Confusion between toxic and edible plants: beware of similarities

In June 2018, a 78-year old man died after eating a plant that he picked while rambling in the Eastern Pyrenees region [1, 2]. He believed that the leaves came from the striped hemlock or *Molopospermum peloponnesiacum*, a plant belonging to the angelica family. In reality, however, it was a plant known as monkshood or wolfsbane. This highly toxic species, also referred to as "plant arsenic" in ancient times, contains powerful terpene alkaloids, such as aconitine. The plant was not in bloom, so had not yet deployed its characteristic helmet-shaped violet-blue flowers. This contributed to the confusion. Within an hour of eating the leaves, the rambler started to show digestive symptoms, with a loss of sensation (tingling) and an irregular heartbeat, leading to cardiogenic shock and death.

Although confusing toxic and edible plants can prove fatal, the health authorities have issued no recommendations on this subject to date, of a type comparable to the recommendations on picking and eating mushrooms [3].

Following this alert, ANSES joined forces with the network of the French Poison Control Centres (PCCs) to conduct a retrospective study on cases of confusion between edible and toxic plants, in order to quantify the scale of the problem, identify the plants most frequently concerned and suggest preventive measures. The study concerned cases of exposure to plants, with or without symptoms, registered by the PCCs between 1 January 2012 and 31 December 2018. This information was extracted from the information system of the PCCs (SICAP). After reading the medical records ("dossiers"), we studied only cases in which a toxic plant was confused with an edible plant, and included cases involving children under 6, where the plant was eaten as part of a shared meal. The study therefore excluded children under 6 and people with cognitive disorders who had eaten a toxic plant in a different context than of a shared meal. It also excluded cases of zero causality (no causal link between the plant consumed and the symptoms observed) and cases of intentional poisoning in which a toxic plant was consumed in an attempted suicide.

As meals can be eaten by one person or shared by several, a distinction was made in the analysis between the number of people consuming plants by mistake (in order to quantify the scale of the public health issue) ;and the number of "meals" or "dossiers" corresponding to the various confusions (in order to quantify the number of confusions[1] and describe the plants concerned).

The study covered a total 1,872 cases involving confusion between plants. The meals were shared (at least two people) in 56% of cases. The 1,872 cases were split into 1,159 dossiers (or meals), with an average of 1.6 people per meal (between one and eleven people). Almost one-third of the 1,159 meals were shared.

Description of confusion between plants

The number of confusions (or dossiers) recorded by the PCCs seems relatively stable year on year, varying from 257 cases (159 dossiers) in 2013, to 263 cases (181 dossiers) in 2017 (Figure 1). The increase in the number of cases and dossiers in 2018 will need to be viewed against the number of cases in subsequent years (2019 and after) for analysis.

These confusions occurred most frequently in summer (32% of dossiers), and to a lesser extent in autumn (24%), spring (23%) and winter (21%). The regions most frequently concerned were in southern France and Brittany.
In most cases, the confusion concerned leaves (31% of dossiers), bulbs[2] (17%), fruit and berries (13% each respectively), or seeds (12.5%), with flowers, roots and stalks making up the remaining cases.

Most cases of confusion concerned bulbous plants (12% of dossiers), horse chestnut (11%), colocynth or bitter squash (8.5%), arum (7 %), fool's parsley or poison hemlock (4%), laburnum (4%) and black nightshade or climbing nightshade (3.5%) (Figure 2). These accounted for half of all dossiers.

1 confusion = 1 "dossier" = 1 person or several people (cases) who shared the same meal.
2. Plants sold or picked as bulbs: narcissus, daffodil, iris, gladioli, tulip, hyacinth, amaryllis, crocus

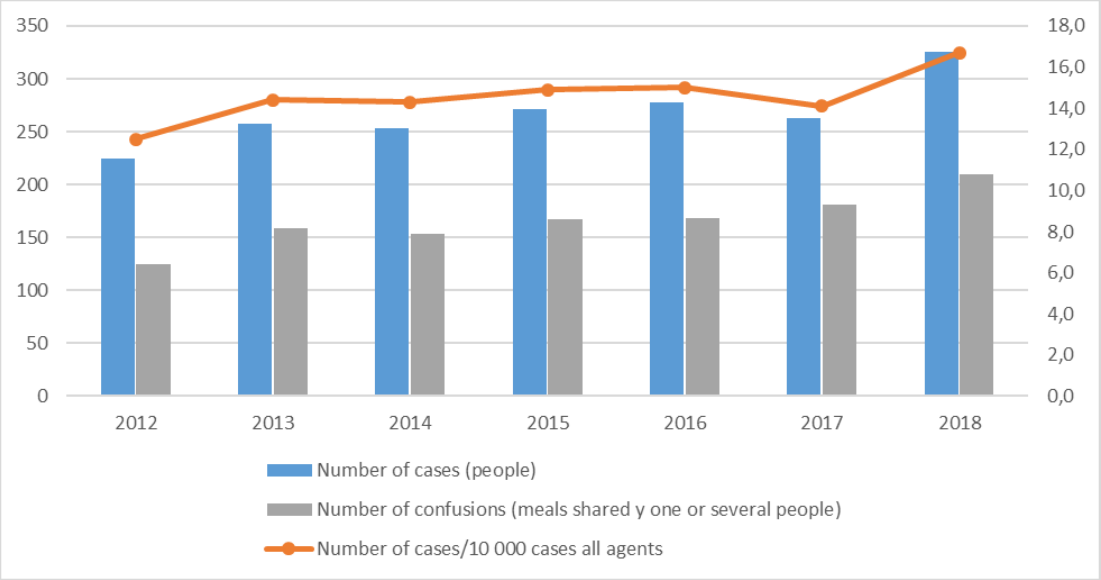

Figure 1 : Annual number of cases and dossiers in which edible plants are confused with toxic plants: number of cases adjusted for 10 000 cases, all agents (N=1,872). 2012-2018. Source: SICAP.

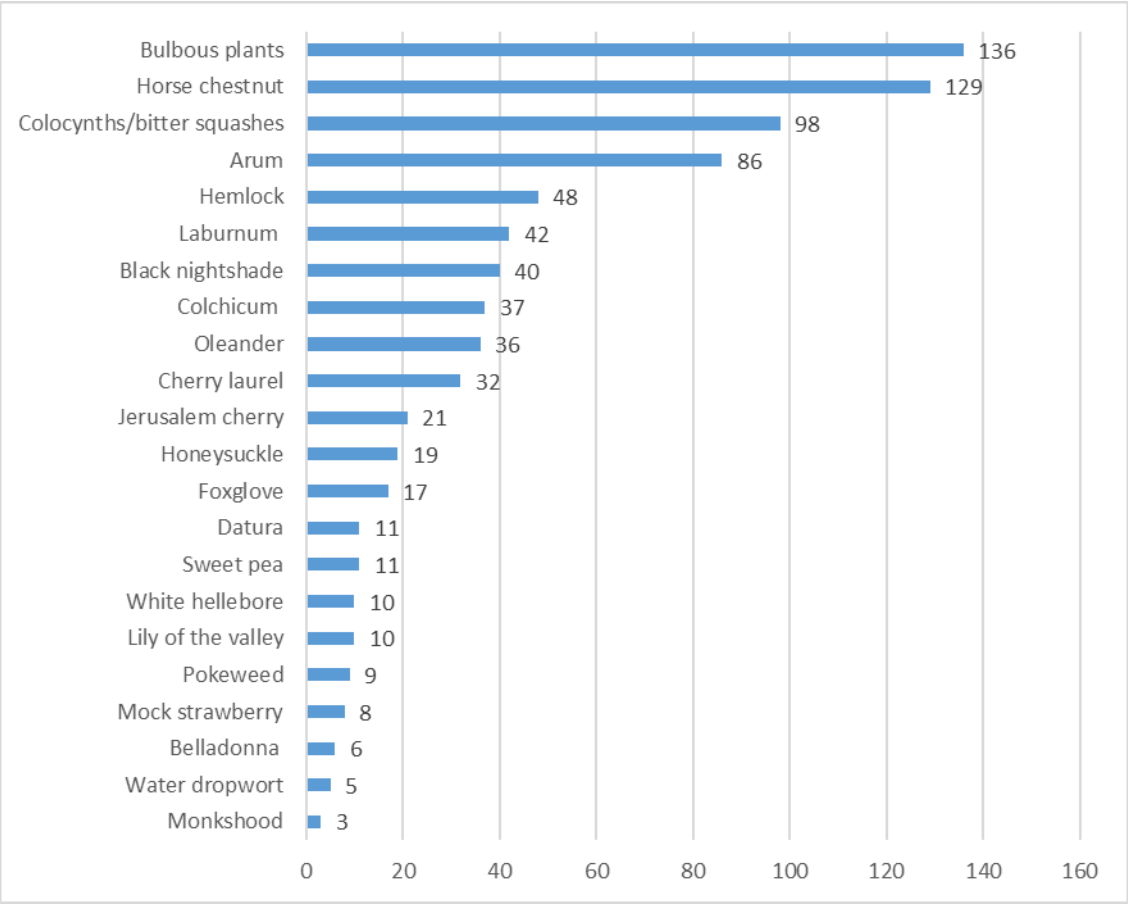

Figure 2 : Plants that were picked most frequently and/or that caused severe poisoning among the cases listed by the study (N=1,159 dossiers). 2012-2018. Source: SICAP.

Description of persons exposed

Of the 1,872 cases studied, 1,687 included information on the presence or absence of symptoms[3] (90%). Only these cases were taken into consideration in the next stage of the analysis. A total of 53.5% reported symptoms (N=903 cases).

Age was specified in 96% of cases, varying from two months (for a breastfed baby) to 98 years, with an average of 39.6 years. Although all age groups were concerned, 16% of people were aged between 30 and 39, while 5% were under six. The male/female ratio was 0.8.

Table I shows the plants most frequently confused and/or causing the most serious cases (high level of severity[4]), depending on the season, with details of the symptoms observed.

In the case of people who consumed bulbous plants, 72% showed symptoms (191 cases, Figure 3). None of the cases involved a high level of severity. In these cases, the bulbs were confused with edible bulbs (onion, garlic, shallot, etc.), causing digestive disorders, headaches and trembling. As bulbs are easy to store, cases of confusion were reported throughout the calendar year, primarily in autumn and winter. In 2012, a case of collective poisoning was reported in the UK, in which eleven people mistakenly consumed (non-flowering) narcissus stalks and bulbs, sold without specific labelling on a stall next to Chinese chives and onions [4].

In cases where colocynths or bitter squashes were confused with edible ones, recognisable only by the absence of bitterness in some cases, 55% of those poisoned showed symptoms (88 cases, Figure 3), leading in some cases to digestive disorders, bloody diarrhoea and severe dehydration owing to the presence of cucurbitacins. A retrospective study of cases involving confusion between colocynths and edible squash recorded by PCCs between 2012 and 2016 showed that, in cases where the supply source was known, 54% of inedible squashes came from the garden vegetable patch, while 46% were purchased commercially [5, 6].

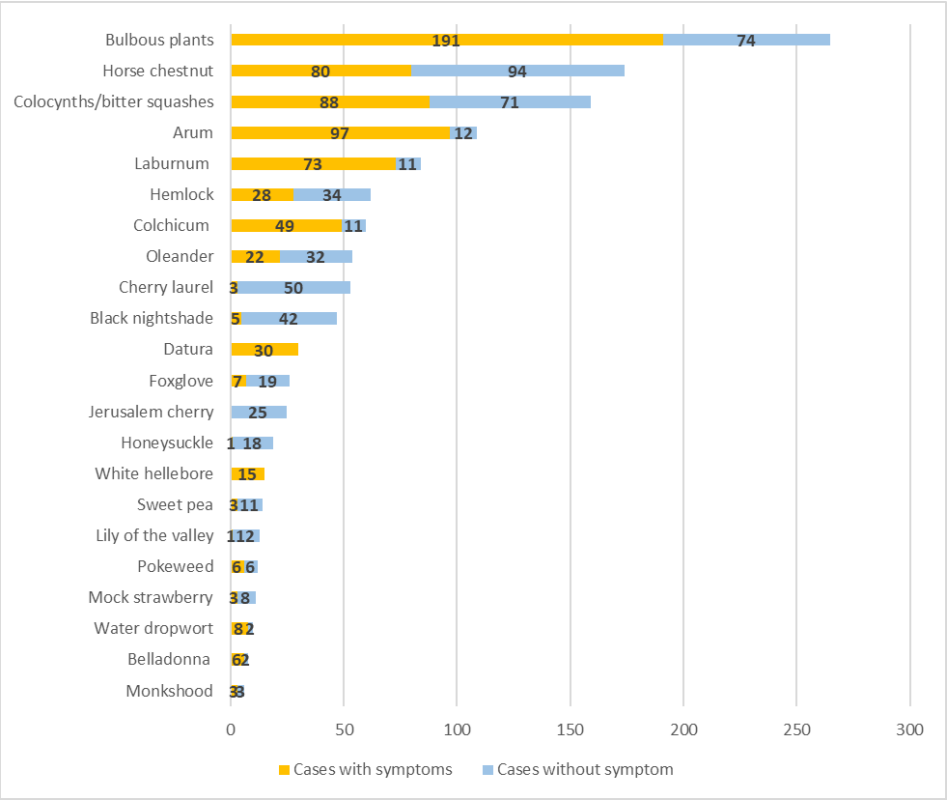

Figure 3 : Plants confused in order of frequency, with the presence or absence of symptoms (N=1,687 people). 2012-2018. Source: SICAP.

3. Poison control centres may be contacted for "collective cases" where the agent of exposure (product, plant, animal, etc.) is clearly identified but where detailed case information (age, sex, symptom, etc.) is not available.

4. Cases where symptoms or signs were severe or life-threatening [7].

Table I : Plants most frequently confused and/or causing severe poisoning at different times of year based on the cases studied. N=903 symptomatic cases 2012-2018. Source: SICAP.

Main season	Plant picked (toxic plant) N cases with symptoms	Confused with (edible plant)	Symptoms observed in cases studied (see literature)
	Bulb (*Narcissus sp.*) N=191 	Onion *Allium sp.* 	Digestive signs*, dizziness, trembling, headaches (even excessive sweating).
	Colocynths N=88 *Citrullus colocynthis L.* 	Squash (*Cucurbita pepo L.*) 	Digestive signs*, including bloody diarrhoea and severe dehydration. Headaches, dizziness.
	Horse chestnuts N=80 *Aesculus hippocastanum L.* 	Sweet chestnuts (*Castanea sativa L.*) 	Digestive signs*, oropharyngeal irritation.
	Laburnum N=73 *Laburnum anagyroides L* 	Acacia (*Robinia pseudoacacia L.*) 	Digestive signs*, tachycardia, asthenia, dizziness, headaches (even trembling, confusion, convulsions).
	Arum N=97 *Arum sp.* 	Sorrel *Rumex sp.* / Spinach *Spinacia oleacea L.*  	Abdominal pain, oropharyngeal irritation (even burns or oral oedema).
	Water dropwort N=8 *Oenanthe crocata L.* 	Wild carrot (*Daucus carota L.*) 	Digestive signs*, headaches, acute kidney failure, cardiac arrest (even convulsions, coma, **death**).
	Colchicum N=49 *Colchicum autumnale L.* 	Wild garlic *Allium ursinium L.* / Wild leek *Allium tricoccum L.*  	Digestive signs*, dizziness, alopecia, agranulocytosis, irregular heartbeat, cardiac arrest, coma (even **death**).
	Belladonna N=6 *Atropa belladonna L.* 	Grape *Vitis sp.* 	Dry mouth and eyes, visual disorders, tachycardia, hallucinations, confusion, coma (even **death**).
	Foxglove N=8 *Digitalis purpurea L.* 	Comfrey (*Symphytum sp.*) 	Digestive signs*, severe bradycardia, low blood pressure, dizziness, headaches (even **death**).
	White hellebore N=15 *Veratrum album L.* 	Gentian (*Gentiana lutea L.*) 	Digestive signs*, headaches, irregular heartbeat, low blood pressure, excessive sweating (even convulsions, cardiovascular shock, **death**).

*Digestive signs: Abdominal pain, nausea, vomiting, diarrhoea.

Other cases of confusion, with a risk of serious or even lethal toxic effects in some cases, involved a possible resemblance between parts of a plant (Table I):

- Sweet chestnuts, flat on one side with spiny husks, confused with horse chestnuts, rounder with only a few short spines on their husks;
- Comfrey leaves, eaten in salads, confused with foxglove leaves, particularly when the plant is not in bloom; wild garlic leaves confused with colchicum or lily of the valley; fool's parsley or poison hemlock with flat-leaf parsley; sweet bay leaves with oleander or cherry laurel;
- Acacia flowers, which can be cooked to make fritters, confused with laburnum flowers;
- Gentian, whose roots are used to make aperitifs or liqueurs, confused with white hellebore; wild carrot, which has edible tubers and roots, confused with water dropwort.

In addition to the death of the rambler who mistook wolfsbane for edible striped hemlock, the study identified fourteen very serious cases, in people aged between 21 and 74, following the consumption of colchicum (five cases), white hellebore (four cases), belladonna (two cases), colocynth/ inedible gourd (one case), foxglove (one case) and water dropwort (one case).

The supply source was specified in 48% of cases (N=905): picked or gathered in 90% of cases, provided by a third party (4.5%) or purchased commercially (5.5%).

As this last situation may require specific management measures by the competent administrative authorities, it is essential to contact the poison control centre, which will escalate the information as appropriate. Six cases of collective poisoning involved children of 3 and 4 years of age, who showed symptoms of moderate[5] severity , after eating datura leaves, sold on a market stall as spinach. The health authorities were unable to find the seller, who had disappeared without a trace.

Spurred by a desire to get back to nature, and to try new culinary experiences with plants, sometimes inspired by their supposed health benefits, members of the public may be encouraged to pick edible plants... thereby increasing the risk of confusion with toxic plants. In response to this risk, ANSES and the PCCs are warning people not to consume plants that they assume to be edible without clear identification. Descriptions and/or photographs in books and web pages may be useful, but are not sufficient to identify a plant with any degree of certainty. If the slightest doubt remains, do not eat the plants gathered. Ask a horticultural or botanical expert for advice. It is also advisable to take photos of any plants gathered to enable identification in the event of poisoning.

Although recent years have seen the development of field training programmes open to everybody, ANSES has decided to step up communication on the risks of confusing toxic and edible plants at different times of year, to help seekers of botanical flavours separate the wheat from the chaff.

Sandra SINNO-TELLIER

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5. Cases where symptoms or signs were pronounced or prolonged [7]