Preplanned Studies

Mushroom Poisoning Outbreaks — China, 2023

Haijiao Li[1]; Yizhe Zhang[1]; Hongshun Zhang[1]; Jing Zhou[1]; Zuohong Chen[2]; Jiaqi Liang[1]; Yu Yin[1]; Qian He[1]; Shaofeng Jiang[1]; Yutao Zhang[1]; Yuan Yuan[1]; Nan Lang[1]; Bowen Cheng[1]; Jiaju Zhong[1]; Zhongfeng Li[1]; Chengye Sun[1,#]

Summary

What is already known about this topic?

Mushroom poisoning poses a significant food safety concern in China, with a total of 196 species identified in poisoning incidents by the end of 2022.

What is added by this report?

In 2023, the China CDC conducted an investigation into 505 cases of mushroom poisoning spanning 24 provincial-level administrative divisions. This investigation resulted in 1,303 patients and 16 deaths, yielding a case fatality rate of 1.23%. A total of 97 mushrooms were identified as the cause of 6 distinct clinical disease types, with 12 species newly documented as poisonous mushrooms in China.

What are the implications for public health practice?

Close collaboration among CDC staff, physicians, and mycologists remains crucial for the control and prevention of mushroom poisoning in the future.

Mushroom poisoning in China has emerged as a significant food safety concern. Over the past decade, the government, CDCs, hospitals, and mycological researchers have collaborated to establish a comprehensive network for collecting information on mushroom poisoning, facilitating diagnosis, and providing treatment support. This network utilizes various communication methods such as WeChat, telephone, and email (*1*–*4*). Following an incident of mushroom poisoning, CDC staff and hospital professionals promptly collect mushroom specimens and photos, which are then sent to mycologists for identification based on morphological and molecular evidence. In parallel, toxin detection is performed on both the mushrooms and biological samples such as blood and urine. By combining the results from species identification, toxin detection, and clinical manifestations, patients are accurately diagnosed and treated in a timely manner (*1*–*4*). In 2023, the China CDC conducted an investigation into 505 incidents of mushroom poisoning across 24 provincial-level administrative divisions (PLADs). This resulted in 1,303 patients and 16 deaths, corresponding to a case fatality rate of 1.23%. A total of 97 poisonous mushroom species, including 12 newly recorded ones, leading to 6 distinct clinical manifestations, were successfully identified. This brings the cumulative number of mushroom species involved in poisoning incidents in China to approximately 220 by the end of 2023.

In 2023, there were multiple incidents of mushroom poisoning, with the number of cases per incident ranging from 1 to 15 and an average of 2. Out of these incidents, only 6 involved more than 10 patients. Among the cases, 23 patients from 11 incidents consumed poisonous mushrooms purchased from markets, while 23 patients from 9 incidents were poisoned after consuming dried mushrooms. Additionally, 217 patients and 5 deaths resulted from 70 incidents where individuals consumed mixed wild mushrooms either self-collected or purchased from markets (Supplementary Table S1, available at https://weekly.chinacdc.cn/).

The temporal distribution analysis revealed that cases of mushroom poisonings were reported throughout the year, with the highest frequency observed between May and October (461 incidents, 1,207 patients, and 15 deaths), reaching a peak in June (127 incidents, 342 patients, and 3 deaths). The first death occurred in late April in Hunan Province. The months with the highest number of deaths were May (7 deaths), followed by June (3 deaths), and August (2 deaths) (Figure 1).

In terms of geographical distribution, mushroom poisoning incidents were reported in 24 PLADs. Among these, 12 PLADs had more than 10 incidents. The PLADs of Hunan, Yunnan, Guizhou, Sichuan, and Hubei were the top 5 affected regions. Hunan had 116 incidents with 223 patients and 1 death, followed by Yunnan with 81 incidents, 225 patients, and 1 death, Guizhou with 72 incidents, 231 patients, and 1

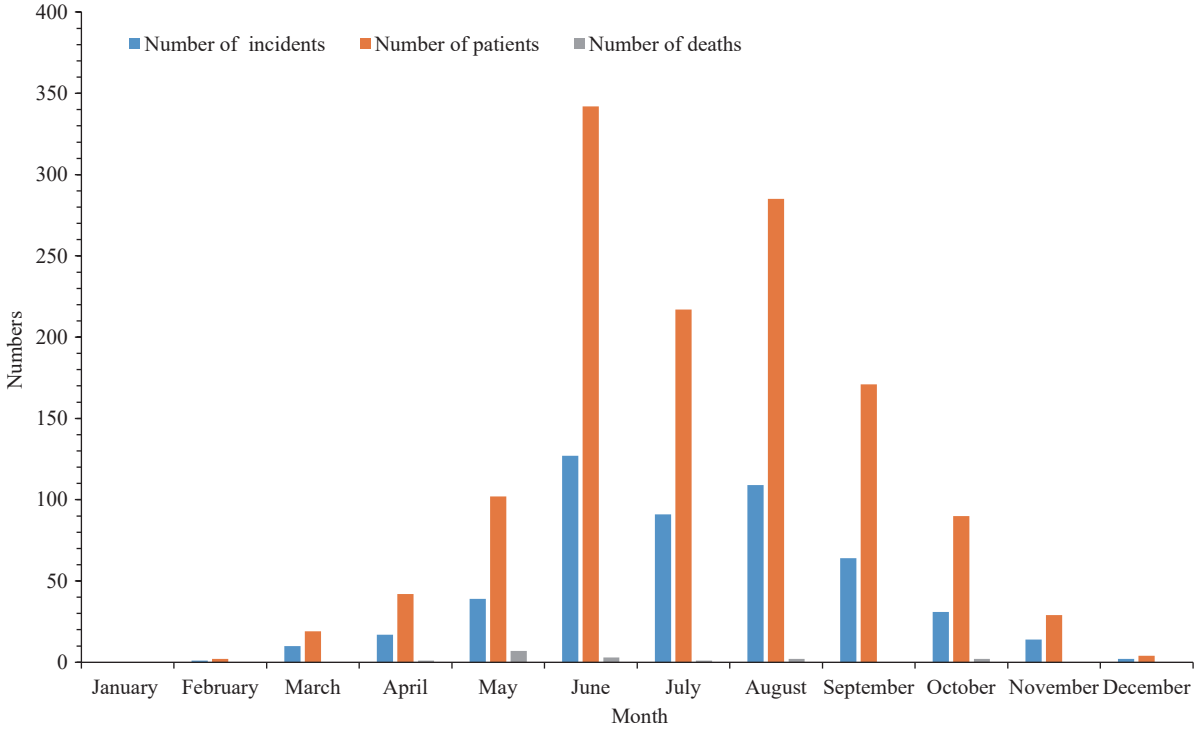

FIGURE 1. Monthly distribution of mushroom poisonings in China in 2023.

death, Sichuan with 48 incidents and 134 patients, and Hubei with 35 incidents and 69 patients (Table 1). Out of the 24 PLADs, 14 had more than 20 patients, with Guizhou, Yunnan, and Hunan having over 200 patients each (Table 1). Regarding fatalities, Guangdong, Guangxi, and Chongqing were the top 3 PLADs, with 5, 4, and 2 deaths, respectively (Table 1).

In 2023, a total of 97 species of poisonous mushrooms were identified in mushroom poisoning cases, leading to 6 distinct clinical syndromes. Among these species, 12 were newly discovered as poisonous in China (Supplementary Table S1). Specifically, *Collybia subtropica*, *Russula brevispora*, *R. flavescens*, and *R. pseudojaponica* were four newly described species in China in 2023 (*5*–*6*). *Collybia subtropica* contained muscarine and caused stimulation of the parasympathetic nervous system, while the last three species caused gastroenteritis. *Collybia subtropica* affected 3 individuals in Hunan from early October to mid-November. *Russula brevispora* was involved in 3 incidents affecting 5 patients, either on its own or in combination with other mushrooms, from June to July in Hunan. *Russula flavescens* was responsible for 2 incidents involving 4 patients from late August to early November in Yunnan. *Russula pseudojaponica* caused 17 incidents, affecting 65 patients, from early June to early November in various regions of China, including South, Southwest, Central, and East China. Additionally, three other newly recorded poisonous mushrooms in China that caused gastroenteritis were *Coprinopsis strossmayeri, Gymnopus dysodes*, and *G. similis*. *Coprinopsis strossmayeri* affected 2 patients in Jiangsu in June. *Gymnopus dysodes* affected 3 patients in June in Yunnan. *Gymnopus similis* was involved in 2 incidents affecting 3 patients in April and July in Hunan. Moreover, *Amanita collariata*, *Inocybe amelandica*, *Pseudosperma conviviale*, *P. triaciculare*, and *P. ushae* were newly described species causing psycho-neurological disorders in Eurasia after 2020 (*7*–*11*). *Amanita collariata*, discovered in Central China in 2022 (*7*), caused 1 incident involving 4 patients in April in Guangxi, 2023. *Inocybe amelandica*, originally discovered in the Netherlands in 2020 (*8*), was involved in 1 incident along with *Pseudosperma umbrinellum*, *P. arenarium*, and *I. serotina* (which contain muscarine) in early October in Ningxia, 2023, affecting 2 patients. *Pseudosperma conviviale*, discovered in Italy in 2020 (*9*), caused 1 incident involving 2 patients in early October in Anhui. *Pseudosperma triaciculare*, discovered in Pakistan in 2020 (*10*), caused 1 incident involving 2 patients in mid-September in Beijing. Lastly, *Pseudosperma ushae*, discovered in Germany in 2022 (*11*), caused 1 incident involving 2 patients in early October in Jilin, together

TABLE 1. Geographical Distribution of Mushroom Poisoning Incidents in China, 2023.

PLADs	Number of incidents	Number of patients	Deaths	Mortality (%)
Hunan	116	223	1	0.45
Yunnan	81	225	1	0.44
Guizhou	72	231	1	0.43
Sichuan	48	134	0	0
Hubei	35	69	0	0
Guangxi	22	83	4	0
Chongqing	21	50	2	4.00
Guangdong	19	51	5	9.80
Jiangsu	17	50	0	0
Fujian	13	39	0	0
Shandong	12	25	1	4.00
Zhejiang	11	21	0	0
Ningxia	9	22	0	0
Anhui	7	26	0	0
Jiangxi	6	11	1	9.09
Hebei	4	13	0	0
Hainan	3	9	0	0
Henan	2	5	0	0
Shanxi	2	3	0	0
Gansu	1	4	0	0
Xinjiang	1	4	0	0
Beijing	1	2	0	0
Jilin	1	2	0	0
Inner Mongolia	1	1	0	0
Total	505	1,303	16	1.23

Abbreviation: PLADs=provincial-level administrative divisions.

with *Cortinarius saturninus*.

The three most deadly mushrooms were identified as *Amanita fuligineoides*, *A. subpallidorosea,* and *Russula subnigricans*, causing 7, 2, and 2 deaths respectively (Supplementary Table S1). Among them, *Chlorophyllum molybdites* was found to have the widest distribution, being discovered in 12 PLADs. This mushroom was also associated with the highest number of poisoning incidents, appearing in 150 incidents and affecting 303 patients. Additionally, it had the longest active period, spanning from early April to early November.

In 2023, a total of 7 species of *Amanita*, 1 species of *Galerina*, and 1 species of *Lepiota* were identified as the cause of acute liver failure in China (Supplementary Table S1). Among these, *Amanita fuligineoides* was found to be the most dangerous, resulting in 7 deaths in 2 incidents involving 18 patients. Another incident involving *Amanita subpallidorosea* and *A. subfuliginea* caused 2 deaths. Additionally, *Amanita exitialis*, *A. subjunquillea*, and *Galerina sulciceps* each caused 1 death. The three most lethal mushroom species responsible for the highest number of incidents were *Amanita exitialis* (10 incidents, 21 affected patients, and 1 death), *Lepiota brunneoincarnata* (9 incidents and 29 affected patients), and *Amanita subjunquillea* (7 incidents, 23 affected patients, and 1 death).

Three species, namely *Amanita oberwinklerana*, *A. pseudoporphyria*, and *A. kotohiraensis*, were identified as the causes of acute renal failure in 2023 (Supplementary Table S1). *Amanita oberwinklerana* was the most prevalent species, present in 13 incidents involving 26 patients, either alone or in combination with other species. *Amanita pseudoporphyria* resulted in 2 fatalities out of 5 incidents and affected a total of 17 patients.

Russula subnigricans caused 14 cases of rhabdomyolysis, affecting a total of 38 patients and resulting in 2 fatalities, either on its own or in conjunction with other mushroom species. Additionally, *Cordierites frondosus* caused photosensitive dermatitis in 4 patients across 2 separate incidents in Yunnan during June (Supplementary Table S1).

A total of 50 mushroom species causing gastroenteritis were identified in China in 2023 (Supplementary Table S1). Among these species, 6 were newly identified as poisonous mushrooms and have been added to the Chinese poisonous mushroom list (*1*–*4*). The three most commonly encountered species in this category were *Chlorophyllum molybdites*, *Entoloma omiense*, and *Russula japonica*.

In 2023, a total of 33 mushroom species associated with psycho-neurological disorders were identified in China (Supplementary Table S1) (*1*). The three most frequently encountered species were *Amanita sychnopyramis* f. *subannulata*, which was involved in 10 incidents and affected 30 patients either alone or in combination with other species, followed by *Amanita subglobosa*, found in 9 incidents and affecting 40 patients, and *Psilocybe cubensis*, observed in 8 incidents and impacting 27 patients.

DISCUSSION

In 2023, mushroom poisoning incidents showed an increase compared to the years 2019 to 2022, with the exception of 2020. The number of patients in 2023 was higher than that of 2019 and 2021, but lower than

that of 2020 and 2022. The number of deaths decreased in 2023 (*1*–*4*). Among the poisoning incidents in 2023, a total of 97 poisonous mushroom species were successfully identified, with 73 of them already recorded in the years 2019 to 2022 (*1*–*4*). This brings the total number of mushroom species involved in incidents to approximately 220 in China by the end of 2023. The most dangerous mushrooms causing fatalities in 2023 were *Amanita fuligineoides*, which differed from the years 2019 to 2022 (*1*–*4*).

The temporal distribution analysis revealed that mushroom poisonings in 2023 were primarily observed from May to October, which is consistent with the patterns observed in 2019 and 2020. However, the duration of the incidents in 2023 was shorter compared to those in 2021 and 2022 (*1*–*4*). Similar to 2022, the peak of mushroom poisonings in 2023 was observed in June (*1*–*4*). Notably, unlike the previous years, no incidents were recorded in January 2023 (*1*–*4*)(Figure 1).

In 2023, the province of Hunan had the highest number of incidents among all PLADs, consistent with the occurrences in 2019, 2020, and 2021, but differing from 2022 (*1*–*4*).

From late October to early November, three patients from two separate incidents in Northeastern China experienced poisoning from *Cortinarius saturninus*, either alone or in combination with *Pseudosperma ushae* (Supplementary Table S1). All three patients developed gastroenteritis and exhibited varying degrees of liver and kidney damage, which is not consistent with the typical symptoms of orellanine poisoning. Further investigation is necessary to identify the specific toxins involved and elucidate the mechanism of toxication.

A study conducted in 2023 focused on the species diversity of *Russula* subgenus *Brevipedum* in China. This study identified and named three new species: *Russula brevispora*, *R. flavescens*, and *R. pseudojaponica*. Interestingly, all three of these species were found to be responsible for cases of gastroenteritis poisoning in the same year. As a result, they have been included in the Chinese poisonous mushroom list (Supplementary Table S1).

This study represents only incidents that were investigated by a system comprising CDC staff, doctors, and mycologists. Our primary focus is on key areas and target populations affected by mushroom poisoning in China. We aim to identify the diversity of poisonous mushrooms, as well as the spatial and temporal distribution characteristics of mushroom poisoning. However, it should be noted that in numerous poisoning incidents, no mushroom specimens or even photos were obtained, making it challenging to confirm the exact species of poisonous mushrooms and provide targeted treatment for patients.

To achieve this goal, we propose the development and dissemination of diverse and accessible educational materials on toxic mushrooms. By reaching a wider audience, we can effectively reduce the incidence of mushroom poisoning.

Acknowledgements: Prof. Zhuliang Yang, Drs. Xianghua Wang, Gang Wu, Hong Luo, Zaiwei Ge, Yanchun Li (Kunming Institute of Botany, Chinese Academy of Sciences), Prof. Ping Zhang (Hunan Normal University), Profs. Taihui Li, Wangqiu Deng, Drs. Ming Zhang, Chaoqun Wang (Institute of Microbiology, Guangdong Academy of Sciences), Prof. Tolgor Bau (Jilin Agricultural University), Drs. Niankai Zeng, Yuguang Fan (Hainan Medical University), Prof. Liping Tang (Kunming Medical University), Prof. Junfeng Liang, Dr. Jie Song (Research Institute of Tropical Forestry, Chinese Academy of Forestry), Profs. Yucheng Dai, Baokai Cui, Shuanghui He, Dr. Jing Si (Beijing Forestry University), Dr. Chuanhua Li (Shanghai Academy of Agricultural Sciences), Prof. Haisheng Yuan (Institute of Applied Ecology, Chinese Academy of Sciences), Dr. Xiaolan He (Institute of Agricultural Resources and Environment, Sichuan Academy of Agricultural Science) and Profs. Liangdong Guo, Lei Cai, Ruilin Zhao, Xiaoyong Liu (Institute of Microbiology, Chinese Academy of Sciences); involved CDCs and hospitals.

Funding: Ministry of Science and Technology of the People's Republic of China National Natural Science Foundation of China 32270021.

doi: 10.46234/ccdcw2024.014

[#] Corresponding author: Chengye Sun, suncy@chinacdc.cn.

[1] National Institute of Occupational Health and Poison Control, Chinese Center for Disease Control and Prevention, Beijing, China; [2] College of Life Sciences, Hunan Normal University, Changsha City, Hunan Province, China.

Submitted: January 12, 2024; Accepted: January 24, 2024

REFERENCES

1. Li HJ, Zhang HS, Zhang YZ, Zhang KP, Zhou J, Yin Y, et al. Mushroom poisoning outbreaks — China, 2019. China CDC Wkly 2020;2(2):19 – 24. https://doi.org/10.46234/ccdcw2020.005.
2. Li HJ, Zhang HS, Zhang YZ, Zhou J, Yin Y, He Q, et al. Mushroom poisoning outbreaks — China, 2020. China CDC Wkly 2021;3(3):41 –

5. https://doi.org/10.46234/ccdcw2021.014.
3. Li HJ, Zhang HS, Zhang YZ, Zhou J, Yin Y, He Q, et al. Mushroom poisoning outbreaks — China, 2021. China CDC Wkly 2022;4(3):35 – 40. https://doi.org/10.46234/ccdcw2022.010.
4. Li HJ, Zhang YZ, Zhang HS, Zhou J, Liang JQ, Yin Y, et al. Mushroom poisoning outbreaks — China, 2022. China CDC Wkly 2023;5(3):45 – 50. https://doi.org/10.46234/ccdcw2023.009.
5. He ZM, Chen ZH, Bau T, Wang GS, Yang ZL. Systematic arrangement within the family clitocybaceae (tricholomatineae, agaricales): phylogenetic and phylogenomic evidence, morphological data and muscarine-producing innovation. Fungal Diversity 2023;123 (1):1 – 47. https://doi.org/10.1007/s13225-023-00527-2.
6. Chen YL, An MY, Liang JY, Li WJ, Deng CY, Wang J, et al. Morphological characteristics and molecular evidence reveal four new species of *Russula* subg. Brevipedum from China. J Fungi 2023;9(61): 61. https://doi.org/10.3390/jof9010061.
7. Su YT, Cai Q, Qin WQ, Cui YY, Chen ZH, Yang ZL. Two new species of *Amanita* section *Amanita* from central China. Mycol Prog 2022;21(9):78. https://doi.org/10.1007/s11557-022-01828-7.
8. Bandini D, Oertel B, Schüssler C, Eberhardt U. Noch mehr risspilze: fünfzehn neue und zwei wenig bekannte arten der gattung *Inocybe*. Mycol Bavarica 2020;20:13-101. https://www.biotaxa.org/Phytotaxa/article/view/phytotaxa.480.2.6.
9. Cervini M, Bizio E, Alvarado P. Nomenclatural novelties. Index Fungorumno4412020:1-2https://www.indexfungorum.org/Publications/Index%20Fungorum%20no.441.pdf.
10. Saba M, Haelewaters D, Pfister DH, Khalid AN. New species of *Pseudosperma* (agaricales, *inocybaceae*) from pakistan revealed by morphology and multi-locus phylogenetic reconstruction. MycoKeys 2020;69:1 – 31. https://doi.org/10.3897/mycokeys.69.33563.
11. Bandini D, Oertel B, Eberhardt U. Noch mehr risspilze (3): einundzwanzig neue arten der familie inocybaceae. Mycol Bavarica 2022;22:31-138. https://www.researchgate.net/publication/360823313_Noch_mehr_Risspilze_3_Einundzwanzig_neue_Arten_der_Familie_Inocybaceae.

SUPPLEMENTARY MATERIAL

SUPPLEMENTARY TABLE S1. Mushroom species implicated in cases of poisoning and their spatial and temporal distribution in China, 2023.

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Acute liver failure					
Amanita exitialis	9	20	0	0.00	April 7 to 8, Guangdong; June 13 to August 20, Yunnan
Amanita exitialis, *A. zangii* [U] and *Amanita* sp. [U]	1	1	1	100.00	June 16, Yunnan
Amanita cf. *exitialis*	1	5	0	0.00	September 2, Yunnan
Amanita fuliginea	2	4	0	0.00	June 26 and July 10, Sichuan and Hunan
Amanita fuligineoides	1	15	5	33.33	May 1, Guangdong
Amanita fuligineoides, *A. pseudoporphyria*[ARF], *A. kotohiraensis*[ARF], *A. fritillaria*[P], *Russula compacta* [E], *Russula* spp. [U] and *Amanita* sp.[U]	1	3	2	66.67	May 2, Guangxi
Amanita pallidorosea	4	9	0	0.00	July 2, Guizhou; July 29, Shandong; August 12, Yunnan; September 3, Shanxi
Amanita subfuliginea	1	3	0	0.00	June 4, Chongqing
Amanita subjunquillea	6	17	1	5.88	July 23 to September 3, Shandong, Hebei
Amanita subjunquillea, *Gymnopus densilamellatus* [G], *Tricholoma sinoportentosum* [G], *Amanita orsonii*[P], *Pholiota spumosa* [U], *Hydnum vesterholtii* [E], *Suillus sibiricus* [U] and *Russula* spp.[U]	1	6	0	0.00	August 4, Sichuan
Amanita subpallidorosea	1	2	0	0.00	October 3, Hubei
Amanita subpallidorosea, *A. subfuliginea*[ALF], *Tapinella atrotomentosa*[G], *Suillus pinetorum*[G], *A. sinocitrina*[P], *Pleurotus pulmonarius*[E] and *Lactarius vividus*[E]	1	2	2	100.00	October 28, Chongqing
Amanita spp.	3	6	0	0.00	June 5 to August 10, Hubei, Yunnan, Shandong
Galerina sulciceps	3	6	1	16.67	March 30, Sichuan; April 23, Hunan; November 4, Yunnan
Lepiota brunneoincarnata	9	29	0	0.00	June 9 to 26, Jiangsu, Guizhou, Hubei; July 23, Jiangsu; August 29 to September 25, Xinjiang, Ningxia
Rhabdomyolysis					
Russula subnigricans	12	35	2	5.71	June 15 to August 17, Yunnan, Jiangxi, Guizhou, Chongqing and Hunan
Russula subnigricans, *R. japonica*[G] and *R. punctipes*[G]	1	2	0	0.00	June 24, Hunan
Russula subnigricans and *Russula* sp.[U]	1	1	0	0.00	August 17, Fujian
Acute renal failure					
Amanita oberwinklerana	10	19	0	0.00	June 2 to October 11, Guizhou, Chongqing, Henan, Shanxi, and Hubei
Amanita oberwinklerana and *A. pseudoporphyria*	1	3	0	0.00	June 8, Chongqing
Amanita oberwinklerana and *A. subjunquillea*[ALF]	1	2	0	0.00	August 31, Hebei
Amanita oberwinklerana, *A. fritillaria*[P], *Agaricus luteofibrillosus*[U] and *Lactarius subzonarius*[E]	1	2	0	0.00	June 18, Guizhou
Amanita pseudoporphyria	5	17	2	11.76	August 31 to September 17, Hunan, Guangxi
Gastroenteritis					
Agaricus xanthodermus	1	2	0	0.00	September 20, Jiangsu
Baorangia major	2	5	0	0.00	June 29, Fujian; December 25, Hunan (dried boletes bought from Yunnan market)
Chlorophyllum globosum	8	24	0	0.00	May 3 to August 18, Guangdong, Hubei, Hainan, Yunnan, Sichuan
Chlorophyllum aff. *globosum*	2	7	0	0.00	August 7 to September 26, Sichuan

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Chlorophyllum hortense	7	19	0	0.00	May 2 to September 4, Zhejiang, Hubei, Sichuan, Hunan
Chlorophyllum molybdites	149	302	0	0.00	April 6 to November 3, Guangdong, Hunan, Guangxi, Hainan, Hubei, Fujian, Anhui, Jiangsu, Sichuan, Yunnan, Zhejiang, Chongqing (2 patients in 2 incidents from Guangdong ate raw mushrooms; 4 patients in 1 incident from Hunan ate dried mushrooms collected in 2022)
Chlorophyllum molybdites and *Coprinus comatus*[E,G]	1	1	0	0.00	August 28, Hubei
Coprinopsis atramentaria	2	3	0	0.00	April 25 and May 6, Ningxia
Coprinopsis strossmayeri	1	2	0	0.00	June 19, Jiangsu
Entoloma caespitosum	1	2	0	0.00	July 14, Yunnan
Entoloma cf. *sinuatum*	1	5	0	0.00	June 15, Guizhou
Entoloma cf. *subsinuatum*	1	4	0	0.00	October 8, Guizhou
Entoloma cf. *subsinuatum* and *Descolea quercina*[U]	1	9	0	0.00	October 6, Guizhou
Entoloma omiense	20	82	0	0.00	June 14 to August 12, Hainan, Jiangxi, Guangxi, Guizhou, Sichuan
Entoloma omiense and *Amanita sinensis*[E]	1	7	0	0.00	June 26, Guangxi
Entoloma omiense and *Amanita sinocitrina*[P]	1	7	0	0.00	June 23, Guizhou
Entoloma omiense, *Amanita* sp.[U], *Russula viridicinnamomea*[U], *Lactarius* aff. *gerardii*[E] and *Russula crustosa*[E]	1	6	0	0.00	August 10, Sichuan
Entoloma omiense, *Calvatia craniiformis*[E,M], *Lactarius vividus*[E] and *Entoloma* sp.[U]	1	4	0	0.00	August 12, Sichuan
Entoloma omiense, *Pisolithus albus*[U], *Retiboletus fuscus*[E] and *Lactarius vividus*[E]	1	2	0	0.00	August 17, Yunnan
Entoloma omiense, *Marasmius maximus*[E] and *Leucoagaricus rubrotinctus*[U]	1	10	0	0.00	July 8, Jiangsu
Entoloma omiense and *Entoloma* sp.[U]	1	2	0	0.00	August 6, Sichuan
Entoloma omiense and *Gymnopus* sp.[U]	1	6	0	0.00	July 28, Guizhou
Entoloma omiense and *Russula viridicinnamomea*[U]	1	2	0	0.00	August 12, Sichuan
Gymnopus densilamellatus	1	1	0	0.00	July 5, Guizhou
Gymnopus cf. *densilamellatus*	2	5	0	0.00	February 18 and March 29, Hunan
Gymnopus dryophilus	1	2	0	0.00	March 26, Guizhou
Gymnopus dryophilus, *G. densilamellatus*, *Suillus pinetorum*[G], *Laccaria laccata*[E], *Infundibulicybe alkaliviolascens*[E], *Russula violeipes*[E], *R. cerolens*[U] and *Gymnopus* sp.[U]	1	3	0	0.00	June 14, Guizhou
Gymnopus dysodes	1	3	0	0.00	June 14, Yunnan
Gymnopus similis	2	3	0	0.00	April 25 and July 8, Hunan
Gymnopus sp. and *Agaricus* sp.[U]	1	2	0	0.00	August 3, Hunan
Gymnopus sp. and *Russula* sp.[U]	1	2	0	0.00	July 13, Yunnan
Heimioporus japonicus	1	2	0	0.00	August 19, Fujian
Lactarius laccarioides	1	10	0	0.00	October 18, Yunnan
Lactarius rubrobrunneus	1	1	0	0.00	July 2, Yunnan
Lactifluus aff. *glaucescens*	1	3	0	0.00	June 27, Guizhou
Lanmaoa sp.	1	2	0	0.00	June 30, Yunnan
Leucocoprinus cretaceus	1	1	0	0.00	July 16, Jiangsu

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Neoboletus venenatus	3	5	0	0.00	August 10, Sichuan; September 10 to 24, Shandong, Hunan (dried boletes, bought from markets)
Omphalotus guepiniformis	3	7	0	0.00	March 20, Guizhou; October 9 and November 3, Hunan
Omphalotus yunnanensis nom. prov.	2	9	0	0.00	August 20 and October 14, Yunnan
Pholiota lubrica	1	3	0	0.00	November 13, Yunnan
Pulveroboletus subrufus, *Lactifluus* cf. *pseudoluteopus*[U], *L. subpruinosus*[E], *L. volemus*[E], *Pleurotus giganteus*[E] and *Russula crustosa*[E]	1	1	0	0.00	August 2, Hunan
Rubroboletus sinicus	1	2	0	0.00	July 16, Yunnan
Russula brevispora	1	1	0	0.00	July 18, Hunan
Russula brevispora, *R. punctipes*, *R. rufobasaliss*[G], *Tylopilus neofelleus*[G], *Suillus pinetorums*[G], *Boletellus indistinctuss*[G], *Xerocomus subtomentosus*[G], *Amanita pseudoporphyrias*[ARF], *Amanita fritillaria*, *Russula crustosa*[E], *Termitomyces* sp.[E], *Lactifluus subpruinosus*[E], *Pleurotus giganteus*[E], *Russula compacta*[E], *Russula aureoviridi*[U], *Russula purpureoverrucosa*[U], *Gyroporus longicystidiatus*[U], *Tylopilus pseudoballoui*[U] and *Lactarius atromarginatus*[U]	1	2	0	0.00	June 25, Hunan (dried mushrooms)
Russula brevispora, *R. punctipes*[G], *R. foetens*[G], *Amanita pseudoporphyria*[ARF], *Lactarius vitellinus*[U], *Lactifluus roseophyllus*[U], *Russula aureoviridi*[U], *Lactifluus* aff. *ambicystidiatus*[E], *Lactifluus* aff. *tropicosinicus*[E], *Lentinus squarrosulus*[E], *Russula lepida*[E] and *Russula vesca*[E]	1	2	0	0.00	July 31, Hunan (dried mushrooms)
Russula flavescens	1	3	0	0.00	November 8, Yunan
Russula flavescens and *Amanita* cf. *similis*[U]	1	1	0	0.00	August 31, Yunan
Russula japonica	20	49	0	0.00	May 5 to July 22, Hunan, Hubei, Guizhou, Yunnan, Zhejiang
Russula pseudojaponica	11	45	0	0.00	June 6 to November 7, Guangxi, Guizhou, Jiangxi, Yunnan, Fujian, Hunan
Russula pseudojaponica, *Amanita* cf. *princeps*[E] and *Russula* sp.[U]	1	1	0	0.00	July 30, Sichuan
Russula pseudojaponica, *R. punctipes*[G], *R. viridicinnamomea*[U] and *Russula* spp.[U]	1	2	0	0.00	August 11, Sichuan
Russula pseudojaponica, *R. densifolia*[E], *R. callainomarginis*[U] and *Russula* sp.[U]	1	6	0	0.00	June 19, Guizhou
Russula pseudojaponica, *R. densifolia*[E] and *Calvatia craniiformis*[E,M]	1	4	0	0.00	July 25, Sichuan
Russula pseudojaponica, *R. foetens*[G], *R. punctipes*[G], *Lactifluus pilosus*[G], *Suillus granulatus*[G] and *Russula virescens*[E]	1	5	0	0.00	June 17, Guizhou
Russula pseudojaponica, *Russula* sp.[U] and *Amanita* sp.[U]	1	2	0	0.00	August 4, Sichuan
Russula punctipes, *R. callainomarginis*[U], *Russula* sp.[U], *Amanita griseofolia*[U] and *A. fritillaria*[P]	1	2	0	0.00	August 7, Sichuan
Scleroderma cepa	3	15	0	0.00	June 27 to July 16, Guizhou, Yunnan
Scleroderma sp., *Clitocella* sp.[U], *Amanita melleiceps*[P] and *Agaricus atrodiscus*[G]	1	3	0	0.00	September 23, Sichuan
Suillus granulatus	2	3	0	0.00	August 10 and October 4, Guizhou, Shandong
Tricholoma olivaceum	1	2	0	0.00	September 5, Yunnan
Tricholoma olivaceum, *Entoloma* cf. *subsinuatum*[G] and *Amanita* sp.[U]	1	1	0	0.00	August 21, Yunnan
Tricholoma sinopardinum	1	2	0	0.00	November 9, Sichuan

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Tricholoma stans	1	4	0	0.00	November 1, Yunnan
Tylopilus vinosobrunneus, *Lactifluus piperatus*[E,G], *Boletus reticulatus*[E], *Tylopilus pseudoballoui*[E], *Neoboletus obscureumbrinus*[E], *Retiboletus sinensis*[E], *Rugiboletus extermioirentalis*[E], *Lanmaoa angustispora*[U], *Neoboletus multipunctatus*[U] and *Lactifluus dwaliensis*[U]	1	2	0	0.00	November 14, Guizhou (dried mushrooms)
Psycho-neurological disorder					
Amanita collariata, *Russula sanguinea*[E]	1	4	0	0.00	April 18, Guangxi
Amanita concentrica	1	1	0	0.00	June 8, Yunnan
Amanita melleiceps	2	2	0	0.00	April 24, Jiangxi; August 26, Hunan
Amanita parvipantherina	3	11	0	0.00	May 23 to June 6, Guizhou
Amanita pseudosychnopyramis	1	4	0	0.00	April 15, Zhejiang
Amanita cf. *pseudosychnopyramis* and *A. rufoferruginea*	1	5	0	0.00	June 8, Fujian
Amanita rufoferruginea	4	10	0	0.00	May 26 to July 1, Hunan, Chongqing, Guizhou
Amanita siamensis	1	2	0	0.00	July 30, Sichuan
Amanita siamensis and *Termitomyces* sp.[E]	1	3	0	0.00	July 29, Sichuan
Amanita subglobosa	7	33	0	0.00	June 16 to July 2, Guizhou; August 6 to 15, Chongqing, Yunnan; September 30, Guizhou
Amanita subglobosa, A. pseudoporphyria[ARF], *Pisolithus arhizus*[U]	1	4	0	0.00	October 20, Sichuan
Amanita subglobosa and *Agaricus atrodiscus*[G]	1	3	0	0.00	October 7, Guizhou
Amanita sychnopyramis f. *subannulata*	8	24	0	0.00	April 25 to June 25, Guangxi, Hunan, Chongqing
Amanita sychnopyramis f. *subannulata* and *Chlorophyllum molybdites*[G]	1	1	0	0.00	June 27, Fujian
Amanita sychnopyramis f. *subannulata*, *A. castanea*[U] and *A. pseudoporphyria*[ARF]	1	5	0	0.00	July 15, Hunan
Candolleomyces candolleanus	1	3	0	0.00	June 19, Yunnan
Clitocybe dealbata	1	1	0	0.00	October 7, Hunan
Collybia subtropica	3	3	0	0.00	October 9 to November 17, Hunan
Gymnopilus dilepis	3	6	0	0.00	May 14 to August 9, Guizhou, Yunnan
Gyromitra venenata	1	1	0	0.00	March 31, Guizhou
Inocybe serotina	1	1	0	0.00	September 29, Ningxia
Inosperma cf. *virosum*	1	1	0	0.00	September 4, Yunnan
Inosperma sp.	2	16	0	0.00	September 1 and 2, Yunnan
Lanmaoa asiatica	3	3	0	0.00	July 5 to November 6, Guangdong, Jiangxi (bought from Yunnan market)
Ophiocordyceps sobolifera	1	1	0	0.00	September 17, Chongqing
Panaeolus cyanescens	2	4	0	0.00	October 11 and 31, Guangxi, Guizhou
Pseudosperma arenarium	1	1	0	0.00	October 14, Ningxia
Pseudosperma conviviale	1	2	0	0.00	October 8, Anhui
Pseudosperma triaciculare	1	2	0	0.00	September 15, Beijing
Pseudosperma umbrinellum	2	4	0	0.00	July 28 and September 9, Ningxia
Pseudosperma umbrinellum, *P. arenarium*[P], ***Inocybe amelandica***[P], *I. serotina*[P] and *Hebeloma dunense*[U]	1	2	0	0.00	October 7, Ningxia
Pseudosperma yunnanense, *Tylopilus neofelleus*[G] and *Collybiopsis subnuda*[U]	1	6	0	0.00	August 9, Guizhou

Continued

Mushroom species	Number of incidents	Number of patients	Deaths	Case fatality (%)	Spatial and temporal distribution
Psilocybe cubensis	7	16	0	0.00	May 4 to June 15, Hunan, Guizhou; November 6, Guangxi
Psilocybe cubensis and *Chlorophyllum hortense*[G]	1	11	0	0.00	April 29, Guangxi
Psilocybe papuana	1	4	0	0.00	August 9, Yunnan
Tolypocladium dujiaolongae	1	3	0	0.00	September 21, Guangdong
Photosensitive dermatitis					
Cordierites frondosus	2	4	0	0.00	June 20, Yunnan
Unclassified					
Agaricus albovariabilis[U]	1	1	0	0.00	August 21, Fujian
Agaricus beijingensis[U]	1	1	0	0.00	October 3, Shandong
Agaricus campestris[E]	3	3	0	0.00	March 13 to April 3, Hunan
Agaricus sp.[U], *Oudemansiella orientalis*[E], *Lactarius cinnamomeus*[E]	1	1	0	0.00	May 29, Guizhou
Agaricus sp.[U], *Russula* sp.[U]	1	1	0	0.00	June 18, Guizhou
Amanita cf. *princeps*[E]	1	2	0	0.00	July 15, Sichuan
Amanita manicata[U]	1	1	0	0.00	June 28, Guangxi
Amanita pseudoprinceps[E]	1	1	0	0.00	August 16, Yunnan
Calvatia cyathiformis[U]	1	1	0	0.00	September 3, Guangdong
Calvatia gigantea[U]	1	1	0	0.00	June 7, Chongqing
Cortinarius saturninus[U]	1	1	0	0.00	September 25, Inner Mongolia
Cortinarius saturninus[U], ***Pseudosperma ushae***[P]	1	2	0	0.00	October 3, Jilin
Hygrophorus yunnanensis[U] and *H. pseudopurpurascens*[U]	1	2	0	0.00	November 9, Yunnan (bought from market)
Leucoagaricus lacrymans[U] and *Agaricus* sp.[U]	1	1	0	0.00	May 18, Guangdong
Neoboletus flavidus[E]	1	1	0	0.00	July 2, Yunnan
Neoboletus flavidus[E] and *Albatrellus ellisii*[E]	1	2	0	0.00	July 3, Shandong (dried boletes)
Neofavolus alveolaris[U] and *Tyromyces chioneus*[U]	1	1	0	0.00	December 25, Chongqing
Pisolithus arhizus[U]	1	4	0	0.00	October 4, Sichuan
Pleurotus pulmonarius[E]	1	1	0	0.00	April 18, Hubei
Russula pulchra[U]	1	3	0	0.00	August 10, Chongqing
Scleroderma yunnanense[E]	1	4	0	0.00	October 26, Guizhou
Trametes hirsuta[U]	1	1	0	0.00	July 10, Guangdong
Trichaptum byssogenum[U]	1	4	0	0.00	September 17, Hubei
Turbinellus cf. *parvisporus*[U]	1	2	0	0.00	June 30, Yunnan

Abbreviations used for mushroom poisoning incidents involving more than two species: ALF=Acute liver failure, ARF=Acute renal failure, G=Gastroenteritis, P=Psycho to neurological disorder, M=Medicinal, U=Unclassified, E=edible.
Note: Species newly recorded as poisonous mushrooms in China are in italics and bolded.