

Outbreak Reports

A Poisoning Outbreak Caused by *Millettia Pachycarpa* — Chongqing Municipality, December 2020

Qian He¹; Xun Tang²; Shisong Wang³; Maolin Zhang³; Hongshun Zhang^{4,*}

Summary

What is already known about this topic?

Millettia pachycarpa belongs to the Fabaceae family and is widely distributed in the southern China. It is toxic for the rotenone contained in its roots and seeds, and ingesting its seeds could result in poisoning.

What is added by this report?

In December, 2020, a poisoning from plant seeds occurred in Chongqing Municipality. The etiological association was confirmed based on epidemiological investigation, clinical manifestation, plant species identification, and rotenone analysis. The patient rapidly developed central nervous and respiratory depression with metabolic acidosis. The plant was identified as *Millettia pachycarpa*, and toxin analysis indicated that the rotenone content contained in the seeds was high enough to cause intoxication.

What are the implications for public health practice?

Millettia pachycarpa poisoning is rare but could be fatal. Efforts should be made to educate and communicate with the public, doctors, and public health practitioners that the toxic effects the seeds could be life-threatening when swallowed, both accidentally or intentionally.

On December 18, 2020, the National Poison Control Center received notification that a poisoning accident occurred due to ingestion of plant seeds, and the patients were admitted to Fengdu County People's Hospital of Chongqing Municipality. The plant seemed to stem from the *Millettia* genus based on the pictures provided by one patient's wife. To further clarify the causality of the intoxication outbreak and provide control measures, an investigation into the outbreak was conducted in collaboration with Chongqing Poison Control Center. The plants with fruits were collected at the site where the poisoning occurred, and the doctors and patients were interviewed to obtain the clinical course and treatments. Then, the species of plants was identified, and the rotenone contents of the seeds and gastric

lavage samples were analyzed.

INVESTIGATION AND FINDINGS

Around 11:30 on December 18, 2020, 2 workers picked fruits thinking they were edible on the hillside besides their workplace in a village in Fengdu County, Chongqing Municipality. Subsequently, they grilled the fruits and shared several fruits with another worker, and all the three workers ate the seeds after peeling the pericarp. They developed discomfort a few minutes after ingesting the seeds. Two of the workers spit out most of the seeds due to poor taste and experienced slightly transient nausea and dizziness but recovered relatively quickly. In contrast, the other 32-year-old male worker who swallowed a whole seed unsuccessfully tried to induce vomiting for himself. He underwent limb weakness and dizziness and rapidly lost consciousness and progressed to coma about ten minutes later. He was then sent to Fengdu County People's Hospital immediately. The patient was unconscious on the way to the hospital and admitted to hospital in about fifty minutes.

The patient experienced central nervous system depression and respiratory failure when arriving at the hospital. He presented deep coma, mydriasis, and had no light reflection. His breath was slow, averaging 6 breaths per minute, and the blood oxygen saturation was 67%. Physical examination showed breathing sounds were rough and that wet rales (crackling sounds) were present in both lower lungs. The patient was intubated and treated with ventilator-assisted ventilation to stabilize the vital signs immediately, during which scarlet foam was ejected from the trachea, and gastric lavage was performed to decrease toxin absorption. Chest computed tomography (CT) showed patchy shadows and pleural effusion in both lower lungs. Blood gas analysis indicated metabolic acidosis with pH: 7.09; lactic acid: 11.76 mmol/L. The patient was admitted to the intensive care unit after emergency treatment, underwent hemoperfusion therapy once, and was administered intravenous

sodium bicarbonate to maintain electrolyte balance. The patient took off the ventilator 28 hours after admission and resumed spontaneous breathing, and his consciousness recovered. He was treated and observed in the hospital until his chest CT completely recovered and was discharged.

The plant specimens were collected at the scene of the poisoning incident and testified as the ingested plants by the patient. It was identified as the *Millettia pachycarpa* (Figure 1) using morphological and DNA barcoding method, which belongs to Fabaceae family. The specimen was deposited in the Poisonous Plants Herbarium affiliated with the National Poison Control Center (No. 2020121801).

The primary toxin rotenone in *Millettia pachycarpa* seeds and biological samples were analyzed used liquid chromatography coupled to mass spectrometry method. The rotenone content in *Millettia pachycarpa* seeds (n=2) were 1,389.46 mg/kg and 928.88 mg/kg, and the rotenone content in gastric fluid sample was 3.16 µg/mL. In addition, there were others rotenoid compounds found in the seeds with untargeted screening.

DISCUSSION

China CDC collaborated with the local poison control center to conduct an investigation to clarify

how this poisoning occurred. This outbreak was exactly attributed to the ingestion of *Millettia pachycarpa* seeds, and the etiological association was confirmed based on the evidence in epidemiological correlation, clinical manifestations, plant species identification and rotenone toxin analysis. This work demonstrated that *Millettia pachycarpa* has potential for poisoning and that the public should be warned about the severe toxic effects and potential fatal effects.

Although ingestion of *Millettia pachycarpa* seeds is relatively rare, it may be fatal without appropriate and timely treatment. This incident involved 3 persons, 2 of whom experienced slightly transient dizziness and recovered fast, while the other suffered severe central nervous and respiratory depression, due to the difference in intake amount. The neurological symptoms of the 32-year-old male patient progressed rapidly from dizziness to coma with respiratory depression in about 10 minutes after the ingestion. The scarlet foam ejected from the trachea and the chest CT indicated aspiration pneumonia developed, which was accounted for the central nervous depression and vomiting caused by gastrointestinal irritation. The patient was intubated and ventilated immediately after admission to the emergency department, then, the gastric lavage was carried out to break off more toxin absorption. In addition, the patient underwent hemoperfusion therapy and administered sodium



FIGURE 1. The leaves, fruits, and seeds of *Millettia pachycarpa*.

bicarbonate to maintain acid-base balance.

The toxicity of *Millettia pachycarpa* seeds is attributed to its rotenone and rotenoids. Rotenone mainly exerts toxicity to the nervous, respiratory, and gastrointestinal systems when ingested orally. There is no specific antidote available for rotenone poisoning, and treatment mainly relies on symptomatic and supportive measures (1), including intubation, mechanically-assisted ventilation, maintenance of acid-base balance, and stabilizing the vital signs. Gastrointestinal decontamination, such as emetic and gastric lavage, should be used to prevent more toxin absorption even when the patient is unconsciousness. There is insufficient evidence that hemoperfusion therapy is effective for eliminating rotenone, but it is one of the choices for the treatment of rotenone poisoning. The recognition and treatment of the inhalation of pneumonia should be a priority when such patients are encountered.

Millettia pachycarpa is a rotenone-containing plant and is widely distributed in the south of China. Reports of *Millettia pachycarpa* poisoning were uncommon in China, but 2 incidents occurred in Guizhou and Hunan provinces in 2020. Another rotenone-containing plant, *Pachyrhizus erosus*, has an edible root and is cultivated extensively in southeastern China, but its rotenone-containing seeds can cause occasional poisonings by accidental ingestion. Additionally, there were several reports of poisonings caused by rotenone-containing plants in other countries and regions. In China (Taiwan) (2–3) and Thailand (4), *Pachyrhizus erosus* seeds, also called “yam beans,” were reported to result in life-threatening poisonings and deaths. In French Guiana (5), a woman ingesting another rotenone-containing plant belonging to *Lonchocarpus* genus committed suicide, and the exact species was unable to be determined.

In the region where *Millettia pachycarpa* and other rotenone-containing plants were distributed, ingestion and misuse of the plants should be prevented. Therefore, the public should be educated to distinguish the plants and recognize its toxic effects. Clinicians should be aware and trained to recognize clinical toxicological characteristics and treatment of rotenone-containing plants intoxication. In addition, the pathophysiological, toxicokinetic, and treatment strategy of rotenone-containing plants poisoning should be further reviewed and studied.

doi: 10.46234/ccdcw2021.075

Corresponding author: Hongshun Zhang, zhanghs@niohp.chinacdc.cn.

¹ National Institute of Occupational Health and Poison Control, China CDC, Beijing, China; ² Fengdu County People's Hospital, Chongqing, China; ³ The First Affiliated Hospital of Chongqing Medical and Pharmaceutical College, Chongqing, China; ⁴ National Institute of Occupational Health and Poison Control, China CDC, Beijing, China.

Submitted: February 19, 2021; Accepted: March 19, 2021

REFERENCES

1. Gupta RC. Rotenone. In: Gupta RC, editor. Veterinary toxicology. 2nd ed. Oxford: Academic Press. 2012; p. 620-3. <http://dx.doi.org/10.1016/B978-0-12-385926-6.00052-1>.
2. Yu JH, Huang CF, Wang TH, Hung DZ, Mu HW, Pan CS. Oxidative storm in a patient with acute rotenone-containing plant poisoning. *Am J Emerg Med* 2020;38(6):1296.e1 – 3. <http://dx.doi.org/10.1016/j.ajem.2020.01.019>.
3. Hung YM, Hung SY, Olson KR, Chou KJ, Lin SL, Chung HM, et al. Yam bean seed poisoning mimicking cyanide intoxication. *Intern Med J* 2007;37(2):130 – 2. <http://dx.doi.org/10.1111/j.1445-5994.2007.01245.x>.
4. Narongchai P, Narongchai S, Thampituk S. The first fatal case of yam bean and rotenone toxicity in Thailand. *J Med Assoc Thai* 2005;88(7): 984-7. <https://www.ncbi.nlm.nih.gov/pubmed/16241030>.
5. Chesneau P, Knibiehly M, Tichadou L, Calvez M, Joubert M, Hayek-Lanthois M, et al. Suicide attempt by ingestion of rotenone-containing plant extracts: one case report in French Guiana. *Clin Toxicol* 2009;47(8):830 – 3. <http://dx.doi.org/10.1080/15563650903146818>.