The Veterinary Journal 197 (2013) 163–168

Contents lists available at SciVerse ScienceDirect

The Veterinary Journal

journal homepage: www.elsevier.com/locate/tvjl

Review

Epidemiology of intoxication of domestic animals by plants in Europe

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ARTICLE INFO

Article history:
Accepted 1 March 2013

Keywords:
Domestic animals
Poisonous plants
Poisoning
Toxicoepidemiology

ABSTRACT

This review focuses on some of the most important poisonous plants in Europe and provides an overview of the poisoning episodes that have occurred in European countries. Poisoning of livestock and companion animals by plants is a relatively common occurrence. In Europe livestock and horses are commonly poisoned by *Datura stramonium* (Jimson weed), *Senecio* spp. (ragworts and groundsels), *Quercus* spp. (oak), *Taxus baccata* (European yew), *Nerium oleander* (oleander), *Pteridium aquilinum* (bracken fern), *Robinia pseudoacacia* (black locust) and *Rhododendron* spp. (rhododendrons and azaleas). Poisoning may occur when the fresh plant is ingested in pasture or when it contaminates hay or silage.

In pets, the greatest majority of plant poisonings are the result of ingestion of house or garden plants, such as *Cycas revoluta* (Sago palm), *Ricinus communis* (castor bean), *Allium* spp., *Euphorbia pulcherrima* (poinsettia), *Lilium* spp., *Convallaria majalis* (Lily of the valley), *Pyracantha* spp. (firethorn), *Rhododendron* spp. (rhododendrons and azaleas), *Melia azedarach* (Chinaberry tree), *Taxus baccata* (European yew) and *Nerium oleander* (oleander).

Introduction

Plants are responsible for many cases of poisoning of companion animals (Giuliano Albo and Nebbia, 2004; Berny et al., 2010; Caloni et al., 2012b) and ruminants, in which plants are the second most common class of toxicants after pesticides (Guitart et al., 2010). Recent publication of epidemiological data on domestic animal poisoning in Europe (Berny et al., 2010; Guitart et al., 2010; Caloni et al., 2012b) has increased our knowledge and emphasised the abundance of information available from individual case reports and statistical data from poison centres for humans and animals, the latter including the Centre National d'Information Toxicologique Vétérinaire[1] (CNITV) in Lyon, France and Veterinary Poison Information Service[2] (VPIS) in London, United Kingdom (Modrá and Svobodová, 2009; Vandenbroucke et al., 2010; Berny et al., 2010; Caloni et al., 2012b).

There are, however, significant difficulties in harmonising the data as well as considerable variability of multi-factorial basis in several European countries (Caloni et al., 2012a). Data from CNITV (Keck et al., 2004) have shown that 11% of domestic animal poisoning was attributable to plants, while data from the Poison Control Centre of Milan (CAV) and the Swedish Poison Information Centre (SPIC) showed that plants poisonings accounted for 5.5% (Caloni et al., 2012b) and 13% (SPIC, 2011), respectively. In this review, the principal plants responsible for the poisoning of domestic animals in Europe are reported. Table 1 summarises the poisoning episodes occurred in European countries.

Alkaloid-containing plants

Colchicum autumnale (meadow saffron)

Meadow saffron is an autumn flowering plant naturally found in meadows across Europe. All parts of the plant contain colchicine, a potent gastrointestinal toxin, as well as other alkaloids (Kupper et al., 2010; Anadón et al., 2012). Poisoning primarily affects cattle and clinical signs include salivation, dysphagia, colic, abdominal pain, diarrhoea and fetid faeces with tenesmus. Death occurs from cardiorespiratory collapse (Anadón et al., 2012).

In Europe, cases of cattle poisoning by meadow saffron have been recorded in Switzerland (Kupper et al., 2010) and in North-Eastern Germany (Schrader et al., 2001). In Switzerland, a heifer developed severe signs of acute intestinal irritation 48 h after the ingestion of fresh leaves of *Colchicum autumnale* (Kupper et al., 2010). Death occurred 3 days later after a period of slight recovery. Confirmation of the suspected toxicosis was obtained from the detection of colchicine in serum and urine (Kupper et al., 2010).

Datura stramonium (Jimson weed)

Jimson weed is a flowering plant which may be found as a weed or may be grown as an ornamental plant in Europe. The wide

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[1] See: www.vetagro-sup.fr/services/espace-entreprises/%C3%A9quipements-scientifiques/plateaux-techniques/cnitv.

[2] See: www.vpisuk.co.uk/portal/.

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http://dx.doi.org/10.1016/j.tvjl.2013.03.007

Table 1
Toxic plants involved in animal poisoning episodes in Europe.

Scientific name	Common name	Toxins	Animal poisoned	Countries	References
Allium spp.	Onion, garlic, leek, chives, shallots, scallions	Organosulphur compounds	Dog, cat, cattle	Netherlands, Spain, UK	van der Kolk (2000), Guitart et al. (2008), and Sturgeon and Campbell (2008)
Colchicum autumnale	Meadow saffron	Alkaloid colchicine; other alkaloids	Cattle	Germany, Switzerland	Schrader et al. (2001) and Kupper et al. (2010)
Convallaria majalis	Lily of the valley	Cardiac glycosides	Dog, cat	France	Gault et al. (1995) and Berny et al. (2010)
Cycas revoluta	Sago palm	Glycoside cycasin; β-methylamino-L-alanine; an unidentified high molecular weight compound	Dog	Italy, Sweden	Holmgren and Hultén (2009) and Caloni et al. (2012b)
Datura stramonium	Jimson weed	Tropane alkaloids	Dog, cat, cattle, horse	Bulgaria, France, Spain	Hansen and Clerc (2002), Binev et al. (2006), Soler-Rodríguez et al. (2006), Bofill et al. (2007), and Berny et al. (2010)
Euphorbia pulcherrima	Poinsettia	Diterpene esters	Dog, cat	Italy, UK	Campbell and Chapman (2000), Giuliano Albo and Nebbia (2004), and Caloni et al. (2012b)
Lilium spp.	Lilies	Unknown	Cat	Italy, UK	Sturgeon and Campbell (2006), Berny et al. (2010), and Caloni et al. (2012b)
Melia azedarach	Chinaberry tree	Tetranortriterpene melianotoxins	Dog	Spain	Ferreiro et al. (2010)
Nerium oleander	Oleander	Cardiac glycosides	Dog, cat, cattle, horse	Belgium, France, Italy	Gault et al. (1995), Berny et al. (2010), Guitart et al. (2010), Vandenbroucke et al. (2010), and Caloni et al. (2012b)
Prunus spp.	English cherry laurel, bird cherry	Cyanogenic glycosides	Dog, cattle, goat, horse	Austria, Italy, UK	Sargison et al. (1996), Mosing et al. (2009), and Caloni et al. (2012b)
Pteridium aquilinum	Bracken fern	Thiaminase; ptaquiloside	Cattle	Germany, Spain	Schrader et al. (2001) and García-Arroyo et al. (2005)
Pyracantha spp.	Firethorn	Cyanogenic glycosides	Dog	Italy, UK	Campbell and Chapman (2000) and Caloni et al. (2012b)
Quercus spp.	Oak	Tannins and tannin metabolites	Cattle, sheep	Belgium, France, Netherlands, Spain	Barbier (2005), García-Arroyo et al. (2005), Muskens et al. (2009), and Vandenbroucke et al. (2010)
Rhododendron spp.	Rhododendrons, azaleas	Grayanotoxins	Dog, cat, cattle, sheep	Italy, UK	Black (1991), Campbell and Chapman (2000), and Caloni et al. (2012b)
Ricinus communis	Castor bean	Toxalbumin ricin	Dog, cat	France, Italy, Sweden	Berny et al. (2010), Caloni et al. (2012b), and Holmgren and Lindberg (2012)
Robinia pseudoacacia	Black locust	Toxalbumin robinin; glycoside robitin	Horse	Belgium	Vandenbroucke et al. (2010) and Vanschandevijl et al. (2010)
Senecio spp.	Ragworts, groundsels	Pyrrolizidine alkaloids	Cattle, horse	Belgium, Netherlands, Spain, UK	Vos et al. (2002), Moyano et al. (2006), Crews and Anderson (2009), and Vandenbroucke et al. (2010)
Taxus baccata	European yew	Tanxine alkaloids	Dog, cattle, horse	Belgium, France, Italy, UK	Campbell and Chapman (2000), Chandes (2002), Berny et al. (2010), Guitart et al. (2010), Vandenbroucke et al. (2010), and Caloni et al. (2012b)

occurrence of the plant and its potential presence in hay or silage causes the poisoning of livestock, horses and pets. The toxic compounds found in all parts of the plant, especially in the seeds, are tropane alkaloids which possess strong anticholinergic properties (Soler-Rodríguez et al., 2006). Clinical signs are similar in all animal species and generally include tachycardia, mydriasis, dry mouth, incoordination, convulsion and coma (Anadón et al., 2012).

In Spain, two Jimson weed poisoning episodes were reported in two different dairy cattle farms. In both episodes, the plant was mistakenly gathered along with corn intended for animal feed (Bofill et al., 2007). Another Jimson weed poisoning episode in Spain occurred in an equine centre in Toledo, as a result of ingestion of hay grossly contaminated (up to 51% by weight) with Jimson weed. Colic was the most remarkable clinical sign observed in affected horses (Soler-Rodríguez et al., 2006). In Bulgaria, the poisoning of 34 horses after ingestion of harvested ensiled corn heavily contaminated with freshly cut Jimson weed, was reported. Two of the horses died and post-mortem studies revealed toxic liver dystrophy, cardiac lesions and substantial dystrophic and necrotic processes in the kidneys (Binev et al., 2006). In France, cases of pet poisoning by Jimson weed are reported to be frequently observed (Berny et al., 2010). An unusual case of anisocoria in a dog caused by toxic contact with Jimson weed was also reported (Hansen and Clerc, 2002).

Senecio spp. (ragworts and groundsels)

The genus *Senecio* includes more than 1200 species, 25 of which have been confirmed to be poisonous (Anadón et al., 2012). *Senecio* spp. commonly invades pastures and hay fields throughout Europe. These plants contain pyrrolizidine alkaloids which become cumulative hepatotoxins after they are bioactivated in the liver to pyrrole metabolites (Panter et al., 2012). The toxic syndrome is characterised by hepatic insufficiency, secondary photosensitisation and central nervous system (CNS) derangement. All animals can be poisoned, but cattle and horses are especially vulnerable. Common clinical signs include anorexia, depression, severe diarrhoea, jaundice, constipation and aberrant behaviour. CNS signs seem to be more common in horses than in cattle and head pressing and aimless walking may also occur (Osweiler, 1996; Anadón et al., 2012; Panter et al., 2012).

In Belgium, tansy ragwort (*Senecio jacobaea*) is one the major poisonous plants affecting horses. Poisoning generally occurs when seedlings are grazed accidentally along with other forage or when there is a lack of other feed (Vandenbroucke et al., 2010). In England and in the Netherlands, cases of chronic pyrrolizidine alkaloidosis due to ingestion of hay or silage contaminated with tansy ragwort by horses (Crews and Anderson, 2009) and cattle (Vos