Poisonous Mushrooms Known from China - Species Resources and Distribution

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Abstract: There are many poisonous mushrooms (toadstools) occurring in China. More than 200 species have been reported, and new recordings are still to be recognized. To many common people, some of these poisonous species are very similar to edible mushrooms. As a result, disasters happen every year, especially in the south of China, when wild mushroom collectors eat the poisonous mushrooms. This paper describes the species resources and distributions of Chinese poisonous mushrooms. All the known taxa from China, as far as the authors' knowledge extends, are listed. The provinces and autonomous regions where each species is found are noted, doubtful poisonous species are cited, certain mistaken records are corrected, and the resources are discussed. Examples of the disasters that have happened in recent years are also introduced.

Key words: Poisonous mushrooms, species, distribution, China

1 Introduction

There are many wild edible fungi occurring in China, including, for example, the famous *Tricholoma masutake* and *Boletus edulis*. Unfortunately, poisonous mushrooms are also abundant. To common people, some of them are very similar, so that disasters happen every year when the poisonous mushrooms are eaten by the wild mushroom collectors, especially in the south of China. For example, in March 2000, nine workers in the suburbs of Guangzhou collected and ate a kind of wild mushrooms that they considered to be the same as another kind of edible mushroom occurring in their hometown. Sadly, eight of them died in the hospital within several days, while the sole survivor lived a miserable life for another six months before passing away. The mushrooms were later identified as the very toxic species, *Amanita exitialis*.[1]

Although Chinese people have known about some poisonous mushrooms since ancient times, scientific studies on poisonous mushrooms began rather late, and the experts have now undertaken extensive studies in this area. For example, Teng[2] recorded about 20 poisonous species, and the Mycologist Group of the Institute of Microbiology of the Chinese Academy of Sciences[3] published a book "Poisonous Mushrooms." Mao[4-6] has also published several books on the subject. Yang & Mao,[7] Zhang,[8] Hou & Di,[9] Liao,[10] Liu & Wang,[11] and Xiao et al.[12] have described some identification and therapeutic methods. Li & Zhang,[13] Zhang et al., [14, 15] Zhang et al.,[16] Hu et al.,[17] and Chen et al.[18-20] had reported studies on toxin analyses, extraction, purification and identification. Yang[21-25] and Yang et al.[26] have described the discovery of several new toxic species, and have corrected inaccuracies in the naming of some Chinese taxa. At present, more than 200 species have been reported in China. These are listed in Table 1.

Table 1. List of known poisonous mushrooms and their distribution in China

Abbreviation of Provinces and Municipalities in the list and their known species numbers: AH: Anhui (36); BJ: Beijing (16); FJ: Fujian (49); GD: Guangdong (106); GS: Gansu (40); GX: Guangxi (28); GZ: Guizhou (27); HA: Hainan (26); HEB: Hebei (57); HEN: Henan (22); HK: Hongkong (26); HL: Heilongjiang (32); HUB: Hubei (12); HUN: Hunan (63); IM: Inner Mongolia (9); JL: Jilin (75); JS: Jiangsu (56); JX: Jiangxi (10); LN: Liaoning (13); NX: Ningxia (3); QH: Qinghai (39); SA: Shaaxi (38) 陕西; SC: Sichuan (93); SD: Shandong (2) ; SH:Shanghai (10); SX: Shanxi 山西 (24); TB: Tibet (93); TW: Taiwan (28); XJ: Xinjiang (33); YN: Yunnan (107); ZJ: Zhejiang (14)

(The numbers above in the parentheses are the numbers of poisonous species known from those places. List is arranged according to the taxonomic system of Kirk et al.[27]. The question marks "?" in front of some species names indicate those species were sometimes reported as poisonous fungi, but as edible in other records.)

Ascomycota
Ascomycetes
Leotiomycetidae
Helotiales
Dermateaceae
1) *Mollisia* sp. -HUN, SA.
Pezizomycetidae
Pezizales
Discinaceae
2) ? *Gyromitra esculenta*-HL, SC, TB, YN.
3) *Gyromitra infula* -JL, GS, HL, QH, SC, SX, XJ, TB.
Helvellaceae
4) ? *Acetabula leucomelas*-QH, XJ.
5) ? *Helvella lacunose*- GS, HEB, HL, JL, JS, QH, SA, SC, SX, TB, XJ, YN.
6) ? *Helvella pulla* -HEB, GS, JS, QH, SC, XJ, YN.
Morchellaceae
7) ? *Disciotis venosa*-SC.
8) ? *Verpa bohenica* -SA, XJ.
Basidiomycota
Basidiomyceates
Agaricomycetidae
Agaricales
Agaricaceae
9) *Agaricus pequinii*-HEB, QH.
10) ?*Agaricus placomyces* -FJ, GD, GS, GX, GZ, HEB, HK, HL, HUN, IM, JL, JS, SA, SC, SD, SX, TB, TW, YN, ZJ.
11) *Agaricus praeclaresquamulosus* -GD, GX, HEB, HK.
12) *Agaricus semotu*-BJ, TB.
13) *Agaricus xanthodemus* -HEB, QH, SX, TB, XJ.
14) *Chlorophyllum molybdites*-GD, HA, HK, TW..
15) *Lepiota brunneo-incarnata* -AH, BJ, HEB, HL, JS, NX, SC, SH, SX..
16) ? *Lepiota clypeolaria*-GD, HK, HL, JL, JS, QH, SX, TB, XJ, YN.
17) *Lepiota cristata*-GS, HEB, HK, HUN, JS, QH, SA, TB.
18) *Lepiota helveola* -BJ, HEB, JS, QH, SH, TB, YN.
19) ? *Leucoagaricus naucinus* -BJ, HEB, HEN, IM, JL, JS, QH, YN.
20) *Leucocoprinus birnbaumii* = *Lepiota luteus*-GD, HA, HK, FJ, TW, YN.
21) *Leucocoprinus cepaestipes*-GD, HEB, HUN.
Bolbitiaceae
22) *Conocybe tenera* -FJ, GD, GZ, HUN, JS, SA, SC, TB, XJ, YN.
23) *Hebeloma crustuliniforme*-HEB, JL, QH, TB, XJ, YN.
24) *Hebeloma sinapizans*-JL, SA, SC, SX, YN.
25) *Hebeloma fastibile*-GZ, HEB, QH, TB.
26) *Hebeloma saccharioleus*-GS, HL, JL, SC, SX, YN.
27) *Panaeolus campanulatus*-GD, GS, HEB, JL, SC, SX, TB, YN.
28) *Panaeolus cynescens* -FJ, GD.
29) *Panaeolus fimicola* -GD, IM, JS, SX, TW.
30) *Panaeolus foenisecii*-HEB, JL.
31) *Panaeolus phalenarum* -GD, GS, HK, TB, YN.
32) *Panaeolus papilionaceus* -GD, GS, HK, SA, SX, TB, XJ.
33) *Panaeolus retirugis* -GD, GX, HEB, HUN, JL, JS, QH, SC, ZJ.
34) *Panaeolus separatus* -SC, TB, XJ .
35) *Panaeolus solidipes* -HEB, SX, TW.
36) *Panaeolus sphinctrinus* -FJ, GD, GS, HK, SA, SC, TW, XJ, YN.
37) *Panaeolus subbalteatus* (Berk .& Br.)Sacc. -GS, NX, QH.
珊瑚菌科 Clavariaceae
38) ? *Clavariadelphus pistillaris*-FJ, GS, HEB, HL, HUN, JL, SC, TB, YN.
39) *Ramaria formosa*.-AH, FJ, GS, HEB, HEN, HL,

JL, SC, TB, YN.
40) ? *Ramaria flava* -FJ, GD, GS, HEN, LN, SC, SX, TB, TW, YN.
41) *Ramaria fumigata* -AH, SC, YN.
42) ? *Ramaria mairei* -AH, FJ, QH, TB, YN.

Coprinaceae

43) *Coprinus atramentarius*-FJ, GD, GS, GZ, HEB, HL, HUN, JL, JS, QH, SA, SC, TB, TW, XJ, YN.
44) *Coprinus comatus*-GD, GS, HEB, QH.
45) *Coprinus ovatus*-GD, GS, HEB, LN, QH, SA, SC, TB.

Cortinariaceae

46) *Cortinarius bolaris* -HUN.
47) *Cortinarius gentilis* -GS, HUB, QH.
48) *Cortinarius orellanus* -JL, LN.
49) *Cortinarius rubicundulus* -QH, SA.
50) *Cortinarius speciosissimus* -TB.
51) *Galerina autumnalis*-GS, GZ, SC, SX, TB, XJ.
52) *Galerina subpectinata*.-SC.
53) *Galerina sulciceps*-JX.
54) *Galerina marginata*-XJ, YN.
55) *Galerina tibiicystis*-GD.
56) *Gymnopilus aeruginosus*-FJ, GD, GS, GX, HA, HEN, HK, HUN, JL, TB, YN.
57) *Gymnopilus spectabilis*-FJ, GD, GX, HA, HL, HUN, JL, TB, YN.
58) *Inocybe asterospora*-FJ, GZ, HK, HUB, HUN, JL, JS, SC, SX, YN, ZJ.
59) *Inocybe brunnea*.-TB, YN.
60) *Inocybe caesariata*-HEB, JL, JS, SC, XJ, YN.
61) *Inocybe calamistrata*-GD, HUN.
62) *Inocybe cookei*-GD, TB, XJ, YN.
63) *Inocybe decipientoides*-TB, ZJ.
64) *Inocybe fastigiata*-FJ, GD, GS, HEB, JL, TB, XJ, YN.
65) *Inocybe flavobrunnea*-SC, TB .
66) *Inocybe flocculosa*-YN.
67) *Inocybe geophylla*-GD, HL, JL.
68) *Inocybe lanuginosa*-GD, HUN, JL, SC, TB.
69) *Inocybe lilacina*-GD, HEB, HL, JL, SC.
70) *Inocybe pudica*-GD.
71) *Inocybe radiate*-HEB, JS, SC, XJ, YN.
72) *Inocybe repanda*-JS, SC, ZJ..
73) *Inocybe rimosa*-GD, HK, HUB, JL, JS, QH, TB, XJ, YN..
74) *Inocybe umbrinella*-HK, HEB, JL, SC, SX, TB, YN.

Entolomataceae

75) *Rhodophyllus aprilis*-TB.
76) *Rhodophyllus glaucocanus*-GD.
77) *Rhodophyllus lazulinus*-GX, HK.
78) *Rhodophyllus murraii*-HUN.
79) *Rhodophyllus nidorosus*-HUN, JL, LN, SC.
80) *Rhodophyllus rhodopolius*-FJ, GD, GS, HUN, JL, SC, TB, YN.
81) *Rhodophyllus nitidus*-HUN.
82) *Rhodophyllus salmoneus*-FJ, TB, YN.
83) *Rhodophyllus sinuatus*-AH, GD, GS, HEB, HEN, HL, JL, JS, SC, TW.

Hygrophoraceae

84) ?*Hygrocybe ovina*-GD.
85) *Hygrocybe reai*-SC, TB.
86) *Hygrophorus conicus*-GD, HK.

Lycoperdaceae

87) *Lycoperdon marginatum*-IM, SA.

Marasmiaceae

88) *Omphalotus olearius* -SX, YN.

Pluteaceae

89) *Amanita exitialis*-GD.
90) *Amanita farinosa*-GD, GZ, HA, HJ, HUN, JS, T B, YN.
91) *Amanita fritillaria f. fritillaria* -AH, FJ, GD, GX, GZ, HA, HUB, HUN, JL, JS, SC, TB, TW, YN.
92) *Amanita fuliginea*-GD, HUN, SC, YN.
93) ?*Amanita griseoverrucosa*-FJ, GD, HA, JS, SC, YN.
94) *Amanita gymnopus*-GD, HUN, TW.
95) *Amanita incarnatifolia* -AH, GD, JS, SC, TW, YN.
96) *Amanita japonica* -TW, GD, HA, YN.
97) *Amanita kotohiraensis*-JS, GD, HA, AH, HUN, SC, TW, YN.
98) *Amanita longistriata* -GD, HA, HUB, HUN, SA..
99) *Amanita melleiceps*- FJ, GD, GX, HUN.
100) *Amanita muscaria* -HL, JL, XJ.
101) *Amanita neoovoidea*-GD, GX, HUN, JX, SC, YN..
102) *Amanita oberwinklerana* -GD, GZ, HUN, SC, TW.
103) *Amanita pseudoporphyria* -FJ, GD, GS, GX, GZ, HA, HUN, JS, SC, YN.
104) *Amanita rubrovolvata*-GD, HUB, SC, TB, YN, Z J.
105) *Amanita subfrostiana* -GD, TB, YN.
106) *Amanita subjunguillea var. alba* -BJ, GD, GS,

GZ, HEN, HUB, HUN, JL, SA, SC, TB, TW, YN.
107) *Amanita subjunguillea* var. *subjunguillea* -GD, GZ, HEB, JL.
108) *Amanita sychnopyramis* f. *subannulata* (=A. kwangsiensis) -FJ, GD, G X, HA, HUN, YN.
109) *Amanita virgineoides*-AH, GD, HA, HUN, JS, JX, SC, TW, YN.
110) *Volvariella speciosa*-GD, HK, HUN, JL.

Strophariaceae

111) *Hypholoma cinnabarinum* -GD, HA, HK, JS, TB, YN.
112) *Naematoloma dispersum* -TB.
113) *Naematoloma fasciculare* -AH, GD, GS, GX, HEB, HEN, HL, HUN, JL, JS, QH, SA, SC, TB, TW, YN.
114) *Naematoloma squamosum* -SA, TB.
115) *Naematoloma sublateritium* -HUN, JX, JL, QH, SA, SX, TB, TW, XJ, YN.
116) *Pholiota flammans* -GZ, HL, JL, LN, SC, TB.
117) ? *Pholiota squarrosa* -GS, HEB, JL, QH, SC, TB, XJ, YN.
118) *Psilocybe argentipes*-TB.
119) *Psilocybe coprophila* -GD, HUN, TB.
120) *Psilocybe cubensis* -GD, TB.
121) *Psilocybe cyanescens* -FJ.
122) *Psilocybe fasciata* -HK.
123) *Psilocybe merdaria*. -HA, TB, XJ.
124) *Psilocybe venenata* -SX, XJ.
125) ? *Stropharia coronilla*-GS, GX, HEN, IM, QH, SA, SX, TB, XJ, YN.
126) ? *Stropharia semiglobata*-GS, HEB, HUN, JS, JL, SX, TB, YN.
127) *Stropharia yunnanesis*-YN.

Tricholomataceae

128) *Clitocybe cerussata* -JL, QH, SC, YN.
129) *Clitocybe dealbata* -QH.
130) *Clitocybe etypoides* -GD.
131) ? *Clitocybe nebularis* -HEN, HL, JL, QH, SC, S X.
132) *Clitocybe opaca* -JL.
133) *Clitocybe phyllophila* -JL, SC, YN.
134) *Clitocybe rivulosa* -HEB, QH.
135) ? *Collybia dryophila* -AH, GD, GS, HEB, HEN, IM, JL, SA, TB, YN.
136) *Lampteromyces japonicus* -FJ, GZ, HUN.
137) *Lampteromyces mangensis* -HUN.
138) *Panellus stypticus* -FJ, GD, GS, GX, GZ, HEB, HL, HUN, IM, JL, QH, SA, SX, TB, YN.
139) *Panellus tuberculosporus*-GD.
140) ? *Phaeolepiota aurea*-FJ, GS, JL, SA, TB.
141) ? *Tricholoma acerbum*-HEB, HL, QH.
142) ? *Tricholoma album*-HUN, JL, QH, SA.
143) *Tricholoma muscarium*-HUB, HUN.
144) *Tricholoma pardinuim*-SC, YN.
145) ? *Tricholoma pessundatum*-GD, SA, SC, TB, YN..
146) *Tricholoma tigrinum* -YN.
147) *Tricholoma virgatum*-JL, SC, SX.
148) *Tricholomopsis rutilans* -GS, GX, JL, QH, SA, SC, TB, TW, XJ.

Boletales

Boletaceae

149) *Boletellus ananas*-FJ, GD, GX, HK, SC, TB, YN.
150) *Boletellus ananicepss* -GD, HA.
151) ? *Boletinus pinetorum*-AH, FJ, GD, GZ, HUN, JL, SC, TB, YN.
152) *Boletus calopus*-TB, YN.
153) ?*Boletus erythropus* -AH, FJ, GD, HA, HUN, JL, JS, JX, SC, SD, TB, TW, XJ, YN, ZJ.
154) ? *Boletus luridus*-AH, GD, GS, HEB, HEN, HL, JS, SC, XJ, YN.
155) ? *Boletus magnificus*-GD, TB, YN.
156) *Boletus magasporus*-SC, YN.
157) *Boletus parasiticus*-YN.
158) *Boletus purpureus*-AH. HEB, JS,
159) *Boletus radicans* - GZ, JS, SC, TB, YN.
160) *Boletus satanas*-SC, YN.
161) ? *Boletus speciosus*-GD, GZ, GX, J S, SC, TB, YN.
162) *Boletus subvelutipes*-GD, TB, YN.
163) *Heimiella retisporus* -AH, FJ, GD, GZ, HA, JL, JS, SC, YN.
164) *Heimiella subretisporus* -GD, HA.
165) *Leccinum scabrum*-AH, GZ, HA, HEB, HL, HUN, JL, JS, LN, QH, SA, SC, TB, XJ, YN, ZJ.
166) *Pulveroboletus icterinus* -GD, HA.
167) *Pulveroboletus ravenelii*-AH, FJ, GD, GS, GX, GZ, HA, HK, HEB, HUB, JS, SA, SC, TW, YN, ZJ.
168) *Tylopilus felleus*-AH, FJ, GD, HA, HEB, HUN, JL, JS, SA, SC, TW, YN.
169) *Tylopilus felleus var. minor*-AH, FJ, GD, HA, HEB, HUN, JL, JS, SC, YN.
170) ? *Xerocomus badius*-AH, GD, HL, HUN, IM, JL, JS, SC, TB, YN.

171) ? *Xerocomus subpaludosus*-YN.

Gyroporaceae

172) ? *Gyroporus castaneus*-FJ, GD, GX, GZ, SC, TB, YN.

Paxillaceae

173) ? *Paxillus atrotomentosus*-AH, FJ, GD, GX, HEB, HEN, HUN, JL, JS, TB, YN.

174) *Paxillus curtisii*-FJ, GD, GX, HEN, HK, SA, SC, TB, YN.

175) ? *Paxillus involutus*-AH, GD, HEB, HL, JL, P K, SA, SC, TB, YN.

Sclerodermataceae

176) *Scleroderma aurantium*-FJ, GD, HK, TB, TW.

Suillaceae

177) *Suillus lactifluus*-GD, HK.

178) *Suillus placidus*-GD, HK, JL, LN, SA, SC, TB, YN.

Cantharellales

Cantharellaceae

179) ? *Cantharellus floccosus* -AH, FJ, GX, HUN, SA, SC, TB, YN.

Helotiales

Bulgariaceae

180) *Bulgaria inguinans*-GD, GS, HEB, HEN, JL, LN, SC, YN.

Phallales

Phallaceae

181) *Aseroe arachnoidea*-FJ, GD, HA, HK, YN.

182) *Clathrus columnatus* -GD, JS, YN.

183) *Clathrus ruber*-GD, TB, XC, YN.

184) *Dictyophora multicolor*-AH, GD, HA, HK, HUN, JS, TB, TW, YN.

185) *Lysurus mokusin*-AH, FJ, GD, GZ, HEB, HEN, HUB, HUN, JS, SC, TB, YN, ZJ.

186) *Phallus rubicundus*-FJ, GD, GS, GX, HEB, HEN, HUN, JS, LN, SA, SC, TW, YN, ZJ.

187) *Phallus tenuis*-JL, TB.

Russulales

Russulaceae

188) *Lactarius insulsus*-AH, HEB, HEN, HUN, JL, JS, SC, YN.

189) ? *Lactarius lignyotus*-JL, JS, AH, FJ, GD, GZ, HL, HUN, TB, YN.

190) ? *Lactarius piperatus*-AH, FJ, GZ, HEB, HL, HUN, JL, JS, JX, SA, SC, TB, TW, YN, ZJ.

191) *Lactarius pubescens*-GS, HL, JL, LN, QH, SA, SC, TB, XJ, YN.

192) *Lactarius pyrogalus*-JL.

193) *Lactarius repraesentaneus*-QH, SC, TB.

194) *Lactarius rufus*-SC, YN.

195) *Lactarius scrobiculatus*-GS, HL, IM, JL, QH, SC, TB.

196) *Lactarius torminosus*-GD, HEB, HL, JL, QH, SA, SC, TB.

197) ? *Lactarius uvidus*-HUB, HL . JL, SC.

198) *Lactarius vellereus*-AH, FJ, GD, HUN, JL, JX, SC, TB, YN.

199) ? *Russula densifolia*-AH, FJ, GD, GX, HEB, JL, JS, JX, SC.

200) *Russula emetica*-AH, FJ, GD, GZ, HEN, HEB, HUN, JL, JS, LN, SC, TB, YN.

201) *Russula emetica var. gregaria*-GD.

202) *Russula emetica var. fageticola*-GD, HEB.

203) ? *Russula farinipes*-GD, HUN, JL, JS, YN.

204) *Russula fragilis*-AH, FJ, GD, HEB, HEN, HL, HUN, JL, JS, TW, YN, ZJ.

205) *Russula foetens*-AH, GD, GX, HEB, HEN, HL, HUN, JL, JS, LN, SA, SC, TB. YN.

206) ? *Russula laurocerasi*-GD, GZ, HEN, HUB, JS, LN, SC, TB.

207) ? *Russula nigricans*-AH, FJ, GD, GX, HUN, JL, JS, JX, SC, YN.

208) *Russula queletii*-FJ, XJ.

209) *Russula senecis*-GD, GX, HEB, HEN, JX, SC.

210) *Russula subnigricans*-FJ, HUN, JS, SC.

Tremellomycetidae

Tremellales

Exidiaceae

211) *Exidia glandulosa* -AH, GS, GX, HEB, HUN, JS, NX, QH, SA, TB, ZJ.

2 Discussion

China is a vast country and is rich in biodiversity, but experts working on poisonous mushrooms are relatively few. Many wild fungi are very similar, so that mistakes can easily happen. Some misidentified species may still remain on the list although some old records have been excluded. The excluded species are *Amanita agglutinata, A. aspera, A. bingensis, A. excelsa, A. flavorubescens, A. gemmata, A. muscaria* var. *alba, A. muscaria* var. *formosa, A. pantherina, A. pantherina* var. *multisquamosa, A. phalloides, A. phalloides* var. *striatula, A. phalloides* var. *umbrina, A. solitaria, A.spissa, A. spissacea, A. spreta, A. spreta* var. *parva, A. strobiliformis, A. subphalloides, A. vittadinii, A. verna, A. virosa,* and *A. volvata.* Such species were recorded in China based on misidentified collections[27], or were actually not poisonous.

In China, the Southwest and South of China are the richest in terms of poisonous mushrooms. For example, Yunnan has 107 species, Guangdong 106, Sichuan 95, Tibet 93 and Hunan 64. Northeast China also has quite a lot of species (e.g., Jilin has 75 species). Disasters mostly occur in the southern provinces. In 2004, for example, it was reported that more than 30 disasters of this kind occurred, and at least 41 victims died. Reports were mainly from the south (Fujian, Jiangxi, Guangdong, Guizhou, Sichuan, Chongqing, Yunnan, Hunan, Hubei and Hong Kong) and were relatively rarely in the North (Hebei, Jilin).

Many poisonous species have still to be discovered in China, since many places have not been investigated intensively. Nevertheless, the authors hope that this paper will be helpful in understanding the Chinese poisonous mushrooms in general, and also stimulate further study on these fungi.

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