Preplanned Studies

Mushroom Poisoning Outbreaks — China, 2020

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Summary

What is already known about this topic?

Acute liver failure, rhabdomyolysis, acute renal failure, and hemolysis caused by poisonous mushrooms are the most important mushroom poisoning threats to the Chinese population. The most notorious lethal mushrooms are the species from genera *Amanita*, *Lepiota*, and *Galerina* that cause acute liver failure, and *Russula subnigricans* that leads to rhabdomyolysis.

What is added by this report?

In 2020, the total number of investigations reached 676, involving an estimated 102 species of poisonous mushrooms, 24 of which were newly recorded in China. *Gyromitra venenata* was newly discovered in incidents in Yunnan and Guizhou provinces and were the first reported poisonings due to gyromitrins in China since 2000. The rare poisoning Shiitake mushroom dermatitis was recorded in China. Hemolysis poisoning caused by *Paxillus involutus* was recorded for the second time since the beginning of the new century, resulting in one death in Inner Mongolia Autonomous Region.

What are the implications for public health practice?

Promoting knowledge about safe consumption of mushrooms is essential to reduce mushroom poisonings. It is not wise to collect and eat wild mushrooms. For southwestern provinces such as Yunnan, especially, caution must be exercised with unfamiliar mushroom species.

Preventing mushroom poisonings depends on cooperation between clinical doctors, CDC experts, and mycologists as well as the application of internet technology tools (*1*). Systematic epidemiological investigations, timely and accurate species identification, toxin detection, and appropriate diagnosis and treatment are key to properly controlling mushroom poisoning events.

In 2020, a total of 676 independent mushroom poisoning incidents from 24 provincial-level administrative divisions (PLADs) involving 1,719 patients and 25 deaths were investigated and the overall mortality was 1.45%. The number of cases ranged from 1 to 27,* and 14 outbreaks involved more than 10 patients. Of these cases, 93 patients from 24 incidents had eaten poisonous mushrooms purchased from market or given by friends; 51 patients from 12 incidents had been poisoned after eating dried mushrooms; 404 patients from 131 incidents with 7 deaths ate mixed mushrooms. Three rare clinical syndromes were recorded: Gamma-Aminobutyric Acid (GABA)-blocking mushroom poisoning caused by *Gyromitra venenata*, Hemolysis poisoning caused by *Paxillus involutus*, and Shiitake mushroom dermatitis caused by *Lentinula edodes*. Similar to 2019, mushroom poisonings occurred in every month but were centered from June to October (*1*). There were 2 peaks appearing in June and September involving 160 and 193 incidents, 428 and 412 patients, and 8 and 3 deaths, respectively (Figure 1).

In terms of geographical distribution, Southwest China [Yunnan, Guizhou, Sichuan, Chongqing, and Xizang (Tibet)] were the most severely affected region with 200 incidents, 604 patients, and 15 deaths. Central China (Hunan, Hubei, and Jiangxi) had more incidents (323 incidents), more patients (707 patients), but less deaths (4 deaths). East China (Anhui, Fujian, Jiangsu, and Zhejiang) had 82 incidents, 159 patients, and 0 deaths and were followed by the other regions: South China (Guangdong, Guangxi, and Hainan) had 33 incidents, 146 patients, and 3 deaths; North China (Beijing, Hebei, Henan, Shandong, and Shanxi) had 22 incidents, 69 patients, and 1 death; Northwest China (Ningxia and Gansu) had 13 incidents, 30 patients, and 1 death; and Northeast China (Inner Mongolia and Liaoning) had 3 incidents, 4 patients, and 1 death. In addition, 3 Burmese workers in Yunnan had gastroenteritis after eating *Chlorophyllum*

* The median number of cases per incident was two.

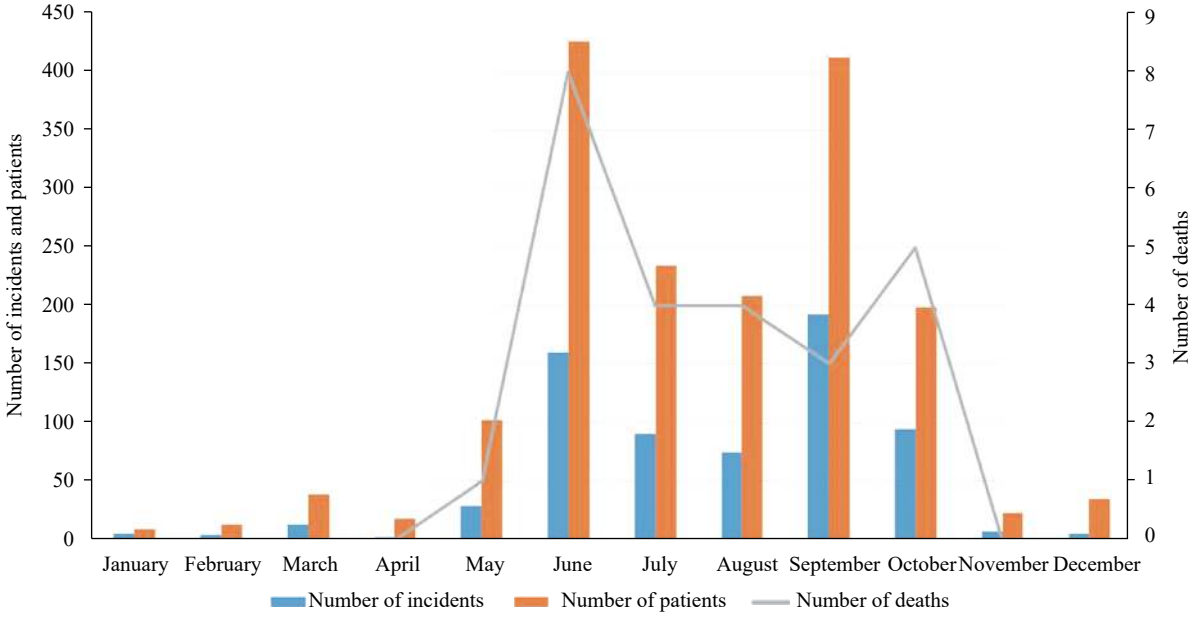

FIGURE 1. Monthly distribution of mushroom poisonings in China, 2020.

molybdites. Detailed information for each PLAD was displayed in Table 1.

Approximately 102 species of poisonous mushroom causing seven different clinical syndromes (acute liver failure, acute renal failure, rhabdomyolysis, hemolysis, gastroenteritis, psycho-neurological disorder, and Shiitake mushroom dermatitis) (*2*–*3*) were successfully identified. In 2020, 24 species were newly recorded as poisonous mushrooms and were added to the Chinese poisonous mushroom list. The most lethal 3 mushroom species were *Lepiota brunneoincarnata*, *Russula subnigricans*, and *Amanita subpallidorosea* killing 5, 4, and 4 people, respectively (Supplementary Table S1, available in http://weekly.chinacdc.cn/). *Chlorophyllum molybdites* caused the most poisonings (appearing in 154 incidents, 304 patients), were the most widely distributed mushroom (discovered in 15 PLADs) and had the longest active period (from late March to late October) in China, 2020 (Supplementary Table S1).

Similar to 2019, the same 9 species causing acute liver failure were identified in China, 2020 (*1*). *Lepiota brunneoincarnata* was found to be the most dangerous species in 2020, being responsible for 15 incidents, 29 patients, and 5 deaths as the lone cause or in combination with other species. *Lepiota brunneoincarnata* was discovered under coniferous trees, but in 2 incidents occurring in 2020, it was found in hardwood forest dominated by fagaceous trees in Guizhou and under *Ziziphus jujube* in Mengcun County, Hebei Province. The incident in Hebei Province on August 29 involved 6 patients. *Amanita exitialis* also appeared in Guangdong in late February, which was earlier than in 2019 but resulted in less deaths (*1*). There were also more incidents of patients consuming a combination of poisonous mushrooms, which can cause greater difficulties and risks for diagnosis and treatment due to species resulting in different symptoms (Supplementary Table S1).

Amanita gymnopus was a species discovered from poisoning investigations causing acute renal failure that was not found in 2019 (*1*). Due to delayed diagnosis and treatment, 3 people were killed by *A. pseudoporphyria* in early June in Guangxi. *Amanita oberwinklerana* was discovered in 18 incidents from 8 PLADs. *Amanita oberwinklerana*, a species occurring in southern China, also caused 6 incidents including 11 patients in North China for the first time from late July to late September. More deaths were caused by *Russula subnigricans*, which leads to rhabdomyolysis, when compared to 2019 (*1*, Supplementary Table S1).

On September 12–13, 2 incidents involving 2 patients and 1 death caused by *Paxillus involutus* resulting hemolysis occurred in Chifeng and Tongliao, Inner Mongolia Autonomous Region. Clinically, this type of poisoning stimulates an autoimmune reaction, with a short incubation period (usually 30 min–3 h), followed by gastrointestinal tract effects (GIT) including nausea, vomiting, abdominal pain, and/or diarrhea. Intravascular haemolysis, anaemia, with potential secondary renal failure, shock, disseminated

TABLE 1. Geographical distribution of mushroom poisoning incidents, cases, deaths, and case fatality in China, 2020.

PLADs	Number of incidents	Number of patients	Deaths	Case fatality (%)
Hunan	302	666	3	0.45
Yunnan	81	244	7	2.87
Guizhou	43	148	7	4.73
Zhejiang	43	78	0	0
Sichuan	40	123	1	0.81
Chongqing	35	88	0	0
Fujian	18	42	0	0
Guangxi	15	87	3	3.45
Anhui	12	30	0	0
Ningxia	12	29	1	3.45
Hubei	12	24	1	4.16
Guangdong	11	21	0	0
Jiangxi	9	17	0	0
Jiangsu	9	9	0	0
Beijing	8	23	0	0
Hainan	7	38	0	0
Hebei	7	33	0	0
Shandong	3	8	1	12.50
Henan	3	3	0	0
Inner Mongolia	2	2	1	50.00
Liaoning	1	2	0	0
Shanxi	1	2	0	0
Gansu	1	1	0	0
Xizang (Tibet)	1	1	0	0
Total	676	1,719	25	1.45

Abbreviation: PLADs=provincial-level administrative divisions.

intravascular coagulopathy, and acute respiratory failure developed on the following few days and even caused death (*3*).

A total of 56 species causing gastroenteritis were identified from mushroom poisoning incidents in China in 2020 (Supplementary Table S1). Among them, *Baorangia major*, *Chlorophyllum demangei*, *Entoloma caespitosum*, *Gymnopus densilamellatus*, *Lactarius atromarginatus*, *Lactifluus deceptivus*, *Lf. puberulus*, *Leucocoprinus cretaceous*, *Micropsalliota furfuracea*, *Neonothopanus nambi*, *Pholiota multicingulata*, *Pulveroboletus subrufus*, *Russula rufobasalis*, and *Tricholoma stans* were species newly discovered as poisonous mushrooms and subsequently added to the Chinese poisonous mushroom list (*1*–*2*, *4*–*6*). This was the first report of *Baorangia major* in China. The top 3 species were *Chlorophyllum molybdites*, *Russula japonica*, and *Entoloma omiense*, which was the same as 2019, but these 3 species caused more incidents and had wider geographical distribution (*1*).

About 28 species causing psycho-neurological disorders were identified from mushroom poisoning incidents in China in 2020, including *Clitocybe subditopoda*, *Gyromitra venenata*, *Inocybe* aff. *ericetorum*, *Mallocybe fulvipes*, *Inosperma* aff. *virosum*, *Inosperma* cf. *virosum*, *Pseudosperma* cf. *bulbosissimum*, and *Pseudosperma yunnanense*, which were species newly discovered as poisonous mushrooms and thus added to Chinese poisonous mushroom list (*1*–*2*, *7*–*9*). The top five species are *Amanita subglobose*, *A. rufoferruginea*, *Gymnopilus dilepis*, *A. melleiceps*, and *A. sychnopyramis* f. *subannulata* (Supplementary Table S1). Among them, *Gyromitra venenata* is a new species discovered from Yunnan and Guizhou resulting 4 patients poisoned as containing gyromitrins (*7*).

Inosperma aff. *virosum* and *Inosperma* cf. *virosum* were potentially two new independent species resulting in typical muscarinic syndrome post ingestion.

Lentinula edodes, commonly known as Shiitake mushroom, is one of the most famous edible mushrooms worldwide (*2*). Shiitake mushroom dermatitis was also reported, though its pathophysiology is unclear at present (*3*,*10*). Clinically, this type of mushroom poisoning presents 1–2 days post ingestion of raw or cooked mushrooms with sudden onset of whiplike (flagellate) linear wheals on limbs, trunk, and/or face/neck, and its toxin was assumed to be the thermolabile polysaccharide, lentinan (*3*,*10*). On January 5, an individual showed typical Shiitake mushroom dermatitis after eating *L. edodes* from Jiangxi. However, two other people who also consumed *L. edodes* were asymptomatic.

About 33 edible species were also identified from mushroom poisoning incidents in 2020 (Supplementary Table S1). These poisoning incidents may be attributed to consumption of mixed mushrooms with poisonous mushrooms, contaminated mushrooms, or some species potentially poisonous to certain people.

DISCUSSION

When comparing incidents in 2019 to 2020, more mushroom poisoning incidents occurred (276 in 2019 *vs.* 676 in 2020) involving more patients (769 *vs.* 1719) and deaths (22 *vs.* 25) (*1*). As in 2019, monthly distribution analysis showed that mushroom poisonings occurred every month and were centered from June to October; however, 1 peak appeared in July in 2019 (*1*), while 2 peaks (June and September) appeared in 2020. Geographical distribution analysis showed that mushroom poisoning incidents were reported in 24 PLADs in 2020—among which, 16 PLADs also reported cases in 2019 with the new PLADs being Anhui, Jiangxi, Beijing, Hebei, Inner Mongolia, Liaoning, Gansu, and Xizang (Tibet) (Supplementary Table S1). The PLADs with the highest number of mushroom poisonings were Hunan, Yunnan, Guizhou, Zhejiang, and Sichuan in 2020 (Supplementary Table S1), and Hunan, Yunnan, Zhejiang, Guizhou, and Chongqing in 2019 (*1*). Yunnan and Guizhou had the most deaths (*7*) in 2020, but in 2019, Yunnan had 14 deaths (*1*). Approximately 102 species of poisonous mushrooms were identified in incidents in 2020, among which 35 species were also identified in 2019, and the total number reached approximately 130 species.

In Spring 2020, 4 people were poisoned by "false morels" resulting in typical metabolic-based pathology secondary to blocking of GABA synthesis in multiple organs. Clinically, the incubation period is 5–12 hours or longer, followed by gastrointestinal system effects, ataxia, hypoglycaemia, haemolysis, methaemoglobinaemia, or even hepatic damage (*3*). Another study showed that this species was different from *Gyromitra esculenta* and represented a new species described as *G. venenata* (*7*).

Paxillus involutus was used as medicine for treating lumbago, skelalgia, and limb numbness in China and was considered edible in some areas of Northeast China, and recent studies also showed it was a good source of antioxidant (*2*). However, *Paxillus involutus* was reported as causing hemolysis after repeated exposure, and its toxins and poisoning mechanism are still unclear (*3*). The 2 incidents in 2020 involving 6 people but only 2 persons were poisoned with 1 death and the other developing renal failure. For safety, we strongly advise not to collect and eat this species although it seems safe to many people.

Gerhardtia sinensis was identified in 2 incidents involving 6 patients and treated as a highly suspected poisonous species in 2019 (*1*). In 2020, this species caused 4 incidents involving 13 patients and was confirmed as poisonous although its toxicology was still unclear (Supplementary Table S1). Another mushroom causing 5 people GIT on August 23 from Dehong, Yunnan, was identified as *Lactifluus pseudoluteopus*. As no toxicological knowledge is available, this mushroom is highly suspected as poisonous presently although several closely related species are edible (*4*).

Patients from many mushroom poisoning incidents consumed mixed wild mushrooms (Supplementary Table S1), and these poisonous mushrooms often caused different clinical syndromes, which put them at high risk. For example, patients consuming together *Amanita fuliginea* and *A. neoovoidea*, *A. fuliginea* and *A. pseudoporphyria*, or *A. fuliginea* and *A. oberwinklerana* could cause acute liver failure and acute renal failure at the same time (Supplementary Table S1). *Coprinus comatus* is a widely consumed mushroom, but as it is matures, coprine accumulates and may lead GIT, especially when combined with alcohol. Therefore, we strongly advise not combining consumption of mixed wild mushrooms and alcohol.

Over 1,000 edible mushrooms and approximately 500 poisonous species were reported in China (*1*–*2*,*4*).

Morphologically, many poisonous species are similar to edible ones, e.g. the lethal *Russula subnigricans* causing rhabdomyolysis is similar to the edible *R. nigricans*, making it hard to differentiate and repeatedly causing poisoning incidents. Educated individuals with the ability to recognize poisonous mushrooms and people aware of the risk of eating wild mushrooms are the basis for mushroom poisoning prevention and control. Therefore, science education is of great importance for reducing mushroom poisoning. In the last few years, many educational science materials for mushroom poisonings in China were produced with cooperation from governments, CDCs, doctors, and mycologists.

Accurate and timely species identification is of pivotal importance in mushroom poisoning incidents, and progress has been made as more incidents were properly identified, which could better guide the diagnosis and treatments for patients. The number of incidents with satisfactory mushroom identification grew from only 2 during 2010–2014 (*11*) to over 200 in 2019 (*1*) and over 600 in 2020. The growing number of poisonous mushroom identifications suggests that what we know only a portion of the variety of poisonous mushrooms. Many species need to be formally described and their edibility is not clear. More effort and closer cooperation are still needed urgently from local and national governments, CDC staff, doctors, and mycologists to properly control mushroom poisoning events.

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SUPPLEMENTARY TABLE S1. Mushroom species involved in poisoning incidents and their spatial and temporal distribution in China, 2020.

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Acute liver failure					
Amanita exitialis	11	36	2	5.56	Feb 24 to Mar 30, Guangdong; June 22 to July 22, Yunnan
Amanita fuliginea	9	23	0	0	June 1 to July 18, Hunan and Guizhou
Amanita fuliginea and *A. neoovoidea*[ARF]	1	2	0	0	June 28, Zhejiang
Amanita fuliginea and *A. pseudoporphyria*[ARF]	2	3	0	0	June 2 to 9, Hunan
Amanita fuliginea and *A. subjunquillea*[ALF]	1	4	3	75.00	July 18, Guizhou
Amanita fuliginea and *A. oberwinklerana*[ARF]	1	2	0	0	June 23, Hunan
Amanita fuliginea and *A. fritillaria*[G/P]	3	9	0	0	June 5 to 15, Hunan
Amanita* cf. *fuliginea	2	9	0	0	June 18 to June 19, Guizhou and Chongqing
Amanita pallidorosea	4	7	0	0	June 16 to July 8, Guizhou
Amanita pallidiorosea and *A. sinocitrina*[P]	1	1	0	0	June 30, Guizhou
Amanita pallidorosea and *A. fritillaria*[G/P]	1	2	0	0	June 30, Chongqing
Amanita rimosa	4	10	0	0	June 6 to 27, Hunan, Hubei, and Chongqing
Amanita rimosa and *Lepiota brunneoincarnata*[ALF]	1	4	0	0	June 12, Hunan
Amanita subjunquillea	6	28	0	0	June 18 to 28, Guizhou; Aug 20 to Sept 2, Hebei and Beijing
Amanita subpallidorosea	4	8	4	50.00	Sept 16 to Oct 15, Yunnan and Guizhou
Amanita subpallidiorosea, A. citrina[P] and ***Lactifluus puberulus***[G]	1	3	0	0	Oct 20, Guizhou
Amanita sp., *Psathyrella candolleana*[G/P], *Russula* sp.[U] and *Agaricus* sp.[U]	1	2	1	50.00	July 13, Sichuan
Galerina sulciceps	6	12	2	16.67	Oct 8 to 16, Yunnan, Sichuan, and Guizhou
Lepiota brunneoincarnata	14	28	5	17.86	May 13 to July 3, Hubei, Hunan, and Jiangsu; Aug 19 to 30, Ningxia, Gansu, Shandong, Hebei and Liaoning
Lepiota brunneoincarnata and *Gymnopus dryophilus*[G]	1	1	0	0	Sept 14, Guizhou
Rhabdomyolysis					
Russula subnigricans	10	26	4	15.38	June 26 to Oct 4, Yunnan, Zhejiang, and Hunan
Russula subnigricans and *R. japonica*[G]	1	4	0	0	July 5, Yunnan
Russula subnigricans and *Entoloma prismaticum*[U]	1	2	0	0	Aug 8, Sichuan
Acute renal failure					
Amanita gymnopus	3	4	0	0	June 14 to July 7, Hunan and Yunnan; Oct 10, Zhejiang
Amanita neoovoidea	4	4	0	0	Sept 24 to Oct 19, Hunan and Sichuan
Amanita oberwinklerana	14	36	0	0	June 6 to July 5, Guizhou, Chongqing, Hunan, and Jiangsu; July 26 to Sept 25, Henan, Shanxi, Beijing, Hebei and Hunan
Amanita oberwinklerana and *A.* cf. *ibotengutake*[P]	1	1	0	0	Sept 5, Beijing
Amanita oberwinklerana and *A. pseudoporphyria*[ARF]	2	3	0	0	June 3 to Sept 30, Hunan
Amanita pseudoporphyria	14	49	3	6.12	June 6 to Oct 14, Hunan, Guangxi, and Yunnan
Amanita aff. *pseudoporphyria*	3	10	0	0	June 6 to Oct 5, Hunan

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Amanita pseudoporphyria and *Suillus placidus*[G] (dried mushrooms)	1	3	0	0	Dec 16, Hunan
Hemolysis					
Paxillus involutus	2	2	1	50.00	Sept 12 to 13, Inner Mongolia
Gastroenteritis					
Baorangia major	1	4	0	0	May 25, Fujian
Baorangia major and *B. pseudocalopus*[G]	1	7	0	0	July 19, Yunnan
Baorangia sp.	1	5	0	0	July 23, Yunnan
Boletellus cf. *emodensis*	1	1	0	0	Aug 12, Yunnan
Chlorophyllum demangei and *Scleroderma aurantiacum*[G]	1	2	0	0	July 31, Sichuan
Chlorophyllum globosum	3	14	0	0	June 3 to Aug 20, Sichuan
Chlorophyllum hortense and *Clitocybe* sp.[P]	1	1	0	0	Oct 26, Sichuan
Chlorophyllum molybdites	152	302	0	0	Mar 28 to Oct 20, Hunan, Guangxi, Zhejiang, Anhui, Sichuan, Hubei, Yunnan, Chongqing, Jiangxi, Hainan, Henan, Guangdong, Fujian, Guizhou, and Jiangsu
Chlorophyllum molybdites and *Ch. hortense*[G]	1	1	0	0	Sept 13, Hunan
Chlorophyllum molybdites and *Entoloma omiense*[G]	1	1	0	0	Sept 28, Hunan
Chlorophyllum spp.	3	9	0	0	July 31 to Dec 14, Sichuan, Hunan, and Guangdong
Cortinarius sinensis.[E] and *C. fulminoides*[U] (bought from market)	1	4	0	0	Sept 8, Ningxia
Entoloma caespitosum	1	1	0	0	Sept 20, Hunan
Entoloma omiense	28	49	0	0	June 28 to Oct 9, Hunan, Zhejiang, Hainan, and Fujian
Entoloma omiense, Entoloma sp[U] and *Psathyrella candolleana*[G/P]	1	1	0	0	July 8, Hunan
Entoloma omiense and *Micropsalliota* sp[U]	1	3	0	0	Sept 10, Fujian
Entoloma omiense and *Suillus placidus*[G]	1	4	0	0	Sept 17, Guizhou
Entoloma cf. *rhodopolium*	1	5	0	0	Aug 4, Yunnan
Entoloma cf. *sinuatum*	2	4	0	0	Sept 14 to 21, Guizhou
Entoloma spp.	17	51	0	0	June 5 to Oct 18, Guangxi, Guizhou, Hunan, and Yunnan
Gerhardtia sinensis	4	13	0	0	Oct 7 to 11, Hunan
Gymnopus densilamellatus	3	19	0	0	Feb 12 to May 31, Hunan and Guizhou
Hygrophorus cf. *whitei*[U], *Lycoperdon caudatum*[U] and *Megacollybia marginata*[U]	1	5	0	0	Oct 9, Sichuan
Hypholoma fasciculare	3	9	0	0	July 8 to Dec 4, Sichuan and Yunnan
Lactarius subhirtipes	3	9	0	0	May 31 to July 26, Hunan, Guizhou, and Anhui
Lactifluus deceptivus, *Lf. pilosus*[G], *Lf.* aff. *piperatus*[G] and ***Lf. puberulus***[G] (dried mushrooms)	1	2	0	0	Feb 9, Hunan
Lactifluus pseudoluteopus[U]	1	5	0	0	Aug 23, Yunnan
Leucocoprinus cretaceous and *Lc. cepistipes*[G]	1	2	0	0	Sept 13, Hunan
Marasmius maximus[E] and *Mycena* sp.[U]	1	1	0	0	July 18, Hubei
Melanoleuca griseobrunnea[U]	1	2	0	0	May 12, Zhejiang
Micropsalliota furfuracea	1	2	0	0	Sept 14, Hunan

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Micropsalliota sp.[U], *Hortiboletus rubellus*[E] and *Russula pectinatoides*[E]	1	2	0	0	Sept 24, Hunan
Neoboletus venenatus (patients of two incidents ate dried mushrooms, bought from market)	4	9	0	0	Aug 13 to Sept 24, Xizang, Guangdong, Hunan, and Sichuan
Neoboletus venenatus and *Scleroderma bovista*[G] (dried mushrooms, bought from market)	1	2	0	0	June 18, Hunan
Neonothopanus* aff. *nambi	2	4	0	0	May 13 to July 13, Yunnan
Omphalotus guepiniformis	2	10	0	0	May 28, Guangxi; Oct 4, Hunan
Omphalotus olearius	2	16	0	0	Sept 9 to Nov 16, Yunnan
Pholiota multicingulata	2	9	0	0	Sept 22 to Oct 5, Hunan
Pulveroboletus subrufus, *Russula punctipes*[G], *Chiua virens*[G] and *Suillus pinetorum*[G]	1	2	0	0	Dec 6, Guizhou
Rubroboletus sinicus and *Neoboletus* cf. *multipunctatus*[U]	1	4	0	0	July 28, Guizhou
Rubroboletus sinicus and *Retiboletus fuscus*[E]	1	3	0	0	June 18, Yunnan
Rubroboletus sp.[U]	1	2	0	0	July 25, Hunan
Russula viridicinnamomea[E], *Agaricus* sp.[U], *Termitomyces microcarpus*[E] and *Lactarius vividus*[E]	1	5	0	0	Aug 2, Sichuan
Russula rufobasalis	1	1	0	0	June 10, Hunan
Russula rufobasalis, ***Lactarius atromarginatus***[G], *Amanita fritillaria*[G/P] and *Russula citrina*[U]	1	2	0	0	June 11, Hunan
Russula rufobasalis, *Amanita fritillaria*[G/P], *Russula compacta*[E], *R. nigricans*[E], *R. subatropurpurea*[E], *R.* cf. *fragrantissima*[U], and *Cortinarius purpurascens*[U]	1	2	0	0	June 11, Hunan
Russula grata, R. cf. *subfoetens*[G], *Lactifluus* aff. *glaucescens*[G], *R. fragrantissima*[U], *R. pseudoamoenicolor*[U], *R. sarnarii*[U], *R. cyanoxantha*[E], *R. variata*[E], *R. vesca*[E], *R. virescens*[E] and *Entoloma* cf. *undatum*[U] (dried mushrooms, bought from market)	1	3	0	0	Feb 5, Hunan
Russula japonica	58	151	0	0	May 31 to Oct 15, Hunan, Zhejiang, Chongqing, Anhui, Yunnan, Guizhou, Fujian, and Hubei
Russula japonica, Entoloma omiense[G] and *Agaricus* sp.[U]	1	3	0	0	Oct 5, Hunan
Russula japonica, R. cerolens[E], *Leotia lubrica*[U] and *Phylloporus dimorphus*[E]	1	2	0	0	July 11, Guizhou
Russula japonica and *R. foetens*[G]	1	1	0	0	June 15, Hunan
Russula japonica and *R. sanguinea*[G]	1	3	0	0	June 10, Hunan
Russula japonica and *R. puncitpes*[G]	1	3	0	0	Oct 3, Hunan
Scleroderma areolatum	1	12	0	0	Aug 12, Beijing
Scleroderma cepa	4	11	0	0	July 7 to Sept 27, Yunnan, Sichuan, Hunan, and Chongqing
Scleroderma citrinum	1	1	0	0	Oct 13, Hunan
Suillus granulatus (dried mushrooms, bought from market)	1	2	0	0	Mar 23, Ningxia
Suillus granulatus, Amanita sinocitrina[P], *A. griseofolia*[G/P], *Russula* spp.[U], *Lycoperdon* sp.[U] and *Gymnopus* sp.[U]	1	1	0	0	Sept 24, Hunan
Suillus pinetorum	1	8	0	0	July 21, Yunnan
Thicholoma highlandense	1	2	0	0	Nov 13, Yunnan
Tricholoma sinopardinum, T. sinoportentosum[E], *Lactarius deterrimus*[E] and *Agaricus* sp.[U]	1	3	0	0	July 21, Sichuan

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Tricholoma stans	1	6	0	0	Nov 14, Yunnan
Tylopilus neofelleus	1	1	0	0	Aug 9 to Sept 27, Yunnan and Chongqing
Psycho-neurological disorder					
Amanita griseopantherina and *Russula foetens*[G]	1	12	0	0	July 21, Sichuan
Amanita melleiceps	5	20	0	0	May 30 to Sept 15, Hunan and Guangxi
Amanita orientigemmata	1	1	0	0	Sept 23, Hunan
Amanita orsonii, A. pseudovaginata[U] and *Entoloma* cf. *subcorvinum*[U]	1	2	0	0	June 28, Guizhou
Amanita rufoferruginea	6	18	0	0	June 6 to Aug 6, Hunan, Chongqing, and Sichuan
Amanita cf. *subfrostiana*	1	2	0	0	July 21, Yunnan
Amanita subglobosa	17	49	0	0	June 19 to Sept 24, Guizhou, Anhui, Chongqing, Sichuan, Yunnan, and Hunan
Amanita sychnopyramis f. *subannulata*	4	42	0	0	Apr 26 to June 10, Hainan, Guangxi, and Hunan
Butyriboletus roseoflavus (bought from market, maybe from Yunnan)	1	9	0	0	Nov 5, Hainan
Clitocybe dealbata	1	2	0	0	July 15, Yunnan
Clitocybe subditopoda	1	3	0	0	Oct 5, Guizhou
Gymnopilus dilepis	6	13	0	0	June 21 to Sept 23, Sichuan, Yunnan, and Guizhou
Gymnopilus spp.	5	8	0	0	May 9 to Oct 3, Jiangxi, Hubei, Hunan, and Yunnan
Gyromitra venenata	2	4	0	0	Mar 13 to 21, Guizhou, Yunnan
Inocybe* aff. *ericetorum and *Russula insignis*[G]	1	1	0	0	May 26, Hunan
Inocybe serotina	1	2	0	0	Sept 19, Ningxia
Inocybe serotina and ***Mallocybe fulvipes***[P]	1	1	0	0	Sept 2, Ningxia
Inocybe serotina and *Pseudosperma umbrinellum*[P] = *Inocybe umbrinella*	1	4	0	0	Aug 28, Ningxia
Inocybe splendentoides	1	1	0	0	Oct 7, Beijing
Inosperma* aff. *virosum	2	16	0	0	Sept 9 to 16, Yunnan
Inosperma* cf. *virosum	1	5	0	0	May 9, Hainan
Lanmaoa asiatica	1	4	0	0	July 19, Yunnan
Lanmaoa asiatica, Rubroboletus latisporus[G], *Suillus granulatus*[G], *Caloboletus xiangtoushanensis*[U] and *Imperator* sp.[U] (dried mushrooms, from Chongqing)	1	3	0	0	Aug 27, Guangdong
Lanmaoa asiatica, Rubroboletus latisporus[G], *Tylopilus neofelleus*[G], *Neoboletus* sp.[U] and *Sutorius* aff. *eximius*[G] (dried mushrooms, from Chongqing)	1	3	0	0	Oct 13, Zhejiang
Panaeolus fimicola	1	2	0	0	June 30, Shandong
Pseudosperma* cf. *bulbosissimum	1	4	0	0	Oct 5, Ningxia
Pseudosperma umbrinellum, ***Mallocybe siciliana***[P] = *Inocybe siciliana, Hebeloma dunense*[U] and *Psathyrella candolleana*[G/P]	1	4	0	0	Sept 4, Hebei
Pseudosperma yunnanense	1	1	0	0	July 10, Yunnan
Psilocybe cubensis	1	2	0	0	Nov 27, Hunan
Shiitake mushroom dermatitis					
Lentinula edodes[E]	1	1	0	0	Jan 5, Jiangxi

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Unclassified					
Agaricus blazei[E]	1	2	0	0	Aug 25, Yunnan
Amanita cf. *constricta* and *Entoloma* cf. *piceinum*[U]	1	5	0	0	Aug 7, Sichuan
Amanita griseofolia	1	4	0	0	June 27, Guizhou
Butyriboletus yicibus[E] (from Yunnan)	1	4	0	0	July 26, Hunan
Coprinopsis nivea[E]	1	3	0	0	June 29, Hunan
Coprinus comatus[E]	2	3	0	0	Early August to Oct 25, Beijing and Ningxia
Cortinarius sinensis.[E] (bought from market)	1	2	0	0	Sept 24, Ningxia
Lactarius cinnamomeus[E]	1	2	0	0	Mar 14, Hunan
Lactifluus tenuicystidiatus[E]	1	2	0	0	Aug 25, Yunnan
Panus gigianteus[E]	1	4	0	0	Sept 20, Hunan
Panus tigrinus[E]	1	1	0	0	May 16, Yunnan
Pleurotus ostreatus[E]	1	1	0	0	Oct 31, Ningxia
Retiboletus fuscus[E] (dried mushrooms, from Yunnan)	1	2	0	0	Mar 6, Fujian
Russula cf. *viridicinnamomea*[E]	1	4	0	0	July 29, Fujian
Scleroderma yunnanense[E]	3	7	0	0	June 25 to Sept 15, Hunan, Yunnan, and Fujian
Stropharia rugosoannulata[E]	1	1	0	0	Jan 31, Guizhou
Xerocomus parvulus[E]	1	4	0	0	Sept 28, Hunan

Abbreviations: ALF=Acute liver failure, ARF=Acute renal failure, G= Gastroenteritis, P= Psycho to neurological disorder, U=Unclassified, E=edible.

Note: Species newly recorded as poisonous mushrooms in China are in bold.