Preplanned Studies

Mushroom Poisoning Outbreaks — China, 2022

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Summary

What is already known about this topic?

Mushroom poisoning is one of the most serious food safety issues in China. By the end of 2021, over 520 poisonous mushrooms had been discovered in China. The Southwest region of China was the most severely affected. Mushroom poisonings mainly concentrated in the summer and autumn months.

What is added by this report?

In 2022, China CDC conducted an investigation of 482 incidents of mushroom poisoning across 21 provincial-level administrative divisions (PLADs). This resulted in 1,332 patients and 28 deaths, with a total case fatality rate of 2.1%. A total of 98 mushrooms were identified, causing 7 different clinical types of diseases. Three provisional new species (*Collybia humida* nom. prov., *Spodocybe venenata* nom. prov., and *Omphalotus yunnanensis* nom. prov.) were newly recorded as poisonous mushrooms in China, in addition to 10 other species.

What are the implications for public health practice?

In view of the extensive impact and harm of poisonous mushrooms on public health, it is necessary to promote prevention and improve the ability of professionals to identify, diagnose, and treat mushroom poisoning.

Mushroom poisoning has become a serious food safety issue in China. With the support of the government, over the past decade, China has gradually established a mushroom poisoning prevention and treatment system involving experts in disease prevention and control, clinical diagnosis and treatment, fungal classification, and basic medicine (*1*–*3*). In recent years, a mushroom-poisoning information collecting, diagnosis, and treatment support network has been established, utilizing WeChat, telephone, email, and other methods. After poisoning incidents occur, mushroom samples are collected by CDC staff or hospital professionals and sent to mycological researchers at universities and institutions for identification, based on morphological characters and DNA sequence data (*1*–*3*).

In 2022, China CDC investigated 482 mushroom poisoning incidents involving 1,332 patients and 28 deaths, with a total case fatality rate of 2.1%. The number of cases per incident ranged from 1 to 28, with an average of 2. A total of 13 incidents involved more than 10 patients. Of these cases, 73 patients from 23 incidents ate poisonous mushrooms purchased from markets or given by friends; 9 patients from 6 incidents were poisoned after eating raw *Chlorophyllum molybdites*, *Boletus bainiugan*, and *Macrocybe gigantea*, although the last two species were considered to be edible after proper cooking (Supplementary Table S1, available in https://weekly.chinacdc.cn/); 44 patients from 7 incidents were poisoned after eating dried mushrooms; and 213 patients and 3 deaths from 55 incidents ate mixed mushrooms.

The temporal distribution shows that mushroom poisonings occurred in all months, with the highest number of incidents occurring between May and November (460 incidents, 1,234 patients, and 22 deaths). The first death occurred in mid-February in Fujian. The top 3 months for deaths were June (13 deaths), July (3 deaths), and September (3 deaths) (Figure 1).

In terms of geographical distribution, mushroom poisoning incidents were reported in 21 provincial-level administrative divisions (PLADs). Overall, 10 PLADs had more than 10 incidents, and Yunnan, Hunan, Sichuan, Guangxi, Chongqing, and Zhejiang were the top 6 (Table 1); 11 PLADs had more than 20 patients, and Yunnan, Hunan, Sichuan, and Guangxi had over 100 patients each (Table 1). Yunnan, Hunan, and Guangdong were the top 3 PLADs in terms of deaths, with 9, 7, and 5 deaths, respectively (Table 1). Southwest China (Yunnan, Sichuan, Chongqing, and Guizhou) was the most severely affected region, with 234 incidents, 703 patients, and 13 deaths. This was followed by Central China (Hunan, Hubei, and Henan) with 109 incidents, 277 patients, and 8 deaths; East China (Zhejiang, Fujian, Jiangsu, Jiangxi, Anhui,

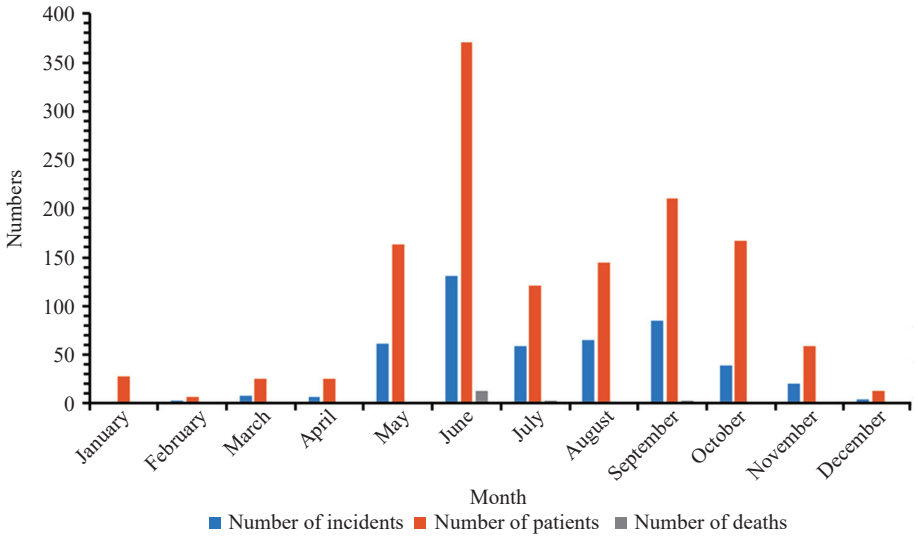

FIGURE 1. Monthly distribution of mushroom poisonings in China, 2022.

TABLE 1. Geographical distribution of mushroom poisoning incidents in China, 2022.

PLAD	Number of incidents	Number of patients	Deaths	Mortality (%)
Yunnan	131	404	9	2.23
Hunan	89	229	7	3.06
Sichuan	57	130	2	1.54
Guangxi	29	106	0	0
Chongqing	27	82	1	1.22
Zhejiang	27	72	0	0
Guangdong	20	46	5	10.87
Guizhou	19	87	1	1.15
Ningxia	19	29	0	0
Hubei	17	42	0	0
Shandong	9	19	1	5.26
Fujian	8	15	1	6.67
Jiangsu	7	20	0	0
Jiangxi	6	7	0	0
Anhui	5	16	0	0
Hebei	4	10	0	0
Henan	3	6	1	16.67
Shanghai	2	2	0	0
Liaoning	1	5	0	0
Shanxi	1	3	0	0
Heilongjiang	1	2	0	0
Total	482	1,332	28	2.10

Note: Species newly recorded as poisonous mushrooms in China are in italic bold.
Abbreviation: ALF=Acute liver failure; ARF=Acute renal failure; G=Gastroenteritis; P=Psycho to neurological disorder; M=Medicinal; U=Unclassified; E=edible.

and Shanghai) with 55 incidents, 132 patients, and 1 death; South China (Guangxi and Guangdong) with 49 incidents, 152 patients, and 5 deaths; Northwest China (Ningxia) with 19 incidents, 29 patients, and 0

deaths; North China (Shandong, Hebei, and Shanxi) with 14 incidents, 32 patients, and 1 death; and Northeast China (Liaoning and Heilongjiang) with 2 incidents, 7 patients, and 0 deaths. Detailed information for each PLAD is presented in Table 1.

In 2022, 98 species of poisonous mushrooms were successfully identified from mushroom poisoning events, resulting in seven different clinical syndromes. Among these 98 species, 13 were newly recorded as poisonous species in China. *Collybia humida* nom. prov., *Spodocybe venenata* nom. prov., and *Omphalotus yunnanensis* nom. prov. represented 3 undescribed species. The first two species contained muscarine and stimulated the parasympathetic nervous system, while the last species caused gastroenteritis. *Coprinopsis aesontiensis* and *Leucoagaricus purpureolilacinus* species complex were two new records in China causing gastroenteritis. The eight remaining species, previously of unclear edibility, were confirmed to be poisonous based on poisoning incidents. These species were *Tricholoma olivaceum*, a species originally discovered in China and causing gastroenteritis (*4*); *Candolleomyces yanshanensis*, *Anthracoporus holophaeus*, *Anthracoporus nigropurpureus*, *Inocybe* cf. *assimillata*, *Inocybe* aff. *decemgibbosa*, *Inocybe* aff. *pseudoreducta,* and *Inosperma* cf. *gregarium,* which caused psycho-neurological disorders (*5*–*6*).

The top three lethal mushroom species were *Amanita exitialis*, *A. rimosa,* and *Russula subnigricans*, which caused 7, 7, and 6 deaths, respectively (Figure 2, Supplementary Table S1). *Chlorophyllum molybdites*, the most widely distributed mushroom (discovered in 16 PLADs), caused the most poisonings incidents (appearing in 114 incidents and affecting 257 patients) and had a distinct long active period (from early April to early December).

In 2022, nine species causing acute liver failure were identified in China (Figure 2, Supplementary Table S1). *Amanita exitialis* was the most dangerous species, causing 7 deaths in 14 incidents involving 41 patients. *Amanita rimosa* and *Galerina sulciceps* caused seven and three deaths, respectively. *Amanita subfuliginea*, a lethal species originally described from Guangdong in 2016 (*7*), was also identified. On May 29, two people from Chongqing were poisoned by a gray amanita mushroom, marking the first reported poisoning incident since the mushroom was described and the first record of this gray poisonous amanita in Southwest China (*7*).

Three species of mushroom were identified as causing acute renal failure in mushroom poisoning incidents (Figure 2, Supplementary Table S1). *Amanita pseudoporphyria* was the most common, appearing in 12 incidents either alone or in combination with other species. *Amanita neoovoidea* had the longest active period, occurring from mid-June to early November.

Russula subnigricans was linked to 15 incidents of rhabdomyolysis, involving 44 patients and resulting in 6 deaths, either alone or in combination with other mushroom species. This species was found in Yunnan, Hunan, and Zhejiang from June to September. The first *Paxillus orientalis* poisoning incident from China, resulting in hemolysis, occurred in Sichuan in early June (Figure 2, Supplementary Table S1).

A total of 51 species causing gastroenteritis were identified from mushroom poisoning incidents in China in 2022 (Supplementary Table S1). Among them, four species were identified as poisonous mushrooms and subsequently added to the Chinese poisonous mushroom list (*1*–*3*,*8*). *Omphalotus yunnanensis* nom. prov. was discovered from a poisoning incident in Yunnan. The top three species in this category were *Chlorophyllum molybdites*, *Russula japonica,* and *Scleroderma cepa* (Figure 2).

In 2022, 32 species of mushrooms causing psycho-neurological disorders were identified in China (Supplementary Table S1). Nine of these species were newly discovered as poisonous (*1*–*3*,*8*), including *Collybia humida* nom. prov. and *Spodocybe venenata* nom. prov., which need to be formally described. The top five species were *Lanmaoa asiatica*, *Gymnopilus dilepis*, *Anthracoporus nigropurpureus*, *Amanita rufoferruginea*, and *Amanita sychnopyramis* f. *subannulata* (Figure 2).

On September 30, five Burmese workers in Dehong, Yunnan were poisoned by *Inosperma hainanense*, a newly discovered species containing muscarine that was identified in Hainan in 2021 (*9*).

DISCUSSION

In 2022, mushroom poisoning incidents and patients were more than those in 2019 and 2021 but fewer than in 2020, while deaths slightly increased (28 compared to 22, 20, and 25) (*1*–*3*). Heilongjiang was newly recorded with poisoning incidents (*1*–*3*). A total of 98 poisonous species were successfully identified from poisoning incidents in 2022, among which 62 species had already been recorded from 2019 to 2021 (*1*–*3*), raising the total number of species from incidents to over 190 in China by the end of 2022.

FIGURE 2. Poisonous mushrooms identified from mushroom poisoning incidents in China in 2022.
Note: 1: *Amanita exitialis*; 2: *A. fuliginea*; 3: *A. fuligineoides*; 4: *A. rimosa*; 5: *A. subfuliginea* (provided by Yalin Zhou); 6: *A. subjunquillea*; 7: *A. pallidorosea*; 8: *Galerina sulciceps*; 9: *Lepiota brunneoincarnata*; 10: *Russula subnigricans*; 11: *A. neoovoidea*; 12: *A. oberwinklerana*; 13: *A. pseudoporphyria*; 14: *Paxillus orientalis*; 15: *Cordierites frondosus*; 16: *Chlorophyllum molybdites*; 17: *Russula japonica*; 18: *Scleroderma cepa* (provided by Tianhong Li); 19: *Coprinopsis aesontiensis* (provided by Wensong Chen); 20: *Leucoagaricus purpureolilacinus* species complex (provided by Xia Rong); 21: *Omphalotus yunnanensis* nom. prov.; 22: *Tricholoma olivaceum*; 23: *Lanmaoa asiatica* (provided by Guanliang Wen); 24: *Gymnopilus dilepis* (provided by Ya'an CDC); 25: *Anthracoporus nigropurpureus*; 26: *Amanita rufoferruginea*; 27: *A. sychnopyramis* f. *subannulata* (provided by Zuohong Chen); 28: *Anthracoporus holophaeus* (provided by Yanchun Li); 29: *Collybia humida* nom. prov.; 30: *Spodocybe venenata* nom. prov.

The most dangerous mushrooms were *Amanita exitialis* and *A. rimosa*, each causing seven deaths in 2022, different from 2019 to 2021 (*1*–*3*).

Temporal distribution analysis showed that mushroom poisonings in 2022 were concentrated from May to November, similar to 2021 but longer than 2019 and 2020 (*1*–*3*). The peak occurred in June and the incidents decreased in July and August, likely due to the rare drought in southern China. With the arrival of rain in September, mushroom poisoning reached its second peak in September and then gradually decreased in the following three months (Figure 1).

From 2019 to 2021, Hunan was the province with the most incidents among PLADs. However, in 2022, Yunnan had the highest number of incidents, and Southwest China remained the most severely affected area (*1*–*3*). Yunnan also had the most deaths over the last four years (*1*–*3*).

On June 5, one person in Sichuan was poisoned by *Paxillus orientalis*, resulting in hemolysis. This was the first reported case of poisoning from this species in China (*10*). In 2020 and 2021, species of the same genus, *Paxillus involutus*, were reported to have caused poisoning in Xizang (Tibet) and Inner Mongolia (*2*–*3*). We strongly advise against collecting and eating species of *Paxillus*, despite their previous acceptance as edible and/or medicinal fungi in China and the perception of safety among many people (*8*,*10*).

In 2022, 51 species of gastroenteritis-causing organisms were identified, more than in 2019 (30 species) and 2021 (39 species), but slightly fewer than in 2020 (56 species). The top two species were *Chlorophyllum molybdites* and *Russula japonica*, which remained the same from 2019 to 2021, but the third species in 2022 was *Scleroderma cepa*, instead of *Entoloma omiense* in the previous three years (*1*–*3*).

In 2022, 32 species causing psycho-neurological disorders were identified, more than the 18, 28, and 22 species reported in the previous three years (*1*–*3*). Surprisingly, *Lanmaoa asiatica* ranked first, unlike the previous three years when *Amanita subglobosa* was the most common (*1*–*3*). *Lanmaoa asiatica* is a delicious bolete that must be cooked properly (*8*). The increased poisoning incidents of this species may be partially attributed to the rise of online shopping, which lacks face-to-face communication about proper cooking.

Anthracoporus nigropurpureus (*Porphyrellus nigropurpureus*), a black bolete, caused nine poisoning incidents in Sichuan, Yunnan, and Zhejiang, resulting in dizziness, blurred vision, amyosthenia, headache, muscle cramps, hand or foot tremors, and red eyes, among other symptoms. However, its toxicity remains unclear, and further studies are urgently needed. Another species from the same genus, *Anthracoporus holophaeus*, was also identified from two incidents with similar clinical manifestations. At present, we strongly advise against collecting and eating black boletes of the genus *Anthracoporus*.

Cordierites frondosus is a species morphologically similar to edible *Auricularia* spp., but the former species can cause typical photosensitive dermatitis, which poisoned three people from Chongqing on April 21, 2022. Compared to 2019, we found that this species appeared in different months in different areas; for example, two incidents occurred in Yunnan in early June and in Guizhou in early December (*1*). Further research is needed to uncover its spatial and temporal distribution characteristics and rules for better poisoning control.

Sixteen edible mushrooms were identified from mushroom poisoning incidents in 2022 (Supplementary Table S1). These incidents were likely due to the consumption of mixed mushrooms with poisonous mushrooms, contaminated mushrooms, or some species that may be poisonous to certain individuals.

This study only represents a portion of actual mushroom poisonings. In some cases, no mushroom specimens were obtained, making it impossible to confirm the exact poisonous mushroom species. To reduce the risk of poisoning, we recommend that people set aside some fruiting bodies before eating or take a photo of the fresh mushrooms before cooking. Knowledge popularization of poisonous mushrooms is also important to decrease the number of poisoning incidents. To this end, we recommend creating more scientific, plain, and varied popularization materials and publicizing them to people at risk before and throughout the poisoning season. In the past decades, our knowledge of poisonous mushrooms has increased drastically, and more patient poisoning incidents have become more standardized.

The previous practice of controlling and preventing mushroom poisoning demonstrates that more effort and closer cooperation are urgently needed from governments, CDC staff, doctors, and mycologists in the future.

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SUPPLEMENTARY MATERIAL

SUPPLEMENTARY TABLE S1. Mushroom species involved in poisoning incidents and their spatial and temporal distribution in China, 2022.

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Acute liver failure					
Amanita exitialis	14	41	7	17.07	February 13 to April 1, Fujian and Guangdong; May 6 to 30, Sichuan and Guizhou; June 7 to July 2, Yunnan
Amanita cf. *exitialis*	1	1	0	0.00	May 29, Guangxi
Amanita fuliginea	8	19	0	0.00	May 23 to June 19, Hunan
Amanita fuliginea, *A. fritillaria*[P] and *Russula* spp.[U]	1	1	0	0.00	June 13, Hunan
Amanita fuligineoides	1	4	0	0.00	June 8, Yunnan
Amanita fuligineoides, *A. pseudoporphyria*[ARF] and *A. kitamagotake*[E]	1	2	0	0.00	June 15, Zhejiang
Amanita cf. *pallidorosea*	2	5	1	20.00	July 28, Henan; September 1, Shandong
Amanita rimosa	4	27	7	25.93	June 11 to 25, Hunan, Zhejiang
Amanita subfuliginea	1	2	0	0.00	May 29, Chongqing
Amanita subjunquillea	3	9	0	0.00	June 11 and 24, Guizhou; September 1, Shandong
Amanita subjunquillea, *A. fritillaria*[P], *Lactarius oomsisiensis*[G] and *Agaricus flocculosipes*[E]	1	2	0	0.00	July 27, Shandong
Amanita subjunquillea, *Amanita pallidorosea*[ALF], *Amanita oberwinklerana*[ARF], *Hypholoma fasciculare*[G], *Agaricus abruptibulbus*[G], *Agaricus sinoplacomyces*[G], *Amanita fritillaria*[P], *Agaricus flocculosipes*[E], *Lepista nuda*[E], *Agaricus beijingensis*[U] and *Lanmaoa* sp.[U]	1	5	0	0.00	September 23, Liaoning (bought from market)
Amanita sp., *Suillus luteus*[G], *Lactarius hatsudake*[E] and *Russula sanguinea*[E]	1	2	1	50.00	September 1, Shandong
Amanita sp.	1	5	1	20.00	May 19, Chongqing
Galerina sulciceps	9	33	3	9.09	June 19, Guizhou; September 22 to November 26, Sichuan, Yunnan, Guizhou
Galerina sp.	1	1	0	0.00	June 19, Yunnan
Lepiota brunneoincarnata	11	17	0	0.00	June 27, Ningxia; July 5, Yunnan; July 15 to August 28, Ningxia
Rhabdomyolysis					
Russula subnigricans	11	32	6	18.75	June 22 to September 23, Yunnan, Hunan
Russula subnigricans and *R. adusta*[E]	2	3	0	0.00	August 18 and September 5, Yunnan
Russula subnigricans, *R.* cf. *nigricans*[E] and *R. densifolia*[E]	1	7	0	0.00	July 23, Zhejiang
Russula subnigricans, *Lactifluus sinensis*[E], *Russula pseudocompacta*[E], *Russula viridirubrolimbata*[E], *Xerocomus parvulus*[E] and *Russula* sp.[U]	1	2	0	0.00	July 10, Hunan (bought from market)
Acute renal failure					
Amanita neoovoidea	4	6	0	0.00	June 16, Yunnan; September 19 to October 1, Zhejiang; November 4, Chongqing (bought from market)
Amanita oberwinklerana	5	11	0	0.00	June 23 to July 1, Guizhou and Yunnan; August 1, Jiangsu; August 31, Hebei
Amanita cf. *oberwinklerana*	1	3	0	0.00	August 13, Hebei
Amanita pseudoporphyria	9	20	0	0.00	May 25 to July 6, Guangxi, Jiangxi, Hubei, Hunan, Yunnan
Amanita pseudoporphyria and *Russula japonica*[G]	2	6	0	0.00	June 13 and 14, Zhejiang, Hunan
Amanita pseudoporphyria and *A. fritillaria*[P]	1	4	0	0.00	June 14, Hunan

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Hemolysis					
Paxillus orientalis	1	1	0	0.00	June 5, Sichuan
Gastroenteritis					
Agaricus bresadolanus and *Lycoperdon pratense*[E]	1	2	0	0.00	August 25, Shandong
Albatrellus dispansus	1	1	0	0.00	August 1, Yunnan
Baorangia major	2	9	0	0.00	May 26 and 29, Yunnan (one incident bought from market)
Chlorophyllum globosum	1	4	0	0.00	May 31, Yunnan
Chlorophyllum aff. *globosum*	3	10	0	0.00	September 12 to 27, Sichuan
Chlorophyllum hortense	1	1	0	0.00	July 25, Hubei
Chlorophyllum molybdites	114	257	0	0.00	April 2 to December 6, Guangdong, Hubei, Jiangxi, Guangxi, Hunan, Fujian, Sichuan, Chongqing, Yunnan, Shandong, Anhui, Jiangsu, Sichuan, Zhejiang, Shanghai, Fujian (5 patients in 4 incidents from Guangdong, Shanghai and Jiangsu were eaten raw)
Chlorophyllum cf. *molybdites*	1	1	0	0.00	September 2, Henan
Coprinopsis aesontiensis	1	6	0	0.00	April 21, Yunnan
Entoloma cf. *sinuatum*	1	2	0	0.00	August 13, Yunnan
Entoloma sp., *Xerocomus parvulus*[E], *Russula* cf. *pseudobubalina*[U]	1	2	0	0.00	September 9, Zhejiang
Entoloma omiense	5	15	0	0.00	June 6, Yunnan; July 12 and August 13, Guangxi, Guangdong; September 14 and 21, Zhejiang, Guizhou
Entoloma omiense, *Suillus pinetorum*[G], *Suillus luteus*[G], *Amanita sinocitrina*[P], *Lycoperdon perlatum*[E,M] and *Lactarius vividus*[E]	1	5	0	0.00	September 24, Sichuan
Gymnopus densilamellatus	1	3	0	0.00	May 30, Yunnan (bought from market)
Gymnopus dryophilus	1	1	0	0.00	June 15, Yunnan
Heimioporus gaojiaocong	1	5	0	0.00	August 24, Guizhou
Lactarius hirtipes	1	2	0	0.00	October 10, Sichuan
Lactarius laccarioides	1	1	0	0.00	August 7, Yunnan
Lactarius rubrocorrugatus	1	1	0	0.00	June 13, Yunnan
Lactarius subhirtipes or *L. subatlanticus*[G]	1	1	0	0.00	June 13, Chongqing
Lactifluus pseudoluteopus	1	3	0	0.00	June 14, Yunnan (bought from market)
Lactifluus piperatus	1	5	0	0.00	June 23, Yunnan
Leucoagaricus leucothites	2	6	0	0.00	September 21, Ningxia; November 27, Anhui
***Leucoagaricus purpureolilacinus* species complex**	1	1	0	0.00	September 21, Sichuan
Neoboletus venenatus	1	8	0	0.00	August 2, Sichuan
Neoboletus venenatus and *Butyriboletus yicibus*[E]	1	2	0	0.00	Late June, Hunan (dried boletes, bought from market)
Omphalotus guepiniformis	3	18	0	0.00	March 25 and 26, Guangxi; December 13, Fujian
Omphalotus guepiniformis and *Macrolepiota procera*[E,M,G]	1	8	0	0.00	October 5, Yunnan
Omphalotus olearius	1	3	0	0.00	September 24, Yunnan

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
***Omphalotus yunnanensis* nom. prov.**	1	1	0	0.00	September 24, Yunnan
Rubroboletus latisporus	2	10	0	0.00	July 22, Yunnan; October 2, Guizhou
Russula japonica	42	136	0	0.00	May 16 to October 27, Yunnan, Hunan, Chongqing, Sichuan, Zhejiang, Guizhou, Anhui
Russula japonica, *R. crustosa*[E,M] and *Amanita fritillaria*[P]	1	1	0	0.00	June 8, Hunan
Russula japonica, *Lactifluus volemus*[E] and *Hygrocybe* sp.[U]	1	5	0	0.00	June 8, Chongqing
Russula japonica and *R. aeruginea*[E]	1	2	0	0.00	June 10, Hunan
Russula japonica and *R. compacta*[E]	1	4	0	0.00	June 9, Hunan
Russula japonica and *R. punctipes*[G]	1	2	0	0.00	June 1, Hunan
Russula japonica and *R. punctipes*[G], *R. virescens*[E] and *Lactifluus leoninus*[E]	1	3	0	0.00	August 10, Sichuan
Russula japonica, *Suillus granulatus*[E,G] and *Tylopilus pseudoballoui*[E]	1	1	0	0.00	July 16, Yunnan
Russula japonica and *Gomphus* sp.[U]	1	1	0	0.00	July 11, Yunnan
Russula japonica and *Russula* sp.[U]	1	2	0	0.00	August 7, Sichuan
Russula rufobasalis	1	3	0	0.00	May 29, Hunan
Scleroderma aff. *albidum*	1	2	0	0.00	September 7, Yunnan
Scleroderma cf. *areolatum* and *Scleroderma yunnanense*[E]	1	9	2	22.22	June 12, Yunnan
Scleroderma cepa	9	41	0	0.00	June 20 to August 7, Yunnan; September 9 and 18, Yunnan, Hunan; October 25, Zhejiang
Scleroderma cepa and *S. bovista*[E,M]	1	2	0	0.00	June 17, Yunnan
Scleroderma venenatum	1	2	0	0.00	September 1, Hebei
Suillus granulatus and *Lactarius hatsudake*[E]	1	1	0	0.00	June 13, Chongqing
Suillus phylopictus, *Amanita vaginata* complex[U], *Lactarius cinnamomeus*[E], *Russula compacta*[E], *Cortinarius hinnuleoarmillatus*[U], *Veloporphyrellus pseudovelatus*[U], *Entoloma undatum*[U], *Lactarius brachycystidiatus*[U] and *Russula* spp.[U]	1	2	0	0.00	July 8, Yunnan
Tricholoma equestre and *Tricholoma* sp.[U]	1	1	0	0.00	October 10, Yunnan
Thicholoma highlandense and *Tricholoma* sp.[G]	1	6	0	0.00	October 6, Yunnan
Tricholoma highlandense, *Gomphus floccosus*[G], *Boletus* sp.[U], *Russula* spp.[U] and *Ramaria* sp.[U]	1	4	0	0.00	June 14, Yunnan
Tricholoma olivaceum	1	2	0	0.00	August 18, Yunnan
Tricholoma stans, *Hygrophorus yunnanensis*[E] and *Hygrophorus* sp.[U]	1	6	0	0.00	October 17, Guizhou (eaten in a restaurant)
Tylopilus felleus, *Suillus granulatus*[G,E], *Amanita fritillaria*[P], *Amanita* cf. *hemibapha*[E], *Amanita princeps*[E], *Russula cerolens*[U], *Russula* sp.[U], *Lactifluus* sp.[U] and *Cortinarius* sp.[U]	1	2	0	0.00	July 8, Shandong
Psycho-neurological disorder					
Amanita concentrica	1	2	0	0.00	June 15, Yunnan
Amanita melleiceps and *Gymnopus* sp.[U]	1	2	0	0.00	June 10, Fujian
Amanita pseudosychnopyramis	1	1	0	0.00	March 26, Zhejiang
Amanita rufoferruginea	4	11	0	0.00	June 10 to 14, Hunan, Chongqing, Guangxi; August 4, Sichuan

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Amanita rufoferruginea, *Russula compacta*[E] and *Termitomyces* sp.[E]	1	4	0	0.00	June 9, Zhejiang
Amanita rufoferruginea, *A. subglobosa*[P]	1	3	0	0.00	June 17, Hunan
Amanita subglobosa	2	4	0	0.00	June 1 to July 29, Chongqing
Amanita sychnopyramis f. *subannulata*	5	15	0	0.00	May 18 to June 12, Guangxi, Hunan
Anthracoporus holophaeus	1	1	0	0.00	June 10, Yunnan
Anthracoporus holophaeus, *Lactarius subhirtipes*[G]	1	3	0	0.00	June 5, Sichuan
Anthracoporus nigropurpureus	9	17	0	0.00	June 10 to July 13, Sichuan, Yunnan, Zhejiang
Candolleomyces yanshanensis	1	3	0	0.00	June 16, Shandong
Clitocybe nebularis	1	1	0	0.00	August 25, Yunnan
***Collybia humida* nom. prov.**, ***Spodocybe venenata* nom. prov.**[P], *Hypholoma fasciculare*[G], *Pholiota multicingulata*[G], *Gymnopus dryophilus*[G], *Lactarius citrinus*[G], *Mycena pura*[P], *Lepiota magnispora*[U], *Cystodermella lactea*[U], *Laccaria* sp.[U], *Cystoderma amianthinum*[E] and *Armillaria mellea*[E]	1	20	0	0.00	October 19, Yunnan
Collybia sp.	1	7	0	0.00	October 1, Guizhou
Gymnopilus dilepis	10	34	0	0.00	May 2 to June 9, Sichuan, Hunan, Chongqing; July 23, Fujian; October 28, Sichuan
Inocybe* aff. *decemgibbosa	1	2	0	0.00	May 21, Hunan
Inocybe* cf. *assimillata	1	1	0	0.00	November 27, Hunan
Inosperma* cf. *gregarium	1	1	0	0.00	September 22, Yunnan
Inosperma hainanense	2	7	0	0.00	August 9, Guangxi; September 30, Yunnan (5 Burmese)
Inosperma muscarium	1	4	0	0.00	May 20, Guangxi
Laetiporus versisporus	1	1	0	0.00	June 28, Yunnan
Lanmaoa asiatica	12	14	0	0.00	July 6 to October 20, Guangdong, Chongqing, Yunnan, Hunan (9 patients from 7 incidents ate boletes bought from Yunnan market)
Panaeolus cyanescens	1	1	0	0.00	September 12, Shandong
Panaeolus subbalteatus	1	1	0	0.00	July 1, Ningxia
Pseudosperma citrinostipes and ***Inocybe* aff. *pseudoreducta***[P]	1	4	0	0.00	July 3, Yunnan
Pseudosperma umbrinellum	3	4	0	0.00	August 31 to September 15, Ningxia
Pseudosperma sp.	1	2	0	0.00	May 17, Hunan
Psilocybe cubensis	4	9	0	0.00	March 29, Hunan; August 1 and 4, Hunan, Guangxi; November 2; Guangxi
Psilocybe keralensis	1	1	0	0.00	May 4, Fujian
Psilocybe ovoideocystidiata	1	5	0	0.00	May 1, Hubei
Psilocybe samuiensis	2	2	0	0.00	November 28 and December 3, Zhejiang, Hunan
Photosensitive dermatitis					
Cordierites frondosus	1	3	0	0.00	April 21, Chongqing
Unclassified					
Amanita pseudoprinceps[E]	1	2	0	0.00	August 12, Yunnan

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Armillaria gallica[E]	1	3	0	0.00	May 6, Hunan (dried mushrooms, given by a friend from Northeast China)
Armillaria mellea[E]	1	3	0	0.00	November 10, Guizhou
Boletus bainiugan[E] and *B. reticuloceps*[E]	1	28	0	0.00	January 13, Yunnan (dried boletes, bought from market)
Boletus bainiugan[E]	1	2	0	0.00	August 8, Guangdong (bought from Yunnan market, eaten raw)
Boletus bainiugan[E], *Lanmaoa asiatica*[E,P], *Tricholomopsis rutilans*[G], *Caloboletus xiangtoushanensis*[U], *Imperator* sp.[U] and *Xerocomus* sp.[U]	1	2	0	0.00	July 16, Ningxia (dried boletes, given by a friend from Sichuan)
Butyriboletus yicibus[E]	1	2	0	0.00	July 29, Guangdong (bought from Yunnan market)
Cortinarius sinensis[E]	1	2	0	0.00	September 14, Ningxia
Lanmaoa asiatica[E,P], *Rubroboletus flammeus*[U], *Rubroboletus* sp.[U], *Clitocella orientalis*[U], *Imperator* sp.[U], *Caloboletus* sp.[U], *Inocybe* sp.[U], *Russula laurocerasi*[U] and *Russula mariae*[E]	1	2	0	0.00	August 5, Guizhou (dried boletes)
Lepista nuda[E,M]	1	4	0	0.00	September 12, Hebei
Lycoperdon perlatum[E,M]	1	1	0	0.00	May 27, Yunnan
Macrocybe gigantea[E,M]	1	2	0	0.00	May 25, Yunnan (was eaten raw)
Pholiota spumosa[E,M]	1	3	0	0.00	September 27, Sichuan
Russula crustosa[E] and *Laccaria yunnanensis*[E]	1	6	0	0.00	September 4, Sichuan
Russula leucocarpa[E]	1	3	0	0.00	August 6, Sichuan
Russula leucocarpa[E], *Russula densifolia*[E] and *Russula* sp.[U]	1	2	0	0.00	June 22, Sichuan
Russula leucocarpa[E] and *Amanita* sp.[U]	1	2	0	0.00	June 22, Sichuan
Termitomyces fuliginosus[E]	1	1	0	0.00	June 19, Sichuan
Tricholoma terreum[E]	2	2	0	0.00	March 1 and 5, Hunan

Note: Species newly recorded as poisonous mushrooms in China are in italic bold.
Abbreviation: ALF=Acute liver failure; ARF=Acute renal failure; G=Gastroenteritis; P=Psycho to neurological disorder; M=Medicinal; U=Unclassified; E=Edible.