Diversity of macrofungi in Yushan, Jiangsu, China

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ABSTRACT—A checklist is presented of 84 taxa of macrofungi collected from Yushan National Forest Park, Changshu city, Jiangsu province, China. The taxa represent 48 genera and 28 families, with taxa in *Russulaceae*, *Agaricaceae*, *Amanitaceae*, *Inocybaceae*, and *Psathyrellaceae* comprising 48.8% of the total collected. The food and medicinal potentials of the taxa are indicated.

KEY WORDS—*Ascomycota*, *Basidiomycota*, natural resources

Introduction

Yushan (31°39′N 120°40′E) lies northwest of Changshu city, Jiangsu province. The mountain, which runs northwest to southeast at 263 m altitude with undulating peaks, covers 35 km^2 area south of the Yangtze River and north of Shanghu Lake and is designated a national 4A scenic spot. It has a mild subtropical monsoon climate, with four distinct seasons and abundant rainfall. Yushan has a complex topography and lush vegetation, providing good conditions for the growth and reproduction of macrofungi.

Macrofungi have become the focus of attention of researchers at home and abroad because of their value in food, decoration, and medical fields (Gao & al. 2016; Feng & al. 2016, Xu & al. 2015, Cao & al. 2012, Cupul & al. 2014, Yilmaz & Zencirci 2016, Gambato & al. 2016). In recent years, the research of mushroom diversity in our country is becoming more popular (Bau & al. 2012, Si & Dai 2016). However, there are few reports of fungal resources in southern Jiangsu (Xu & al. 2017) and a large number of macrofungal resources are yet to be discovered and developed. Therefore, surveys can not only enrich the knowledge of fungal biodiversity, but also help to discover, develop, and rationally utilize wild fungal resources.

We carried out field investigation in Yushan and identified a total of 84 taxa of macrofungi from 115 samples. The species are listed with their edible and pharmaceutical status, laying the foundation for development of macrofungal resources in southern Jiangsu.

Materials & methods

Resource investigation and specimen collection

Fungal collection began in July 2015 and ended in October 2017. In view of the close relationship between the growth of macrofungi and temperature and humidity, the time for collection in the mountain was concentrated from June to September. During the period, a team of Xu Bing, Zhao Donglei, Cao Qianjin, Yin Rui, and Wang Huali hiked up the hill three times a month on average. After discovering a fruiting body, we took pictures, observed the specimen, and completed the mushroom record table. Then we collected it, retaining as much of the specimen as possible including surface appendages such as annuli, volvas, and underground parts. Finally we put them into numbered sampling bags for transport to the laboratory, where the specimens were dried and dipped as needed. When necessary for identification, we observed spore prints and photographed the specimens.

Identification of large fungi

We identified the macrofungi primarily based on traditional morphological observation of their macroscopic and microscopic characteristics; we initially classified the collections and determined the Chinese common name consulting Li & al. (2015), Mao (2000), Gu & He (2012), and Dai & Bau (2007). The collected specimens were then determined to species and varieties according to Bau & al. (2007, 2011) and Ge & al. (2015). Voucher specimens were assigned numbers based on their collection site and stored in the large fungal herbarium of the Changshu Institute of Technology, Changshu, China (CITC).

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Checklist & analysis

Agaricus augustus Fr. (*Agaricaceae*)
31°40′14″N 120°41′04″E. Broad-leaved forest; edible. (CITC Y91).

Agaricus bernardii Quél.
31°40′18″N 120°42′37″E. Broad-leaved forest. (CITC Y36).

Agaricus campestris L.
31°41′01″N 120°41′33″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y42).

Agaricus silvaticus Schaeff.
31°39′03″N 120°43′56″E. Rotten leaves in the forest; edible & pharmaceutical. (CITC Y78).

Agrocybe praecox (Pers.) Fayod (*Strophariaceae*)
31°40′43″N 120°40′20″E. Broad-leaved forest; edible. (CITC Y43).

Aleuria aurantia (Pers.) Fuckel (*Pyronemataceae*)
31°41′03″N 120°40′55″E. Rotten leaves in the forest; edible & pharmaceutical. (CITC Y83).

Amanita fuliginea Hongo (*Amanitaceae*)
31°40′40″N 120°42′19″E. Broad-leaved forest; poisonous. (CITC Y21).

Amanita fulva Fr.
31°41′26″N 120°40′55″E. Broad-leaved forest; poisonous. (CITC Y89).

Amanita hemibapha (Berk. & Broome) Sacc.
31°40′18″N 120°42′37″E. Broad-leaved forest; pharmaceutical. (CITC Y35).

Amanita "manginiana" sensu W.F. Chiu
31°40′45″N 120°42′20″E. Broad-leaved forest; edible. (CITC Y51).

Amanita sychnopyramis* f. *subannulata Hongo
31°40′08″N 120°42′37″E. Broad-leaved forest; poisonous. (CITC Y4).

Amanita vaginata (Bull.) Lam.
31°40′50″N 120°40′22″E. Broad-leaved forest; edible. (CITC Y14).

Amanita vera (Bull.) Lam. ["*Amanita virosa*" Secr., nom. inval.]
31°40′38″N 120°42′37″E. Broad-leaved forest. (CITC Y5).

"*Amanita virosa*" Secr.; see *Amanita verna*

***Amanita* sp.**
31°40′38″N 120°42′17″E. Rotten leaves in the forest; poisonous. (CITC Y62).

Antrodiella zonata (Berk.) Ryvarden (*Polyporaceae*)
31°40′51″N 120°41′50″E. Broad-leaved forest, trunk. (CITC Y75).

Apioperdon pyriforme (Schaeff.) Vizzini (*Agaricaceae*)
≡ *Lycoperdon pyriforme* Schaeff.
31°40′42″N 120°42′19″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y19).

Auricularia delicata (Mont. ex Fr.) Henn. (*Auriculariaceae*)
31°40′23″N 120°40′37″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y69).

Auricularia mesenterica (Dicks.) Pers.
31°41′03″N 120°41′33″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y24).

Auricularia nigricans (Sw.) Birkebak, Looney & Sánchez-García
= *Auricularia polytricha* (Mont.) Sacc.
31°41′03″N 120°41′33″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y2).

Auricularia polytricha (Mont.) Sacc.; see *Auricularia nigricans*

Boletus impolitus Fr.; see *Hemileccinum impolitum*

Boletus paluster Peck (*Boletaceae*)
31°41′03″N 120°40′55″E. Forest grassland; edible. (CITC Y8).

Calvatia craniiformis (Schwein.) Fr. (*Agaricaceae*)
31°40′44″N 120°43′04″E. Rotten leaves in the forest; edible. (CITC Y82).

Clavulina coralloides (L.) J. Schröt. (*Clavulinaceae*)
31°40′47″N 120°40′5″E. Broad-leaved forest; edible. (CITC Y34).

Cortinarius caerulescens (Schaeff.) Fr. (*Cortinariaceae*)
31°40′10″N 120°41′55″E. Broad-leaved forest; edible. (CITC Y94).

Cortinarius cinnamomeus (L.) Gray
31°41′01″N 120°41′33″E. Rotten leaves in the forest; edible. (CITC Y72).

Crepidotus mollis (Schaeff.) Staude (*Inocybaceae*)
31°40′55″N 120°40′48″E. Broad-leaved forest. (CITC Y68).

***Cuphophyllus* sp.** (*Hygrophoraceae*)
31°40′45″N 120°41′53″E. Rotten leaves in the forest. (CITC Y76).

Cyclomyces xeranticus (Berk.) Y.C. Dai & Niemelä (*Hymenochaetaceae*)
31°41′27″N 120°42′37″E. Broad-leaved forest. (CITC Y3).

Daedalea modesta (Kunze ex Fr.) Aoshima (*Fomitopsidaceae*)
31°40′13″N 120°41′07″E. Broad-leaved forest, rotten branch. (CITC Y115).

Flammulina velutipes (Curtis) Singer (*Physalacriaceae*)
31°40′37″N 120°43′55″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y81).

Ganoderma australe (Fr.) Pat. (*Ganodermataceae*)
31°41′31″N 120°41′33″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y27).

Ganoderma lipsiense (Batsch) G.F. Atk.; see *Polyporus lipsiensis*

Ganoderma sichuanense J.D. Zhao & X.Q. Zhang
31°41′22″N 120°41′52″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y93).

Ganoderma tropicum (Jungh.) Bres.
31°41′03″N 120°41′33″E. Broad-leaved forest; pharmaceutical. (CITC Y12

Hebeloma crustuliniforme (Bull.) Quél. (*Hymenogastraceae*)
31°40′14″N 120°41′49″E. Broad-leaved forest; inedible. (CITC Y95).

Heimioporus japonicus (Hongo) E. Horak (*Boletaceae*)
31°40′45″N 120°42′20″E. Broad-leaved forest; edible. (CITC Y52).

Hemileccinum impolitum (Fr.) Šutara (*Boletaceae*)
≡ *Boletus impolitus* Fr.
31°40′ 42″N 120°42′17″E. Rotten leaves in the forest. (CITC Y60).

Hydnellum peckii Banker (*Bankeraceae*)
31°41′09″N 120°41′40″E. Broad-leaved forest; poisonous. (CITC Y22).

Hydnum repandum L. (*Hydnaceae*)
31°40′45″N 120°42′20″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y26).

Hypholoma fasciculare (Huds.) P. Kumm. (*Strophariaceae*)
31°41′07″N 120°42′04″E. Rotten wood; poisonous & pharmaceutical. (CITC Y92).

Inocybe cincinnata (Fr.) Quél. (*Inocybaceae*)
31°41′01″N 120°41′33″E. Broad-leaved forest. (CITC Y33).

Inocybe curvipes P. Karst.
31°41′01″N 120°41′33″E. Broad-leaved forest. (CITC Y32).

Inocybe lacera (Fr.) P. Kumm.
31°41′51″N 120°42′27″E. Broad-leaved forest. (CITC Y37).

***Kuehneromyces* sp.** (*Strophariaceae*)
31°40′45″N 120°42′20″E. Broad-leaved forest. (CITC Y45).

Lactarius acerrimus Britzelm. (*Russulaceae*)
31°41′03″N 120°41′33″E. Broad-leaved forest. (CITC Y88).

Lactarius deliciosus (L.) Gray
31°40′31″N 120°40′49″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y30).

Lactarius necator (Bull.) Pers.
31°41′21″N 120°41′33″E. Broad-leaved forest; edible. (CITC Y39).

Lactarius sanguifluus (Paulet) Fr.
31°40′39″N 120°42′27″E. Rotten leaves in the forest. (CITC Y53).

Lactarius volemus (Fr.) Fr.
31°40′14″N 120°41′04″E. Broad-leaved forest; edible. (CITC Y77).

Lactarius zonarius (Bull.) Fr.
31°40′42″N 120°42′19″E. Broad-leaved forest; pharmaceutical. (CITC Y18).

Langermannia fenzlii (Reichardt) Kreisel (*Agaricaceae*)
31°40′48″N 120°42′22″E. Broad-leaved forest; pharmaceutical. (CITC Y41).

Lepiota alba (Bres.) Sacc.; see *Lepiota erminea*

Lepiota erminea (Fr.) P. Kumm. (*Agaricaceae*)
= *Lepiota alba* (Bres.) Sacc.
31°40′39″N 120°42′14″E. Rotten leaves in the forest. (CITC Y66).

Leucocoprinus fragilissimus (Ravenel ex Berk. & M.A. Curtis) Pat. (*Agaricaceae*)
31°41′05″N 120°40′47″E. Broad-leaved forest. (CITC Y106).

Leucopaxillus albissimus (Peck) Singer (*Tricholomataceae*)
31°40′55″N 120°40′49″E. Broad-leaved forest. (CITC Y99).

Lycoperdon asperum (Lév.) Speg. (*Agaricaceae*)
31°40′45″N 120°42′20″E, Rotten bamboo leaves; pharmaceutical. (CITC Y58).

Lycoperdon pyriforme Schaeff.: see *Apioperdon pyriforme*

Marasmiellus candidus (Fr.) Singer (*Omphalotaceae*)
31°39′03″N 120°43′23″E. Dead & fallen branches & twigs. (CITC Y44).

Marasmiellus distantifolius (Murrill) Singer
31°41′01″N 120°41′33″E. Broad-leaved forest. (CITC Y31).

Marasmius bekolacongoli Beeli (*Marasmiaceae*)
31°41′41″N 120°40′34″E. Broad-leaved forest. (CITC Y103).

Marasmius hymeniicephalus (Speg.) Singer
31°40′82″N 120°42′37″E. Broad-leaved forest; inedible. (CITC Y7).

Marasmius oreades (Bolton) Fr.
31°40′14″N 120°43′49″E. Broad-leaved forest; pharmaceutical. (CITC Y80).

Melanophyllum haematospermum (Bull.) Kreisel (*Agaricaceae*)
31°40′38″N 120°40′48″E. Broad-leaved forest, rotten branch. (CITC Y71).

Micromphale foetidum (Sowerby) Singer (*Omphalotaceae*)
31°40′55″N 120°40′48″E. Rotten leaves in the forest. (CITC Y67).

Oudemansiella radicata (Relhan) Singer (*Physalacriaceae*)
31°40′55″N 120°40′49″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y97).

Parasola plicatilis (Curtis) Redhead, Vilgalys & Hopple (*Psathyrellaceae*)
31°41′17″N 120°40′56″E. Broad-leaved forest; pharmaceutical. (CITC Y9).

Pleurotus nebrodensis (Inzenga) Quél. (*Pleurotaceae*)
31°41′03″N 120°41′33″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y25).

Pluteus leoninus (Schaeff.) P. Kumm. (*Pluteaceae*)
31°40′41″N 120°42′19″E. Broad-leaved forest; edible. (CITC Y20).

Polyporus lipsiensis (Batsch) E.H.L. Krause (*Polyporaceae*)
≡ *Ganoderma lipsiense* (Batsch) G.F. Atk.
31°41′03″N 120°41′33″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y1).

Psathyrella candolleana (Fr.) Maire (*Psathyrellaceae*)
= *Psathyra appendiculata* (Bull.) G. Bertrand]
31°40′35″N 120°42′32″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y59).

Psathyrella candolleana* var. *solitaria A.H. Sm.
31°40′50″N 120°40′22″E. Broad-leaved forest; edible. (CITC Y15).

Psathyrella spadicea (P. Kumm.) Singer
31°41′03″N 120°40′55″E. Rotten leaves in the forest. (CITC Y84).

Psathyrella spadiceogrisea (Schaeff.) Maire
31°40′46″N 120°42′19″E. Broad-leaved forest. (CITC Y17).

Ramaria formosa (Pers.) Quél. (*Gomphaceae*)
31°39′03″N 120°43′27″E. Rotten leaves in the forest; pharmaceutical. (CITC Y54).

Russula amoena Quél. (*Russulaceae*)
31°40′42″N 120°42′21″E. Rotten leaves in the forest. (CITC Y63).

Russula decolorans (Fr.) Fr.
31°40′22″N 120°40′41″E. Broad-leaved forest, rotten branch. (CITC Y70).

Russula fellea (Fr.) Fr.
31°40′52″N 120°40′51″E. Broad-leaved forest. (CITC Y85).

Russula pectinatoides Peck
31°41′01″N 120°41′33″E. Broad-leaved forest, moss; edible. (CITC Y74).

Russula rosea Pers.
31°41′05″N 120°40′47″E. Broad-leaved forest; edible. (CITC Y109).

Russula subdepallens Peck
31°40′42″N 120°42′17″E. Rotten leaves in the forest; edible. (CITC Y61).

Russula vesca Fr.
31°40′14″N 120°41′04″E. Broad-leaved forest; edible & pharmaceutical. (CITC Y90).

Russula virescens (Schaeff.) Fr.
31°39′59″N 120°44′02″E. Broad-leaved forest; edible. (CITC Y40).

Schizophyllum commune Fr. (*Schizophyllaceae*)
31°40′02″N 120°42′37″E. Broad-leaved forest, lignicolous; edible & pharmaceutical. (CITC Y11).

Trametes versicolor (L.) Lloyd (*Polyporaceae*)
31°40′49″N 120°42′22″E. Broad-leaved forest; pharmaceutical. (CITC Y13).

Tricholoma fulvum (Bull.) Bigeard & H. Guill. (*Tricholomataceae*)
31°40′45″N 120°42′20″E. Broad-leaved forest; pharmaceutical. (CITC Y48).

Tricholoma saponaceum (Fr.) P. Kumm.
31°39′41″N 120°44′17″E. Broad-leaved forest, rotten wood; inedible. (CITC Y65).

Volvariella volvacea (Bull.) Singer (*Pluteaceae*)
31°40′39″N 120°42′14″E. Broad-leaved forest, rotting grass; pharmaceutical. (CITC Y64).

Xylaria carpophila (Pers.) Fr. (*Xylariaceae*)
31°40′03″N 120°40′57″E. Broad-leaved forest, rotten chestnut shell. (CITC Y111).

Table 1. Summary of families represented by collections.

Family	Genera	Taxa	% of taxa	Order	Phylum
Agaricaceae	8	11	13.1	*Agaricales*	*Basidiomycota*
Amanitaceae	1	8	9.5	*Agaricales*	*Basidiomycota*
Auriculariaceae	1	3	3.6	*Auriculariales*	*Basidiomycota*
Bankeraceae	1	2	2.4	*Thelephorales*	*Basidiomycota*
Boletaceae	3	3	3.6	*Boletales*	*Basidiomycota*
Clavulinaceae	1	1	1.2	*Cantharellales*	*Basidiomycota*
Cortinariaceae	1	2	2.4	*Agaricales*	*Basidiomycota*
Fomitopsidaceae	1	1	1.2	*Polyporales*	*Basidiomycota*
Ganodermataceae	1	3	3.6	*Polyporales*	*Basidiomycota*
Gomphaceae	1	1	1.2	*Gomphales*	*Basidiomycota*
Hydnaceae	1	1	1.2	*Cantharellales*	*Basidiomycota*
Hygrophoraceae	1	1	1.2	*Agaricales*	*Basidiomycota*
Hymenochaetaceae	1	1	1.2	*Hymenochaetales*	*Basidiomycota*
Hymenogastraceae	1	1	1.2	*Agaricales*	*Basidiomycota*
Inocybaceae	2	4	4.8	*Agaricales*	*Basidiomycota*
Marasmiaceae	1	3	3.6	*Agaricales*	*Basidiomycota*
Omphalotaceae	2	3	3.6	*Agaricales*	*Basidiomycota*
Physalacriaceae	2	2	2.4	*Agaricales*	*Basidiomycota*
Pleurotaceae	1	1	1.2	*Agaricales*	*Basidiomycota*
Pluteaceae	2	2	2.4	*Agaricales*	*Basidiomycota*
Polyporaceae	3	3	3.6	*Polyporales*	*Basidiomycota*
Psathyrellaceae	2	4	4.8	*Agaricales*	*Basidiomycota*
Pyronemataceae	1	1	1.2	*Pezizales*	*Ascomycota*
Russulaceae	2	14	17.5	*Russulales*	*Basidiomycota*
Schizophyllaceae	1	1	1.2	*Agaricales*	*Basidiomycota*
Strophariaceae	3	3	3.6	*Agaricales*	*Basidiomycota*
Tricholomataceae	2	3	3.6	*Agaricales*	*Basidiomycota*
Xylariaceae	1	1	1.2	*Xylariales*	*Ascomycota*
Totals	48 genera	84 taxa	(100)	11 orders	2 phyla

Discussion

Five families—*Russulaceae* (14 taxa in 2 genera), *Agaricaceae* (11 taxa in 8 genera), *Amanitaceae* (8 taxa in 1 genus), *Inocybaceae* (4 taxa in 2 genera), and *Psathyrellaceae* (4 taxa in 2 genera)—represented 48.8% of the taxa collected.

The common macrofungi in Yushan were *Amanita vaginata, Auricularia nigricans, Lactarius deliciosus, Langermannia fenzlii,* and *Xylaria carpophila;* and rare macrofungi were *Amanita hemibapha, Amanita vera, Boletus paluster, Hemileccinum impolitum,* and *Tricholoma saponaceum.*

Of the 84 collected taxa, 37 were categorized as edible (Dai & al. 2010, Bau 2012, Wang & al. 2017), 30 as pharmaceutically useful (Wu & al. 2013, Dai & al. 2009, Mao 1998, Dai & Yang 2008, Zhao & al. 2000), and six as poisonous (Mao 2006, Bau & al. 2014, Ren & Bau 2016, Liu 2006); of these 18 taxa have been categorized as both edible & pharmaceutically useful, and one taxon as both poisonous and pharmaceutically useful. Those commonly eaten by local people are *Auricularia nigricans, Lactarius deliciosus, Oudemansiella radicata, Russula subdepallens,* and *Russula virescens;* however, many other edible and pharmaceutically useful taxa are not collected and used, representing a waste of the macrofungal resources of Yushan.

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Literature cited

Bau T. 2012. List of agarics and boletoid fungi from eastern Inner Mongolia. Journal of Fungal Research 10: 20–30.

Bau T, Yevgeniya MB, Zhuang JY, Li Y. 2007. Agarics and other macrobasidiomycetes from Ussuri River Valley. Mycosystema 26(3): 349–368.

Bau T, Liu WZ, Fan YG, Kang GP. 2011. A checklist of macrofungi collected from different forests in Changbai Mountains (V): deciduous forest. Journal of Fungal Research 9: 77–87, 99.

Bau T, Wang JR, Cui BK, Liu Y. 2012. Diversity of macrofungi in Shandong Province, China. Mycosystema 32: 643–670. https://doi.org/10.13346/j.mycosystema.2013.04.014

Bau T, Bao HY, Li Y. 2014. A revised checklist of poisonous mushrooms in China. Mycosystema 33: 517–548.

Cao Y, Wu SH, Dai YC. 2012. Species clarification of the prize medicinal *Ganoderma* mushroom "Lingzhi". Fungal Diversity 56(1): 49–62. https://doi.org/10.1007/s13225-012-0178-5

Cupul WC, Abarco GH, Vázquez RR, Salmones D, Hernández RG, Gutiérrez EA. 2014. Response of ligninolytic macrofungi to the herbicide atrazine: dose-response bioassays. Revista Argentina de Microbiología 46: 348–357. https://doi.org/10.1016/S0325-7541(14)70094-X

Dai YC, Bau T. 2007. Illustrations of edible and medicinal fungi in northeastern China. Beijing: Science Press. 208 p.

Dai YC, Yang ZL. 2008. A revised checklist of medicinal fungi in China. Mycosystema 27: 801–824.

Dai YC, Yang ZL, Cui BK, Yu CJ, Zhou LW. 2009. Species diversity and utilization of medicinal mushrooms and fungi in China. International Journal of Medicinal Mushrooms 11: 287–302. https://doi.org/10.1615/IntJMedMushr.v11.i3.80

Dai YC, Zhou LW, Yang ZL, Wen HA, Bau T, Li TH. 2010. A revised checklist of edible fungi in China. Mycosystema 29: 1–21.

Feng T, Wang WH, Zhang JS, Fan H, Jia W, Bao HY. 2016. Effects of *Flammulina velutipes* different extracts on tumor cells. Mycosystema 35: 1234–1243.

Gambato G, Todescato K, Pavão EM, Scortegagna A, Fontana RC, Salvador M, Camassola M. 2016. Evaluation of productivity and antioxidant profile of solid-state cultivated macrofungi *Pleurotus albidus* and *Pycnoporus sanguineus*. Bioresource Technology 201: 46–51. https://doi.org/10.1016/j.biortech.2016.01.121

Gao C, Luo J, Liu X. 2016. Recent advances in the studies of chemical compositions and bioactivities of the genus *Xylaria*. Mycosystema 35: 767–781.

Ge ZW, Liu XB, Zhao K, Yang ZL. 2015. Species diversity of *Flammulina* in China: new varieties and a new record. Mycosystema, 34(4): 589-603.

Gu XW, He BW. 2012. Macrofungi in the mountain area of southern Zhejiang. Hangzhou: Zhejiang Science and Technology Press. 208 p.

Li Y, Li TH, Yang ZL. 2015. Atlas of Chinese macrofungal resources. Zhengzhou: Zhongyuan Publishing House. 1351 p.

Liu ZX. 2006. Poisonous mushroom species and poisoning cause analysis in Xianning of Hubei Province. Edible Fungi of China 25(6): 12–13,

Mao XL. 1998. Economic fungi of China. Beijing: Science Press. 762 p.

Mao XL. 2000. The macrofungi in China. Zhengzhou: Henan Publishing House of Science & Technology. 719 p.

Mao XL. 2006. Chinese poisonous mushrooms and their toxins. Mycosystema 25: 345–363.

Ren JL, Bau T. 2016. Investigation of poisonous mushrooms resources in Jilin Province. Journal of Fungal Research 14: 86-95.

Si J, Dai YC. 2016. Wood-decaying fungi in eastern Himalayas 5. Polypore diversity. Mycosystema 35(3): 252–278.

Wang FJ, Zhou XY, Jiang AM, Pan K. 2017. Study on the diversity of large fungi on the campus of Hanjiang Normal College. Journal of Hanjiang Normal College 37: 11–16.

Wu XL, Mao XL, Bau T. 2013. Medicinal fungi in China. Beijing: Science Press. 923 p.

Xu B, Zhang WT, Ji H. 2015. Research and application of accelerator on *Auricularia polytricha* mycelial growth. Edible Fungus in China 34: 44-46, 59.

Xu B, Zhang YQ, Ji H. 2017. The optimization of solid medium of the *Termitomyces albuminosus*. Food Research and Development 38: 175–178, 221.

Yilmaz H, Zencirci N. 2016. Ethnomycology of macrofungi in the Western Black Sea region of Turkey: identification to marketing. Economic Botany 70(3): 270–284. https://doi.org/10.1007/s12231-016-9353-z

Zhao JD, Zhang XQ. 2000. Flora fungorum sinicorum. Vol. 18, *Ganodermataceae*. Beijing: Science Press. 204 p.