) Rifai, was found in Tibet (Korf et al., 1987) and a new form of the same species from Guangxi Province was discovered from a misidentified specimen (Zhuang, 1994). The Chinese records of this species might prove that *G. geneosporum* is widely distributed throughout the Asia. It was formerly found in Japan and Indonesia. *Lambertella* Höhnelt includes ca. 50 species. No record of any species in this genus was found in China before 1985. Five species were first collected in Sichuan Province (Korf et al., 1985), 1 from Guizhou (Zhuang et al., 1987), 1 from Hubei, 6 from Yunnan, and 1 from Beijing (Zhuang, 1989, 1990, 1991). In such a short period, this genus became widely distributed in China. *Ionomidotis* Durand, *Nanoscypha* Denison, *Orbicula* Cooke, *Ploiderma* Darker, *Pulvinula* Boud., *Soleella* Darker, *Xeromedulla* Korf and Zhuang and many others have been added to the Chinese records (Korf et al., 1984, 1985; Liu et al., 1987; Zhuang et al., 1989; Lin et al., 1991; Liu, 1991; Zhuang, 1991; Lin et al., 1992; Hou et al., 1993). Generic names appeared after 1983 were as follows: *Acervus*, *Aleurina*, *Arachnopeziza*, *Balsamia*, *Bifusella*, *Bisporella*, *Botryotinia*, *Byssonectria*, *Calycellinopsis*, *Calycina*, *Chlorociboria*, *Chloroscypha*, *Choiromyces*, *Claussenomyces*, *Coprobria*, *Cordierites*, *Crocicreas*, *Dicephalospora*, *Encoelia*, *Fischerula*, *Galiella*, *Gelatinopsis*, *Geneosperma*, *Geopora*, *Hydnotrya*, *Hymenoscyphus*, *Ionomidotis*, *Lachnum*, *Lambertella*, *Lanzia*, *Lirula*, *Lophohacidium*, *meloderma*, *Microstoma*,

Moellerodiscus, *Myriodiscus*, *Nanoscypha*, *Orbicula*, *Otideoopsis*, *Pachyphloeus*, *Picoa*, *Plectania*, *Ploioderma*, *Proliferodiscus*, *Pseudopithyella*, *Psilachnum*, *Pulvinula*, *Sacobolus*, *Smardaea*, *Soleela*, *Tarzetta*, *Torrendiella*, *Tuber*, *Unguiculariopsis*, *Vibrissea*, and *Xeromedulla*.

3.3 Species increase from investigations of individual regions

During a field trip to Yunnan Province in 1988, 270 Discomycete specimens were collected. Rough observations of these collections showed that about 80 species of 44 genera were involved. Among them 24 genera were perviously reported from Yunnan (Tai, 1979) and 20 were new to that area. Two collecting trips were arranged in 1981 and 1983 to Sichuan Province in which about 200 Discomycete specimens were accumulated. Examinations showed that 76 species of 34 genera were likely included, in which 7 were new species, 39 were new Chinese records and 41 were new to Sichuan (Korf et al., 1984, 1985; Liu et al., 1985; Cao, 1988; Cao et al., 1990a; Wang et al., 1991; Lin et al., 1993a). Whereas, the summary of nearly a hundred year studies of Discomycetes in Sichuan by Tai (1979) revealed only 59 species of 28 genera. The above-mentioned field trips covered very limited areas in Sichuan and Yunnan Provinces and the fungi collected represented only those occurred in very short periods of the year. The diversity of Discomycetes is far beyond what one could imagine 10 years ago. It is quite evident that a huge number of Discomycetes will be found in many unexplored regions of China.

4 *Species diversity of Discomycetes in China and our future tasks*

Needless to say that Chinese mycologists have put great efforts to improve their knowledge of Discomycetes since 1983. The known species increased from 292 (81 genera) to 495 (136 genera), which means that work done in the past 10 years equals to that of 60 years before 1983. However, when we compare 495 with ca. 3800 known species in the world the Chinese Discomycetes are much under-investigated. Exploration of the natural fungal resources is an urgent task in front of us. In future studies of Discomycetes, it is suggested that more attention should be paid to species with dull-colored and small fruitbodies alongside to those with large and bright-colored apothecia.

Discomycetes live in various environmental conditions. They can be plant-parasitic, mycoparasitic, fungicolous, facultative-parasitic or saprophytic in different stages of their life cycle. Protection of environment and conservation of the endangered species are our duties. Investigations in the vast unexplored areas, recognition of the unknown species, and understanding species diversity are the basic requirements for knowing genetic diversity and ecosystem diversity. As Korf (1991) stated alpha-taxonomy in Discomycete study is our first priority. There are still huge numbers of unknown and undescribed Discomycetes in the world and in China as well. The potential use of these fungi is unpredictable. Fungi as medicines have a long history in China. Medicinal Fungi of China (Ying et al., 1987) includes mostly species of macrofungi (fungi having large fruitbodies). What about the potential use of the microfungi (species with small fruitbodies)? Some of the Discomycetes are easy to culture, while spores of the others can hardly be germinated. How can we break the spore dormancy? What are the chemicals controlling the metabolism? Many groups of Discomycetes are similar to each other

in some aspects. What are the true evolutionary relationships between or among them? Many mysteries in Discomycetes need to be untied. The first step is to explore and discover the unknown species in nature.

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