# PH-10 The deadly lookalikes: a field identification safety guide for medicinal plants

HEALING after the FALL, research library, PH-10

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## 1. How often the wrong plant is the cause

Nobody knows the true rate, because the people who get it wrong are not always counted. What exists is poison-centre data, and it is enough to set priorities.

The longest clean run is from Marseille. Thiolet and colleagues reviewed 22 years of the Marseille Poison Control Centre, January 2002 to December 2023, and pulled out every case coded as a food confusion between an edible and a poisonous plant: 2,197 cases out of 513,750 reports, about 0.43 per cent of all calls, involving 321 species (Thiolet et al. 2024). Of the 2,197, 1,178 (53.6 per cent) had symptoms, 190 (8.6 per cent) were hospitalised, 9 went to intensive care, 11 (0.5 per cent) were graded severe, and one died. The death was *Aconitum napellus* eaten in mistake for *Molopospermum peloponnesiacum*, a Pyrenean pot-herb umbellifer.

That ratio is the most useful number here. Most confusions are harmless and a few species carry almost all the death. Oleander (*Nerium oleander*) was the commonest confusion at 289 cases, mistaken for bay laurel, and killed nobody. Aconite was fifteenth at six cases and killed one person in six. A guide ranked by frequency misleads a village, so the table in section 2 ranks by frequency multiplied by lethality.

France's national scheme agrees. ANSES has logged over 250 mistaken-identity plant ingestions a year since 2012, 1,872 between 2012 and 2018, and names the same recurring pairs this chapter ranks, among them white hellebore for gentian, foxglove for comfrey and meadow saffron for wild garlic (ANSES, Toxic plants). It counted 15 water hemlock poisonings from 2012 to mid-2019. Germany's Federal Institute for Risk Assessment states that wild garlic confusions produce poisonings every spring, some fatal, clustering in April and May, and recurring across Austria, Switzerland and Croatia (BfR).

For fungi, Beug, Shaw and Cochran assembled roughly 2,000 reports over thirty-plus years for the North American Mycological Association and concluded that deadly mushrooms kill about one person a year across the continent, with about 1 per cent of those made ill dying (Beug et al. 2006). European reviews put amatoxins at 90 to 95 per cent of mushroom-poisoning deaths [VERIFY, the Diaz 2018 review named in the brief could not be retrieved].

Two leads in the brief could not be confirmed and should not be quoted: no 2012 Schenk-Jaeger paper on Swiss plant exposures, and no Colombo 2010 paper on Italian plant poisoning. The Swiss series that does exist is Jaspersen-Schib and colleagues, 1966 to 1994 (abstract only).

For a district of 3,000 the posture is not fear of the hedgerow. It is a short absolute prohibition list, a confirmation rule applied to every gather, and a healer who knows the syndromes from the doorway. ## 2. The ranked table

Ranked by frequency multiplied by lethality, not by frequency. Season is northern-hemisphere temperate. Every check listed is one a person can make by eye, hand or nose without a lens or a key. Where no such check exists, the entry says so.

| Rank | Dangerous plant | Taken for | Region, season | Field check | Onset | Outcome untreated |
|---|---|---|---|---|---|---|
| 1 | *Amanita phalloides*, death cap | Field and straw mushrooms, puffball | Worldwide temperate, autumn | Dig the base whole, look for a white sack. White spore print, free white gills, ring | 6 to 24 h, mean about 12 | 10 to 27 per cent death, liver failure day 4 to 16 |
| 2 | *Cicuta* spp., water hemlock | Parsnip, water parsnip, ginseng | North America, Eurasia, wetland, all year | None reliable. Root chambered, yellow sap. Veins run to notches not tips | 15 to 90 min | 30 per cent death, status epilepticus |
| 3 | *Conium maculatum*, poison hemlock | Wild carrot, parsley, fennel, parsnip | Europe, North America, spring to summer | Stem hairless, hollow, purple-blotched. Wild carrot bristly, solid green. Mousy smell | 30 min to 2 h | Respiratory paralysis, mind clear |
| 4 | *Oenanthe crocata*, hemlock water dropwort | Celery, water parsnip, parsley root | Western and southern Europe, wet ground, all year | None reliable on the tuber. Smells of celery, which is the trap | 30 to 60 min | Convulsions, sardonic grin, death |
| 5 | *Aconitum* spp., monkshood | Horseradish, mountain pot-herbs | Europe, Asia, Americas, all year | None reliable on the root | 10 min to 2 h, tingling lips first | 1 in 6 died in the Marseille series |
| 6 | *Colchicum autumnale*, autumn crocus | Wild garlic (*Allium ursinum*) | Central Europe, April to May | Several leaves from a sheath, no stalk, glossy both sides, no garlic smell | 2 to 24 h | Multi-organ failure day 2 to 7, no antidote |

| Rank | Dangerous plant | Taken for | Region, season | Field check | Onset | Outcome untreated |
|---|---|---|---|---|---|---|
| 7 | *Cortinarius orellanus* and relatives | Chanterelle, brown edibles | Europe, North America, autumn | True gills not ridges, rusty-brown spore print, cobwebby veil, rusty stem zone | 3 to 20 days | Irreversible renal failure, 11 of 102 died, Bydgoszcz 1952 |
| 8 | *Galerina marginata* | Honey fungus (*Armillaria*) | Northern temperate, autumn | Brown spore print, stem under 0.6 cm. *Armillaria* white print, stem over 0.8 cm | 6 to 24 h | As death cap |
| 9 | *Digitalis purpurea* rosette | Comfrey, borage | Europe, naturalised widely, spring | Leaf soft and velvety. Comfrey and borage bristly, scratch, smell of cucumber | 2 to 8 h, cardiac later | Heart block, ventricular fibrillation |
| 10 | *Veratrum album*, white hellebore | Yellow gentian root, wild garlic | Alpine Europe, spring to summer | Leaf strongly pleated, clasping a stout stem. No garlic smell | 15 min to 2 h | Profound bradycardia, recovery usual |
| 11 | *Veratrum viride*, *V. parviflorum* | Ramps (*Allium tricoccum*) | Eastern North America, April to May | Pleated clasping leaf, no onion smell, floodplain not upland | 15 min to 2 h | As above |
| 12 | *Datura*, *Brugmansia* | Spinach, New Zealand spinach | Americas, worldwide weeds, summer | Rank smell, soft hairy leaf, spiny capsule or trumpet flower on the plant | 1 to 4 h | Delirium 24 to 48 h, rarely fatal |
| 13 | *Convallaria majalis*, lily of the valley | Wild garlic | Europe, April to May | Two leaves from a shared sheath, no garlic smell | 1 to 6 h | Vomiting, slow pulse, death rare |
| 14 | *Taxus baccata*, yew | Herbal tea material | Europe, all year | Flat dark needles in two ranks, red fleshy aril | 1 to 24 h | Cardiac arrest, no antidote |

| Rank | Dangerous plant | Taken for | Region, season | Field check | Onset | Outcome untreated |
|---|---|---|---|---|---|---|
| 15 | *Nerium oleander* | Bay laurel in the pot | Mediterranean, all year | No bay smell when crushed, single pale midrib | 2 to 8 h | 289 cases, 1 severe, 0 deaths at Marseille |
| 16 | *Atropa belladonna* berry | Bilberry, blueberry | Europe, late summer | Berry single, large, glossy black, in a green five-pointed star, on a waist-high plant | 30 min to 2 h | Anticholinergic delirium, child deaths |
| 17 | *Chlorophyllum molybdites* | Parasol (*Macrolepiota procera*) | North America, summer | Green spore print, gills greening with age, stem not snakeskin-patterned | 1 to 3 h | Violent gastroenteritis, deaths rare |
| 18 | *Lepiota brunneoincarnata* | Small edible parasols | Europe, Asia, autumn | Small, brown-scaled, on lawns. No reliable layman's check | 6 to 24 h | Amatoxin, 5 deaths in China in 2020 |
| 19 | *Callilepis laureola*, impila | Itself, used as medicine | KwaZulu-Natal, all year | Not a lookalike. A root remedy with no antidote | Hours to days | Hypoglycaemia, liver and kidney necrosis |

**The umbellifers in detail.** The carrot family holds carrot, parsnip, celery, parsley, fennel, caraway, angelica and chervil alongside three plants that kill. All have finely divided leaves and flat white umbels, guides key on the flowers, and the deaths happen over roots and rosettes.

*Conium maculatum* contains coniine. The toxic dose is given as about 60 mg and the fatal dose as 150 to 300 mg [VERIFY, secondary, and alkaloid content varies several-fold]. Burning mouth, salivation and vomiting come first, then tremor, ataxia and ascending paralysis, then respiratory arrest with the mind clear, the picture Plato gives of Socrates. No antidote. Restani and colleagues (2009) reported two Italians who ate hemlock leaves gathered as sweet fennel, both discharged at three days. Washington State records deaths in 1999 and 2010, and its poison centre had treated ten people by mid-May 2015, which its toxicologist called the tip of the iceberg.

*Cicuta* is the most violently toxic plant of the temperate north. Cicutoxin concentrates in the root, which is chambered and weeps yellow oily sap. The CDC states that a 2 to 3 cm piece can kill an adult, and that children have died from toy whistles cut from the stem. On 5 October 1992 in midcoastal Maine two brothers aged 23 and 39, foraging for wild ginseng in a swamp, dug a root. The younger took three bites and died about three hours later despite four

resuscitation attempts. The elder took one bite, was asymptomatic on arrival at hospital, began seizing at two hours, and survived. The root was *Cicuta maculata*. The editorial note records at least 58 United States deaths from 1979 to 1988 after eating a poisonous plant mistaken for an edible one, at least five of them water hemlock, and a case fatality of 30 per cent for poisonings reported 1900 to 1975 (CDC 1994).

*Oenanthe crocata* carries oenanthotoxin in pale finger-like tubers clustered at the stem base like small parsnips. Convulsions begin in virtually all patients between 30 minutes and one hour, with trismus and the fixed grimace called the sardonic grin. In May 2017 two men on a trek near Santarém, Portugal, ate roots, called for help six hours in with vomiting, seizures and disorientation, and were found dead hours later, with oenanthotoxin in their gastric contents (TIAFT 2018 poster).

**The rule that follows.** No layman's character separates a hemlock root from a parsnip root in the hand. Never dig a wild umbellifer root, anywhere, ever. Gather wild umbellifer leaf only from a plant seen in flower and fruit the same season in a patch known for a year, and grow the kitchen umbellifers from bought seed instead. ## 3. The spring bulb-leaf confusions

Across central Europe in April and May people gather *Allium ursinum* by the basketful. Three poisonous plants put up similar lanceolate leaves in the same woods at the same time and none of them is in flower.

*Colchicum autumnale* is the dangerous one. Colchicine arrests cell division and there is no antidote. The course is deceptive: a latent period, violent gastroenteritis, then on days two to seven marrow failure, multi-organ failure and arrest. Brvar and colleagues reviewed 32 confirmed cases eaten as wild garlic, ages 27 to 90. Latency ran 2 to 24 hours, every patient vomited or had diarrhoea, and every patient whose latency exceeded 9 hours had only mild poisoning, which gives the healer a prognostic sign. Preparation mattered: moderate, severe or fatal poisoning followed in 64 per cent of those who ate the leaves boiled against 33 per cent raw, attributed to heat liberating colchicine. Eight of the nine severe or fatal cases were over 65 (Brvar et al. 2004a). The same group reported a man of 76 with alcoholic liver disease who ate two whole plants believing wild garlic good for his liver, presented at 12 hours and died of asystolic arrest on day three (Brvar et al. 2004b). Arif and colleagues reviewed 174 suspected exposures to the Austrian Poisons Information Centre 2002 to 2018, 163 unintentional and 113 in children under 15, with two deaths among the seven patients followed up (Arif et al. 2023). ANSES reports two French deaths from this confusion between 2020 and 2022.

*Convallaria majalis* carries cardiac glycosides, chiefly convallatoxin. AGES describes vomiting then diarrhoea, with considerable impairment but life-threatening poisoning rare.

*Veratrum album* carries protoveratrines and onset is very fast, sometimes within minutes: vomiting, then dizziness, visual disturbance and confusion, then bradycardia and hypotension that can be profound. Gilotta and Brvar (2010) described four adults who ate it as wild garlic with symptoms starting within 15 to 30 minutes. Rauber-Lüthy and colleagues (2010) reported 11 children aged 8 to 12 who made tea from herbs picked at a youth camp: nine had gastrointestinal symptoms, six neurological, three bradycardia, and all recovered within 10 hours.

**Checks, in the order to apply them.** First, leaf and stalk: wild garlic leaves rise singly, each on its own slender stalk straight from the ground. *Colchicum* leaves rise several together from a sheath with no distinct stalk. *Veratrum* leaves are strongly pleated and clasp a stout stem. *Convallaria* leaves come in pairs from a shared sheath. Second, underside: wild garlic is glossy above and matt below, *Colchicum* stiff and glossy on both sides. Third, smell: crush one leaf. Wild garlic smells unmistakeably of garlic and the others are odourless, but BfR warns that the test fails once the hands smell of garlic, which they will after the first handful, and that this is the commonest false pass. Smell checks a single leaf picked with clean hands, not a basket. Habitat is no help, because ANSES notes that in spring all three grow on the same woodland floor, and parallel veins are not a check: *Colchicum* blades are also traversed by numerous parallel veins. Leaf epidermis separates them absolutely under a microscope (Debrecen 2025), which a dispensary could use and a household cannot. ## 4. The rosette confusions

Foxglove does not flower in its first year. It spends that year as a flat rosette of soft, grey-green, downy, net-veined leaves, and comfrey and borage rosettes look similar at arm's length. A British Columbia health report notes the juvenile rosette has been mistaken for borage or comfrey.

The poisoning is digitalis poisoning: nausea, vomiting, diarrhoea and dizziness first, then over hours a slow or chaotic pulse, heart block, ventricular arrhythmia and hyperkalaemia. The lag between the phases kills, because the patient appears to be recovering. A Taiwanese outbreak in the *Journal of the Chinese Medical Association* involved nine patients who drank tea made from leaves taken as comfrey, all presenting with nausea, vomiting, diarrhoea and dizziness, with significant cardiotoxicity developing later in the three who also had mild hyperkalaemia. A poster at the Asia-Pacific Association of Medical Toxicology describes a woman of 55 who drank alleged comfrey tea, developed nausea at eight hours, then ventricular fibrillation, and died on hospital day seven despite eight vials of digoxin-specific Fab. A botanist identified the remaining "comfrey" as foxglove.

**Checks.** Comfrey and borage are covered in coarse stiff bristles that prickle and catch, borage's almost spiny, while foxglove leaves are soft and felt-like. Draw a leaf across the back of the hand: if it scratches it is comfrey or borage, if it feels like felt, stop. Crushed comfrey and borage smell faintly of cucumber and leave a slimy sap, foxglove neither. Foxglove leaves are finely scalloped with a strongly raised net of veins beneath, comfrey margins are nearly entire and the leaf runs down the stem as a wing.

**White hellebore against yellow gentian.** In alpine districts gentian root (*Gentiana lutea*) is dug for bitters and schnapps and *Veratrum album* grows beside it with near-identical non-flowering rosettes. The textbook distinction, gentian leaves opposite and flowers yellow against *Veratrum* leaves alternate and flowers white, fails on a plant being dug for root. Festa and colleagues (1996) reported poisoning from a *Veratrum* infusion taken for gentian, with atropine the drug of choice, and Zagler and colleagues (2005) described two dietary poisonings. A homemade bitters that makes everyone at the table vomit within half an hour and slows their pulses is *Veratrum*, not gentian. ## 5. Berries, roots and the remaining pairs

**Deadly nightshade against bilberry.** The belladonna berry is black, glossy, cherry-sized, sweet, and sits singly in a five-pointed green star on a soft plant up to 1.5 metres. Bilberries are blue-black with a bloom, dimpled at the top, on a low wiry shrub under 50 cm. Height and habit are the practical rules. The syndrome is anticholinergic: dry mouth, wide pupils, hot flushed dry skin, fast pulse, urinary retention, agitation then delirium and hyperthermia. A paediatric series of 62 children flags meaningless speech, lethargy, coma and absence of tachycardia as ominous. Secondary sources state that under 10 mg of atropine has been fatal in children [VERIFY]. Berry counts such as "three berries kill a child" come from gardening sites, not the clinical literature [VERIFY].

**Monkshood against horseradish.** The root is the killer and looks like a small blackish horseradish or parsnip. An 1857 letter in the Dublin *Medical Press* describes three Scottish deaths, two of them clergymen, after the root was plucked in mistake for horseradish, and a Nottingham cottager who died after eating a small portion from his own garden. The Marseille series gives the modern version: one death and two severe cases out of six exposures. Onset is 10 minutes to 2 hours, the signature tingling and numbness of lips, tongue and throat spreading to the limbs, then vomiting, then ventricular arrhythmia. A Nepali case describes a man of 76 who ate "Ekfale" believing it the medicinal "Nirmasi" (*Delphinium denudatum*).

**Yew.** Not usually a lookalike but a lethal tea. The commonly cited lethal dose is about 50 g of needles for an adult, or 3 to 6.5 mg per kg of taxines. A German forensic series of eight cases included two deaths, a Polish series describes four prisoners who drank a decoction of needles of whom two died, and a review table records a woman of 20 who died 24 hours after tea brewed from three spoonfuls. The red arils are not toxic and the seeds inside them are, which is exactly the distinction a village should not rely on. No antidote.

**Oleander against bay.** The commonest single confusion at Marseille, 289 cases, 64 symptomatic, one severe, no deaths. Oleander leaves are long and leathery with one prominent pale midrib and no aroma. A leaf in the pot that does not smell of bay is not bay.

**Comfrey itself.** Even correctly identified, internal use is not safe. Its pyrrolizidine alkaloids are converted by the liver into alkylating intermediates, producing hepatic veno-occlusive disease: obliteration of the small hepatic veins, portal hypertension, cirrhosis and liver failure. A published case describes a woman who drank ground comfrey tea and took six comfrey-pepsin capsules daily for six months, and liver damage has been reported in a baby whose mother drank comfrey tea. Germany, Canada and the United Kingdom restrict internal use, and the United States Food and Drug Administration advised removal of comfrey products from the market in July 2001. Poultice on unbroken skin is a different question from tea. ## 6. The fungi

Fungi need their own rule, because the characters that matter are largely not available to eye, hand and nose. Spore colour, a buried volva and the amyloid reaction separate a death cap from a field mushroom, and only the first two need no reagents.

**Death cap, *Amanita phalloides*.** Amatoxins are heat-stable and are not destroyed by cooking, drying or freezing. The course is why it kills: a latent phase of about 6 to 24 hours, mean about 12, then violent cholera-like vomiting and diarrhoea, then an apparent recovery on day two or three while the liver fails, then jaundice, coagulopathy, encephalopathy and death between day 6 and day 16. The estimated human lethal dose is around 0.1 mg of amatoxin per kg, roughly one cap [VERIFY]. Case fatality varies: 11.6 per cent across 2,110 hospitalised patients (Poucheret et al. 2010, via a 2012 review), 27.3 per cent in 55 Thai cases 2013 to 2015 (Trakulsrichai et al. 2017), 9.7 per cent in 144 Turkish patients 1996 to 2009. In December 2016, after the Bay Area Mycological Society warned the California Poison Control System of an unusually large bloom, 14 people were poisoned in northern California in two weeks, three needed liver transplants, all survived, and one child was left with permanent neurological impairment (Vo et al. 2017). A 2019 British Columbia report describes three poisonings in which the death cap was taken for edible species including the puffball and the paddy straw mushroom. The California Poison Control System reported 23 cases and one death from 18 November in the 2025 to 2026 season, noting that death caps resemble *Amanita* species commonly eaten in Central America. The immigrant-community explanation needs care: the claim that death caps are taken for paddy straw mushroom (*Volvariella volvacea*) is widely repeated, but Bay Area Mushrooms calls it an oft-repeated story and notes that nobody asked the victims. A 2015 *Fungi* magazine article documents a real pattern of *Amanita* poisonings among Hmong and other south-east Asian immigrants. The pattern is well attested, that explanation weakly evidenced.

Field description: cap dull green to olive, yellowish or brownish, rarely white. Gills free, white, close. Stem flaring at the base, with a white skirt-like ring that is sometimes lost. Volva a white sack at the base, often underground or broken. Spore print white (MushroomExpert). Two characters decide it and both are easy to miss: the volva must be dug for, because if the base snaps off in the soil the cup is left behind, and the spore print needs a cap left overnight on paper. Cap colour is useless.

**Galerina against honey fungus.** Same amatoxins, same course. Both grow on dead wood, often the same stump. The spore print is brown in *Galerina* and white in *Armillaria*, and the stem is usually under 0.6 cm in *Galerina* and over 0.8 cm in *Armillaria*. A Swedish woman of 32 ate *Galerina* as honey mushrooms, began vomiting about 10 hours later and was discharged at nine days. NAMA logged three amatoxin cases including one death from a *Galerina* in 2011.

**Webcaps against chanterelles.** Orellanine destroys the renal tubules and the latency is the horror: 3 to 20 days, usually 1 to 2 weeks, with nothing in between, then polyuria, thirst and irreversible renal failure. Horn and colleagues reported four Austrians in 1997 with end-stage renal failure after taking *C. orellanus* for chanterelles (Horn et al. 1997). In Estonia in August 2020 seven people were poisoned, six needing haemodialysis, and at ten months three still required dialysis and three had stage 4 chronic kidney disease, matching Swedish follow-up from 1979 to 2012. The 1952 Bydgoszcz outbreak in Poland involved 102 people with 11 deaths. Chanterelles have blunt forking decurrent ridges rather than true gills, a smell of apricot and solid pale flesh. *Cortinarius* species have true gills, a rusty-brown spore print, and a cobwebby veil on young caps leaving a rusty zone on the stem. No village should gather any *Cortinarius*.

**Parasols.** *Lepiota brunneoincarnata* carries amatoxins in a small brown-scaled mushroom of lawns taken for small edible parasols. A Turkish case records about 19.9 mg of amatoxin from nearly 30 g of mushroom, and Chinese surveillance recorded five deaths from the species in 2020. *Chlorophyllum molybdites* is not deadly but is the most frequently eaten poisonous mushroom in North America, taken for the true parasol: violent vomiting and diarrhoea within 1 to 3 hours, deaths very rare. Its spore print is green and its gills green with age, and *Macrolepiota procera* has a snakeskin stem which it lacks.

**Folk tests are grade X and have killed.** Silver turning black, caps peeling easily, discoloration when cut or cooked, boiling with garlic, onion or a coin, and animals eating a species unharmed are all worthless. *Amanita phalloides* and *Amanita virosa* do not blacken silver and do peel easily, and tasting a piece proves nothing because the commonest killers have latencies of hours or weeks. Slugs and snails eat death caps with little apparent effect while the same amatoxins destroy human liver cells (Tox Info Suisse). A JAMA review states that no reliance is to be placed on the peeling test and that poisonous and non-toxic species act alike on silver. ## 7. Regional pairs outside Europe

**North America: false hellebore against ramps.** Ramp gathering is a spring tradition across Appalachia, New England and eastern Canada, and the young false hellebore shoot is the commonest poisoning of the season. Vermont health officials have warned repeatedly, and in one year the regional poison centre managed 25 possible cases, more than four times its usual number. A *Clinical Toxicology* report describes a couple who presented with vomiting, hypotension and bradycardia after eating *Veratrum parviflorum* taken for *Allium tricoccum*. The separating characters are good: ramp leaves are flat, smooth, rise directly from the ground, grow in upland forest and smell strongly of onion, while false hellebore leaves are deeply pleated, clasp an upright stalk, grow in swamp, and have no onion smell.

**The Americas: *Brugmansia* and *Datura*.** Both are used in Andean and Amazonian traditions and both are gathered by mistake as greens. The syndrome is anticholinergic, onset 1 to 4 hours, duration 24 to 48 hours. A French family of four in 2020 cooked jimsonweed leaves from their own vegetable patch believing them New Zealand spinach and all four needed intensive care (ANSES 2020). The largest events are contamination rather than confusion: over 100 Australians in December 2022 from *Datura stramonium* in commercial baby spinach, and over 200 Ugandans in 2019 from *Datura* seed in a relief corn-soy blend. The Marseille series had 24 *Datura* cases, 19 symptomatic, two severe.

**Southern Africa: *Callilepis laureola*, impila.** The rootstock is a major traditional remedy in KwaZulu-Natal and one of the chief causes of fatal herb-induced liver injury in the region. The triad is hypoglycaemia, centrilobular liver necrosis and acute renal tubular necrosis. A doctoral thesis at the University of Natal reviewed 21,687 consecutive post-mortems at King Edward VIII Hospital, Durban, over 20 years and found acute liver necrosis the major contributing cause of death in 447, of whom 263 had the pattern consistent with impila [VERIFY, author name not confirmed]. The toxin is atractyloside, and a 1979 *South African Medical Journal* paper describes the paediatric syndrome. The danger is not a lookalike but dose, compounded by the remedy being dug as a root, where confusion in the Asteraceae is easy.

**Asia: *Aconitum*.** Chuanwu, caowu and fuzi are major Chinese herbs, processed by prolonged boiling to hydrolyse aconitine. Yu and colleagues reviewed 2,017 mainland cases, attributing 35.0 per cent to caowu, 25.9 per cent to chuanwu and 13.8 per cent to fuzi, with mix-up of Yunnan *Aconitum* species emerging as an important cause after 2004. A Hong Kong Hospital Authority series of 52 laboratory-confirmed cases 2004 to 2009 found 32.7 per cent due to prescription above the recommended dose and 32.7 per cent to the herb being dispensed although not prescribed, with no deaths, a point an earlier Hong Kong series of ten hidden aconite poisonings makes again. A territory-wide study of 179 confirmed episodes 2008 to 2021 found mortality of 1.1 per cent. The lesson: aconite in Asia kills mostly through processing failure and dispensing error rather than field misidentification, and a village that cannot verify processing has no business using it. ## 8. The rule of three independent confirmations, and the never-gather list

The rule below is my own synthesis of practice recommended in extension bulletins, poison-centre advisories and the

mycological literature. No study measures its error rate [VERIFY].

**The rule.** Before any wild plant or fungus enters a mouth, a pot or a medicine jar, three confirmations must agree and must be independent.

1. A character of one organ: leaf shape, margin, vein pattern, surface sheen.
2. A character of a different organ: stem hairiness and cross-section, stalk or no stalk, bulb, the dug-out base of a mushroom stem.
3. A different sense or a different time: smell or sap on a crushed piece, a spore print, or the patch seen in flower in a previous season.

Three characters of the same organ count as one, because they fail together on an atypical plant. A second gatherer who names the plant without being told what the first thought counts as an extra confirmation, but agreement after discussion counts as none. Where a confirmation cannot be made independent, the gather does not proceed. Nothing on the folk-test list counts.

**Rules that cost nothing.** Gather one species per basket, since a single *Colchicum* leaf in two kilos of wild garlic cannot be found later. Keep an uncooked labelled specimen of every gather, with date and place, until 72 hours after the last person has eaten: in every fatal case reviewed here it was the leftover material that told the clinicians what they faced, and 72 hours covers the amatoxin latency. Stop eating at once if the taste is unusual, bitter or burning. Never dig a wild root for medicine, and never let a child gather for the pot unsupervised, since 113 of 163 unintentional Austrian *Colchicum* exposures were in children under 15.

**The never-gather list.** For each, no character a layman can check in the field separates it reliably from its double or from itself, and the cost of error is death or permanent organ damage.

| Never gather | Why | Grow or substitute |
|---|---|---|
| Any wild umbellifer root | Hemlock, water hemlock and water dropwort roots are not distinguishable from parsnip and celery | Carrot, parsnip, fennel, lovage, angelica from bought seed |
| Any wild umbellifer leaf not seen in flower that season | Rosettes are indistinguishable | Parsley, chervil, coriander |
| *Aconitum* in any form | Fatal at small doses, root resembles horseradish, processing unverifiable | None |
| *Digitalis* for any purpose | Margin too narrow without an assay, and the rosette is the comfrey lookalike | None |
| *Veratrum* in any form | Fast profound bradycardia, confused with gentian and ramps | None |
| *Colchicum*, *Convallaria* | No antidote, deceptive latency, confused with wild garlic | None |
| *Atropa*, *Hyoscyamus*, *Datura*, *Brugmansia* internally | Alkaloid content varies many-fold by plant and season | None without a scale and an assay |
| *Taxus* in any form | No antidote, cardiac arrest, about 50 g of needles | None |
| Any *Cortinarius* | Latency up to three weeks, irreversible kidney destruction | None |
| Any small brown mushroom on wood | *Galerina* among *Armillaria* | *Armillaria* only, white print, stem over 0.8 cm |

| Never gather | Why | Grow or substitute |
|---|---|---|
| Any white-gilled, white-spored mushroom with a ring and bulbous base | Death cap and destroying angel | None. Dig the base, look for the sack |
| Comfrey internally | Pyrrolizidine alkaloids, veno-occlusive liver disease | Poultice on unbroken skin only |

## 9. Once the mistake has been made

This is the interface with ME-14, written for a village with no laboratory, no antidote stock and no dialysis.

**First five minutes.** Keep and label the leftover plant or fungus and any vomit, and find everyone who ate, including those who feel well. The hour of eating against the hour of the first symptom is the most useful piece of information a village healer can generate.

**The latency rule runs in two directions.** Vomiting within two hours points to a poison that declares itself quickly and is usually survivable with nursing. Vomiting six or more hours after a wild mushroom meal is the amatoxin pattern and a village emergency. For *Colchicum* the direction reverses: a latency over nine hours predicted mild poisoning in all of Brvar's 32 patients.

**Do not induce vomiting.** The international position statements abandoned syrup of ipecac and routine gastric lavage because of aspiration, perforation and electrolyte harm without demonstrated benefit. The one exception they allow, lavage within 60 minutes with a protected airway, is not available to a village.

**Activated charcoal** is the one decontamination measure a village can hold. Dose 1 g per kg in children, 50 g in adults, as a slurry in water, as soon as possible after ingestion. Volunteer studies show 75 to 98 per cent reduction in bioavailability at five minutes and as little as 10 per cent at sixty. Never give it to a drowsy or fitting patient without someone holding the airway. Hearth charcoal is not activated charcoal and has a fraction of the surface area, so a village without salvaged stock has almost nothing here [VERIFY, no comparative human study found].

**Nursing is what saves people.** Oral rehydration through the cholera-like phase of amatoxin, *Chlorophyllum* and *Colchicum* poisoning, measured and recorded, is the highest-value intervention a village can deliver, because the early amatoxin deaths come from fluid and electrolyte collapse before the liver fails. For coniine, breathing for the patient for the hours the paralysis lasts is theoretically curative and practically beyond most households, which is better said than hidden.

**Specific measures and their real availability.** Atropine normalises *Veratrum* bradycardia within minutes, and digoxin-specific Fab reverses foxglove and oleander poisoning but will not exist after the Fall. Silibinin and N-acetylcysteine are given for amatoxin almost universally and the evidence that either changes survival is weak: in the United States Acute Liver Failure Study Group series silibinin went to 50 per cent of spontaneous survivors against 25 per cent of those who died or were transplanted, a difference that was not significant, and a systematic review of 13 retrospective studies found the superiority of the various agents debatable. Of 13 patients in that series with established liver failure, six survived without transplant, five survived with one and two died, so without transplantation that is six survivors and seven deaths. ## Evidence grades

| Item | Grade | Tradition says | Record shows | Science infers |
|---|---|---|---|---|
| Smell test on one crushed leaf, clean hands (wild garlic, ramps) | B | Smell tells them from their doubles | BfR endorses it and names contaminated hands as the failure mode. Repeated Vermont clusters when ignored | Organosulfur compounds absent in the doubles |
| Hairless purple-blotched stem for *Conium*, bristly for *Daucus* | B, C | Extension standard | Consistent across Washington, Penn State, Michigan State, but fails on young hemlock, which can be hairy | Reliable on second-year plants, not rosettes |
| Parallel veins to identify wild garlic | X | Common advice | *Colchicum* blades have them too | No discriminating value |
| Spore print, and digging for the volva | A, B | Mycologists' standard | Print colour is absolute. The volva is missed when the base snaps in soil, a repeated cause of death | Spore pigment is a species trait. A volva proves *Amanita*, its absence proves nothing |
| Silver spoon, peeling cap, animals eating it, garlic in the pot, tasting a piece | X | Folk rules | Death caps peel, do not blacken silver, are eaten by slugs. The commonest killers have long latencies | No mechanism, and killed people |
| Boiling to make a doubtful plant safe | X | Widespread belief | Boiled *Colchicum* 64 per cent moderate or worse against 33 per cent raw. Amatoxins, colchicine, taxines heat-stable | Heat can liberate toxin. Oenanthotoxin is the lone heat-labile exception, on one report [VERIFY] |
| Activated charcoal within one hour | B | Standard toxicology | 75 to 98 per cent reduction at 5 min, about 10 per cent at 60 | Adsorption, falling with gastric emptying |
| Atropine for *Veratrum* bradycardia | B | Drug of choice in the reports | Rate normalises in minutes, pressure little changed | Antimuscarinic |
| Silibinin or N-acetylcysteine for amatoxin | C | Standard of care | No significant survival difference in the ALFSG series | Plausible, unproven |

| Item | Grade | Tradition says | Record shows | Science infers |
|---|---|---|---|---|
| Comfrey taken internally | X | Traditional tonic | Veno-occlusive disease, restricted in Germany, Canada and the UK, FDA advisory 2001 | Pyrrolizidine alkaloids alkylate hepatic endothelium |

## Means ledger

| Rung | What can be done | What it changes |
|---|---|---|
| Hands and knowledge alone | The three-confirmation rule. Smell tests on single leaves. Stem hairiness, leaf underside sheen, pleated against flat leaves. Dig for a volva. Keep a labelled specimen. Refuse all wild roots and the never-gather list | Removes nearly all the lethal confusions at zero cost, and does more than every rung above it combined |
| At the hearth | Spore print on white paper under a cup overnight. Oral rehydration, measured and recorded. Warm, dark, quiet. Hour of eating against hour of first symptom. Mouth-to-mouth for coniine paralysis | Adds one hard mycological test and the nursing that saves people in the gastroenteric phase |
| Garden and still | Grow the dangerous-to-gather species: carrot, parsnip, fennel, lovage, parsley, borage, chives. Pressed voucher specimens in a book | Converts the main risk from identification to cultivation, the most effective village-scale measure |
| Village dispensary, 300 | A trained gatherer who checks every basket. A microscope for leaf epidermis and spores. A register of every poisoning. Salvaged charcoal and atropine. A posted never-gather list | Turns individual error into collective knowledge, and makes charcoal within the hour and atropine for *Veratrum* possible |
| District infirmary, 3,000 | Ten beds, a nurse, intravenous fluids, continuous observation through the latent period, airway support for coniine | Survival in coniine paralysis and in severe dehydration. Does not much change amatoxin, orellanine or colchicine |
| Hospital before the Fall | Digoxin-specific Fab, silibinin, physostigmine, haemodialysis, liver transplantation, intensive care | Transplant converts about five of thirteen amatoxin liver failures to survival, and dialysis keeps orellanine patients alive. None of it survives the Fall |

## Harm test

**How the guide itself can kill.** A character that works most of the time teaches the reader to trust it all of the time. Three in the literature are of this kind. “Hairy stem means wild carrot” is true of mature plants and false of young

hemlock. “Parallel veins mean wild garlic” is false, because *Colchicum* has them too. “Garlic smell means wild garlic” is true of a leaf but false of a basket and of a hand that has already held garlic.

**Who is at extra risk.** The old: eight of nine severe or fatal *Colchicum* cases were over 65, attributed to falling renal clearance. The liver- or kidney-impaired: the Slovenian fatality had alcoholic liver disease and renal insufficiency, and the authors expected worse presentations in such patients. Children: 113 of 163 unintentional Austrian *Colchicum* exposures, and most belladonna berry cases. The dehydrated, in whom colchicine or amatoxin gastroenteritis compounds fast.

**Contamination, which is not misidentification.** The largest events in the record are not confusions: over 100 Australians in December 2022 from *Datura* in commercial baby spinach. Over 200 Ugandans in 2019 from *Datura* seed in relief corn-soy blend. In Hong Kong, 32.7 per cent of 52 confirmed aconite poisonings came from the herb being dispensed although not prescribed. Store each species separately and labelled, never pooled.

**Signs that it is going wrong.** Burning mouth then weakness climbing from the legs: coniine, going towards respiratory paralysis. Seizure within 90 minutes: cicutoxin or oenanthotoxin. Tingling lips spreading to the limbs: aconite. Vomiting then a slow or irregular pulse hours later: foxglove, oleander, lily of the valley. Vomiting with dizziness and a slow pulse within half an hour: *Veratrum*. Hot dry flushed skin, wide pupils, delirium: *Atropa*, *Datura*, *Brugmansia*. Violent vomiting six or more hours after a mushroom meal: amatoxin. Thirst and flooding urine one to three weeks after one: orellanine.

**Harm from the remedy rather than the mistake.** Comfrey taken internally over six months produced veno-occlusive disease in a named case. Impila, correctly identified and prepared, caused the syndrome behind a large share of 447 fatal acute liver necroses at one Durban hospital over 20 years. Aconite, correctly identified, poisoned 52 Hong Kong patients through dose and dispensing error. Being right about the plant is not the same as being safe. ## Red flags

1. **Vomiting and diarrhoea beginning six or more hours after a wild mushroom meal.** Amatoxin until proved otherwise. No silibinin, no dialysis, no liver. Do: rehydrate by mouth, hour by hour, through the cholera phase and the false recovery on day two, and watch everyone who shared the meal for 48 hours even if well. Expect roughly one death in ten in good conditions and more without fluids. Tell the family the next three days decide it.
2. **Thirst and heavy urination one to three weeks after a mushroom meal, then falling urine output.** Orellanine. Without dialysis this is death from uraemia over days to weeks. Do: water and salt to tolerance, comfort, and prepare the household.
3. **Ascending weakness with a clear mind after eating a wild umbellifer.** Coniine. The one red flag a village can sometimes beat, by breathing for the patient by mouth or bag, in shifts, for many hours. Most households cannot, so say so before starting and do not let one exhausted person try alone.
4. **Repeated seizures within 90 minutes of eating a root.** Cicutoxin or oenanthotoxin, historical case fatality around 30 per cent. Do: protect the head, nothing in the mouth, dark and quiet, on the side between fits. If the seizures stop within a few hours the patient usually lives. Dark urine means muscle breakdown, so push fluids.
5. **A slow, irregular or chaotic pulse hours after a herbal tea.** Cardiac glycoside or aconite. Without Fab or a defibrillator the village can only wait. Do: flat, absolute rest, no exertion, no stimulants, and keep the tea and the plant.
6. **Falling urine output, bleeding gums, confusion and jaundice on day two to five.** Multi-organ failure. Do: comfort, fluids by mouth while they can swallow, company, honesty.
7. **A whole family ill after one meal.** Poisoning, not infection, until the specimen is found.

**Honest comfort.** For amatoxin, orellanine and colchicine the village’s true offering is water, cleanliness, someone awake in the room, and the truth. A healer who sits with a dying person and records what happened has done some-

thing of permanent value, because the register is how the next village avoids that plant. ## The case against

**Against prohibition, this chapter's central move.** The strongest critics are the foraging and ethnobotanical traditions. A blanket ban on wild umbellifer roots removes burdock, wild carrot, sweet cicely and skirret, and a ban on small brown mushrooms on wood removes a staple. The counter is that prohibition is a one-time cost in calories and variety while a single death cap is paid permanently, and that the garden rung recovers most of what it takes. Where the book bans something a tradition uses safely, it should say so, and say the ban is for readers without a teacher.

**Against field characters altogether.** Field guides are written for botanists and assume a flowering specimen, while the deadly confusions happen with rosettes, bulbs, roots and dried material. This is correct and conceded. For *Conium* against *Daucus*, for *Veratrum* against *Gentiana* in the root, and for every dried herb, there is no layman's character, and the chapter's value lies more in its prohibitions, its confirmation rule and its syndrome recognition than in its keys.

**Against the poison-centre numbers.** They are calls, not cases, and they under-represent the rural, the uninsured and the undocumented. A compilation reports four San Diego death cap deaths attributed to delayed presentation because the men feared their immigration status [VERIFY, secondary]. Vermont's Eike Blohm estimated that 70 per cent of such cases are foraging mistakes and vastly under-reported, which is a clinician's estimate in a news story. Most United States plant exposures involve an unknown plant, which makes the misidentification share unmeasurable, so the ranking here is indicative.

**Against the romance of the herbal.** Old does not mean safe. Impila, aconite and comfrey are all correctly identified and traditionally prepared, and all three have organ-destroying records. Convergent use across cultures predicts interest, not safety (THRIVING library, FO-03).

**Against the romance of the hospital.** The ALFSG data show six of thirteen amatoxin liver failures surviving without transplantation, and the systematic review finds the antidotes' superiority debatable. Rehydration, which a village can do, is doing much of the work the hospital gets credit for. At the same time dialysis for orellanine and transplantation for amatoxin have no village equivalent, and pretending otherwise would kill people.

**Survivor bias cuts both ways.** The people who got it wrong are not writing herbals. It is equally true that the never-gather plants were used for centuries by people who did not die, because they had teachers, processing knowledge and dose discipline this book's reader lacks. The prohibitions are a function of the reader, not of the plant. ## 10-line summary

1. A few species account for almost all plant deaths: at Marseille over 22 years oleander was confused 289 times and killed nobody, while aconite was confused 6 times and killed one.
2. Of 2,197 food confusions, 53.6 per cent had symptoms, 8.6 per cent were hospitalised, one died.
3. Roots and non-flowering rosettes are where the deaths are, because field guides key on flowers.
4. The umbellifers are the worst family, and no layman's character separates hemlock, water hemlock or water dropwort root from parsnip and celery, so never dig a wild umbellifer root.
5. The spring *Allium ursinum* confusions are the exception, because the garlic smell is a true chemical test: it works on a single leaf picked with clean hands and fails on a basket.
6. Latency is diagnostic in two directions: a *Colchicum* latency over 9 hours predicted mild illness in all 32 of Brvar's patients, while vomiting 6 or more hours after a mushroom meal is the amatoxin pattern.
7. Cooking does not detoxify: boiled *Colchicum* gave 64 per cent moderate-or-worse poisoning against 33 per cent raw, and amatoxins, colchicine and taxines are heat-stable.
8. Every folk mushroom test is grade X, because death caps peel easily, do not blacken silver and are eaten by slugs.
9. What a village owns is the smell test, the spore print, the dug-out volva, a labelled raw specimen kept 72 hours, charcoal within the hour and relentless oral rehydration.
10. Growing the dangerous-to-gather species removes more risk than any amount of field skill.

## Open questions

- What share of plant poisonings misidentification causes, which cannot be measured while most exposures are coded to an unknown plant.
- Whether the *Volvariella volvacea* explanation for immigrant-community death cap poisoning is true.
- Whether hearth-made wood charcoal adsorbs usefully in human poisoning. No study found.
- Whether silibinin or N-acetylcysteine changes amatoxin survival. No trial exists.

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**A household.** A rule sheet on the wall and nothing else: the never-gather list, the three-confirmation rule, one species per basket, no wild roots, a raw specimen kept 72 hours, the hour of eating written down. It needs a literate adult and a nail. The first failure to expect is the spring basket of wild garlic gathered by a hurrying child with one *Colchicum* leaf in it, because the household applied the smell test to the basket instead of to each leaf.

**A village of 300.** One named gatherer who checks every basket before it is cooked, a posted never-gather list, a herb garden holding the dangerous-to-gather species, white paper for spore prints, salvaged activated charcoal with the dose written on the jar, salt and sugar, and a register of every poisoning. Skills: one person who can read a spore print, one who can dig for a volva, one who can mix rehydration solution correctly. The first failure to expect is the register, which will be kept for four months and then abandoned, and which must be made someone's named duty.

**A district of 3,000.** Pressed voucher specimens of every plant used in medicine, in a book carried between villages, a salvaged microscope, ten beds where a poisoned person can be watched through a latent period, and a harm register feeding SY-10. Skills: one person who can read a leaf epidermis, one who can run airway support in shifts. The first failure to expect is that the district will be asked for an identification by messenger, from a description, and will give one. The specimen travels or the answer is no. ## Protocols

### Protocol 1. The three-confirmation gather

1. Before leaving, name the target species aloud and its dangerous lookalikes. If you cannot name them, do not gather that species.
2. Wash hands, and handle no garlic, onion or other aromatic first.
3. Confirmation one: a leaf character, meaning shape, margin, veins or surface.

4. Confirmation two: a different organ, meaning stem hairiness and cross-section, stalk or no stalk, bulb, or the dug-out base of a mushroom.
5. Confirmation three: smell or sap on a crushed piece, a spore print, or the patch remembered in flower in a previous season.
6. All three must agree and be independent. Three leaf characters count as one.
7. One species per basket. Never mix.
8. On return, set aside one uncooked specimen labelled with species, date and place, and keep it 72 hours after the last person eats.
9. If any confirmation fails for any piece, discard the whole basket.

**Protocol 2. Wild garlic in spring**

1. Wash hands. Do not handle onion or garlic that morning.
2. Pick the first leaf and crush a corner. A strong garlic smell is required. No smell means stop and leave the site.
3. Check the stalk: one leaf on its own slender stalk from the ground. Several from a sheath with no stalk is *Colchicum*, two from a shared sheath is *Convallaria*, a pleated leaf clasping a stout stem is *Veratrum*.
4. Check the underside: matt below, glossy above. Glossy both sides is *Colchicum*.
5. Gather leaf by leaf, smelling every tenth leaf, wiping hands on grass as the smell builds.
6. One species per basket, in a bag not used for anything else.
7. At home, lay the basket flat and inspect every leaf again before cooking. Discard the basket if one leaf is wrong.
8. Keep two raw leaves labelled with date and place for 72 hours.

**Protocol 3. Accepting a gilled mushroom**

1. Dig the whole base out with a knife. Never pull. If the base is lost, discard that mushroom.
2. Look for a sack or cup at the base. A white sack means *Amanita*, so discard it whatever else looks right, as does a ring on the stem plus free white gills plus a bulbous base.
3. Lay a cut cap gill-side down on white paper under a cup for 6 to 12 hours and read the print in daylight.
4. Wood-growing clusters: white print and stem over 0.8 cm is *Armillaria*, brown print or stem under 0.6 cm is *Galerina*. Discard the whole collection on a brown print.
5. Large scaly parasols: green print, or gills greening with age, is *Chlorophyllum*. Discard.
6. Reject every mushroom with a cobwebby veil on the young cap or a rusty zone on the stem.
7. Keep two whole raw specimens labelled, 72 hours.
8. Nobody eats a species for the first time at a shared meal. One adult, a small portion, 48 hours' wait.

**Protocol 4. The first hour after a suspected poisoning**

1. Write the time now, the time the food was eaten, and the time the first symptom appeared.
2. Find every person who ate and write their names, including those who feel well.
3. Find and label the leftover food, the raw specimen and any vomit. Throw none of it away.
4. If the person is fully awake, able to sit up and swallow, and ate within the hour: activated charcoal, 50 g for an adult or 1 g per kg for a child under 40 kg, in about 250 ml of water as a thin slurry, drunk at once. One dose. Not for a drowsy, fitting or vomiting patient.
5. Do not make the patient vomit. No salt water, no mustard, no fingers, no lavage.
6. Oral rehydration solution: 1 litre clean water, 6 level teaspoons sugar, half a level teaspoon salt. Small sips every few minutes, 200 to 400 ml after every loose stool or vomit in an adult, 50 to 100 ml in a small child. Keep a written tally in and out.
7. Warm, dim, quiet. Flat if the pulse is slow, on the side if drowsy.
8. Set a watch: 24 hours for anyone who ate a wild mushroom even if well, 7 days for suspected *Colchicum*.

**Protocol 5. The village register entry, one line per event**

Date. Place gathered. Species believed. Species identified, by whom and how. Parts eaten. Preparation, raw, boiled or dried. Number who ate. Hour eaten. Hour of first symptom in each person. Symptoms in order. What was given, and when. Outcome at 24 hours, 7 days, 30 days. What the gatherer thinks went wrong. Signed. ## Numbers to carry

1. **2 to 3 cm of water hemlock root kills an adult.**
2. **6 hours.** Vomiting that starts 6 or more hours after a wild mushroom meal is amatoxin until proved otherwise.
3. **9 hours.** After a spring leaf meal, a latency over 9 hours predicted mild *Colchicum* poisoning in all 32 of Brvar's patients, and under 9 hours predicted severe.
4. **1 gram per kilogram, within 1 hour.** Activated charcoal for a child, 50 g for an adult, with benefit falling from about 90 per cent at 5 minutes to about 10 per cent at 60.
5. **1 litre, 6 teaspoons sugar, half a teaspoon salt.** Oral rehydration solution, the intervention that saves most poisoned people in a village.
6. **72 hours.** How long the labelled raw specimen must be kept after the last person eats.
7. **64 against 33 per cent.** Moderate or worse poisoning from boiled against raw *Colchicum* leaves. Cooking does not make a doubtful plant safe.
8. **1 in 6.** Six people in 22 years ate aconite in error in southern France and one died. That ratio, not the frequency, is what ranks a plant.

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