REVIEW ARTICLE

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Poisoning Plants in Cats and Dogs

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Abstract

Today, cats and dogs are common pets among domestic animals. These animals are exposed to many diseases or poisonings in their lives. In cases of poisoning, plants have an important role. In this respect, it should not be forgotten that plants at home or outside can cause poisoning in animals. In this review, some plants that can pose a potential danger to cats and dogs, their properties, and the treatment options that can be made with clinical signs in case of poisoning are mentioned.

Keywords: Cat, dog, poisoning plant, therapy.

INTRODUCTION

Plants are the most important creatures of the food chain. They produce their food by photosynthesis, and at the same time, they keep the carbon dioxide in the air in balance by cleaning it. They cling to the soil with their roots and reproduce with their seeds. Substances found in plants play a role in the defense of the plant and cause beneficial or toxic effects for animals that consume them (Gökkür and Doğan, 2018).

Plant poisoning is unusual in dogs and cats as it is not ordinarily part of their diet, but it is still possible. For example, plants mostly used to adorn homes, gardens, and parks are likely to cause poisoning for cats and dogs. Knowing the circumstances under which these poisonings may consist and taking all necessary preventive measures can reduce the incidence of poisoning. For this purpose, it is necessary to identify plants that cause clinical symptoms in animals; In addition, knowing the places where the plant grows (closed areas such as parks, gardens, and ornamental plants) and the places where animals live or go regularly are important elements for diagnosis (Severino, 2009; Kızıl and Çiftçi, 2018).

In this review, some plants that show poisoning for cats and dogs (Table 1), the responsible parts for poisoning for each plant, toxic effects, clinical symptoms following ingestion of plants, and therapeutic applications in such poisonings are included.

Table 1. Poisoning plants in cats and dogs.

Plants	Poisoning parts	Clinical symptoms	Therapeutic approach
Allium species (onion, garlic, green onion, leek, etc.)	Bulbus	Hemolytic anemia; gastroenteritis and are associated with vomiting, diarrhoea, pain, loss of appetite, depression and dehydration	Blood transfusions may be helpful, especially in severe anaemia cases
Atatürk or Christmas flower	Leaves, stem, and red bracts	Gastrointestinal system diseases such as sialorrhea, dermatitis, and stomatitis.	Symptomatic treatment is recommended and it is a good practice to clean the affected areas with warm water
Azalea	Leaves	Hypersalivation, depression, anorexia, vomiting, colic, tachypnea, and tenesmus	Treatment is performed for the symptoms
Breadfruit	Leaves and stems	Edema and dermatitis in the oral and mucous membranes.	Giving antihistamines and rinsing the mouth with calcium gluconate
Boxwood	Leaves	Heart failure	Symptomatic treatment

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Table 1. Continues.

Plants	Poisoning parts	Clinical symptoms	Therapeutic approach
Castor bean	Seeds	Vomiting, diarrhoea, digestive disorders, bleeding in the gastrointestinal tract, abdominal pain, increased dehydration, body temperature, intense thirst, and colic	Symptomatic treatment
Croton	Leaves and seeds	Localized eczema, diarrhea, colic, and vomiting	Symptomatic treatment
Cyclamen	All parts	Salivation, gastrointestinal symptoms, heart rhythm abnormalities	Symptomatic treatment
Hall ivy	Stem and arms	Cane tongue and include symptoms affecting the digestive system (rough edema and stomatitis), skin (vesicular rash or toxic erythema), lungs, and kidneys	Giving antihistamines in addition to general treatment applications
Holly	Leaves	Gastrointestinal disturbances, vomiting and diarrhoea	Symptomatic treatment
Hollyhock	Leaves and seeds	Agitation, shortness of breath, convulsions, vomiting, and tachycardia	Symptomatic treatment
Juniper	All parts	Salivation, diarrhoea (occasionally hemorrhagic), and shortness of breath	Symptomatic treatment
Lily	Flowers or leaves	Ingestion and include vomiting, depression, polyurea, proteinuria, polydipsia, glucosuria, and azotemia	Emetic drugs within at least 2 hours after ingestion or administration of activated charcoal and liquid therapy as soon as possible and this should be continued for at least 48 hours
Meadow	Leaves and stems	Gastrointestinal disorders, neurological and cardiovascular symptoms	Symptomatic treatment
Narcissus	Bulb parts of the plant	Vomiting, diarrhea, anorexia, abdominal pain, and sialorrhea. However, if the amount ingested is high, animals may show lethargy, ataxia, bradycardia, hypothermia, depression, and hypotension	Symptomatic treatment
Oleander	Leaves	Diarrhea, vomiting, heart block, hypercalcemia, hyperkalemia, and hypomagnesemia.	Treatment is symptomatic and administration of ephedrine, atropine, and propranolol
Rhododendron	Leaves	Anorexia, vomiting, hypersalivation, colic, tachypnea, and tenesmus	Symptomatic treatment
Rosaceae	Seeds and leaves	Tremor or ataxia, foaming at the mouth, shortness of breath and convulsions	Sodium nitrate and sodium thiosulfate
Rubber	Leaves and stem	Mucosal, skin and digestive system lesions	Symptomatic treatment
Silk tree	Seeds	Vomiting, colic, hemorrhagic diarrhoea, tetanic spasms, tachycardia, and convulsions	Symptomatic treatment
Theobroma cacao fruit	Fruit	Cardiovascular, gastrointestinal, and nervous effects	Propranolol or metoprolol can be used for tachyarrhythmias and hypertension, atropine for bradyarrhythmias, and lidocaine for refractory ventricular arrhythmias

Table 1. Continues.

Plants	Poisoning parts	Clinical symptoms	Therapeutic approach
Tongue cane	Leaves, stem, and roots	Digestive, respiratory system, and kidney	Symptomatic treatment is performed and it is recommended to give antihistamine, to rinse the mouth with water or sodium bicarbonate solution
Yew	Seeds, leaves, and bark	Agitation and muscle tremors, a state of depression is observed with extinction of respiratory frequency	Heptaminol, analeptics and sliders

Allium species

Allium species (onion, garlic, green onion, leek, etc.) are especially toxic to domestic cats and dogs (Kobayashi, 1981). Among these species, especially onions contain toxic substances that cause hemolytic anemia in many pet species, including cats and dogs. The use of children's foods to stimulate their appetite, especially due to anorexia problems, and the fact that these foods contain onion products cause poisoning cases (Aslani et al., 2005). Allium species contain organosulfoxides, particularly cysteine sulfoxides, which are responsible for their characteristic odor. Crushing the plant (chewing, chopping, etc.) causes the conversion of these organosulfoxides to sulfur-containing compounds, creating negative effects on animals. Of these, dipropyldisulfide and allylpropylsulfide are substances associated with hemolytic anemia (Yamato et al., 1999). Sodium-n-propylthiosulfite, isolated from boiled onions, increases the damage to the erythrocytes of dogs and cats and stimulates the susceptibility to hemolytic anaemia in the following period. In the blood samples taken on different days, it was determined that the number of red blood cells, haemoglobin and hematocrit decreased significantly compared to the first day, the number of Heinz bodies in the erythrocytes increased and other blood parameters changed. Garlic is less toxic to dogs than onions (Tang et al., 2008). In particular, the main effect of the organic sulfur compounds in it is oxidative hemolysis, which occurs when the oxidant level in erythrocytes exceeds the antioxidant capacity. This oxidative damage seems to be related to the amount of glutathione found in red cells (Yamato et al., 1999). The antioxidant activity of catalase in the erythrocytes of dogs is low (Nakamura et al., 1998). In addition, the hemoglobin of cats is 2-3 times more sensitive to oxidative damage than the hemoglobin of other species (Cope, 2005). Consumption of garlic at doses of 5 g/kg body weight in cats and 15-30 g/kg body weight in dogs results in clinically significant haematological changes (Slater et al., 2011). The first striking findings in poisoning cases in cats and dogs are usually related to gastroenteritis and are associated with vomiting, diarrhoea, pain, loss of appetite, depression and dehydration. Within a few days of ingestion, dogs show signs of anaemia, pale mucous membranes, rapid and difficult breathing, weakness, dark urine (red or brown), jaundice, weakness, and tachycardia, which are symptoms associated with erythrocyte loss. In addition, cats and dogs who have recently consumed these foods will have an odour of onions or garlic. For the therapeutic approach, blood transfusions may be helpful, especially in severe anaemia cases (Slater et al., 2011; Bates, 2018).

Atatürk or Christmas flower *(Euphorbia pulcherrima)*

Atatürk or Christmas flower is in the Euphorbiaceae family. The toxic compounds are found in the leaves, stem, and red bracts containing cyclic tetraterpenes that may cause conjunctivitis, lacrimation, photophobia, and keratitis when in contact with the eyes. Rarely, this plant can cause gastrointestinal system diseases such as sialorrhea, dermatitis, and stomatitis. Symptomatic treatment is recommended and it is a good practice to clean the affected areas with warm water (Bilgili et al., 2020).

Azalea *(Rhododendron simsii)*

Azalea is in the Ericaceae family and has different coloring flowers. Its leaves are intoxicating parts and cause symptoms that cause hypersalivation, depression, anorexia, vomiting, colic, tachypnea, and tenesmus. It can also cause kidney and liver failure. There is no specific treatment available, and treatment is performed for the symptoms (Pischon et al., 2018).

Breadfruit *(Monstera deliciosa)*

Breadfruit is in the Araceae family and is called *Philodendron pertusum* because of the holes found in the leaves. It is used in office and home decoration and can reach large sizes. The leaves and stems of the plant include irritating liquid too dangerous to pets. With direct contact, it can cause edema and dermatitis in the oral and mucous membranes. Giving antihistamines and rinsing the mouth with calcium gluconate may be beneficial in the treatment (Colombo et al., 2010).

Boxwood *(Buxus sempervirens)*

Boxwood is an evergreen shrub species belonging to the Buxaceae family, spreading in different areas of Europe, Asia, America and Africa. While it sometimes causes poisoning in pigs, poisoning is rarely seen in pets. The leaves of the plant contain alkaloids that cause sudden heart failure in animals. Symptomatic treatment is recommended in poisoning (Bertero et al., 2021).

Castor bean (*Ricinus communis*)

Castor beans belong to the Euphorbiaceae family. Although it is used as a decorative plant in many countries, it mostly grows as a wild plant extending from the coasts to the mountains. Its toxic substance is a lectin called ricin found in the seeds, and a few seeds can kill pets or a child (Bradberry et al., 2003; Milewski and Khan, 2006). While symptoms differ between species, humans and horses are highly susceptible. Symptoms of poisoning occur approximately 6-42 hours after ingestion and include

vomiting, diarrhoea, digestive disorders, bleeding in the gastrointestinal tract, abdominal pain, increased dehydration, body temperature, intense thirst, and colic (Doan, 2004). One day after ingestion, other symptoms such as tachycardia, bloody diarrhoea, and convulsions may appear. Symptomatic treatment is recommended in poisoning (Audi et al., 2005; Mouser et al., 2007).

Croton (*Codiaeum variegatum pictum*)
Croton is in the Euphorbiaceae family and has large and variegated leaves. The leaves of the plant include caustic latex rich in calcium oxalate. Also, the seeds of plant contain a phytotoxin that may be dangerous to pets. When latex comes into direct contact with the skin at first, it causes localized eczema; then the lesion extends to areas of the body. Also, latex may cause proteinuria and hyperthermia in animals. Ingestion of the seeds causes bloody diarrhea, colic, and vomiting. Symptomatic treatment is recommended in the treatment (Severino, 2009).

Cyclamen (*Cyclamen persicum*)
Cyclamen (Primulaceae family) is a genus including more than 20 plant species as wild and cultivated flowering perennials. The best-known species, *Cyclamen persicum*, has red or white flowers and is often grown in homes. After flowering, a capsule-shaped fruit develops. Leaves of cyclamen are long petiolate, kidney or round shaped. These plants are comprised of toxic terpenoid saponins (saxifragifolin B and cyclamine) found in all parts of them, particularly in their tubers and roots (Van der Kolk, 2000). Cyclamen stems have been used aim of sedative, diarrheal, anthelmintic, and abortive effects in medicine (Robertson et al., 1998; Van der Kolk, 2000; Aslani et al., 2005; Tang et al., 2008). Moreover, cyclamen stem extracts have been shown to exhibit various biological activities such as cytotoxicity and antimicrobial activity (Van der Kolk, 2000). Increased salivation (sialorrhea) and onset of gastrointestinal symptoms (vomiting and diarrhoea) are seen following ingestion of the plant, and seizures, heart rhythm abnormalities, and death may also occur when consumed in large quantities. In case of poisoning, symptomatic treatment is performed (Houston and Myers, 1993).

Hall ivy (*Philodendron scandens*)
Hall ivy is a plant in the Araceae family and is often responsible for fatal poisoning in cats. The stem and arms of plants are responsible for the dangerous part and contain proteolytic enzymes and toxic substances such as calcium oxalate. Poisoning symptoms are similar to those caused by a cane tongue and include symptoms affecting the digestive system (rough edema and stomatitis), skin (vesicular rash or toxic erythema), lungs, and kidneys. For treatment, it is recommended to give antihistamines in addition to general treatment applications (Beasley, 1999).

Holly (*Ilex aquifolium*)
Holly is in the Aquifoliaceae family and dogs are the more commonly poisoned animal species by this plant. Its leaves contain ilicin, ilexanthin, tannins, and ilex acid while its fruits include toxins that cause both emetic and diarrheal effects. Gastrointestinal disturbances, vomiting and diarrhoea are often seen in poisoning. In terms of treatment, symptomatic treatment is recommended (Caloni et al., 2013).

Hollyhock (*Cytisus laburnum*)
The plant, also known as hollyhock or golden chain, is in the Leguminoseae family. In some countries, it is grown to decorate gardens or parks. The yellow flowers of the plant, which form in clusters, have the appearance of a bush reaching the size of a tree, and the fruits are black or small dark brown. Cattle and horses are often poisoned by this plant, while dogs are rarely poisoned. The toxic substances of the plant are the leaves and seeds, which contain toxic alkaloids such as methylcystine, laburine, cystine, and laburnamine. Clinical symptoms include agitation, shortness of breath, convulsions, vomiting, and tachycardia. Animal deaths occur only in the most severe cases. There is no specific treatment available, and symptomatic treatment is recommended (Lorgue et al., 1999; Bates, 2018).

Juniper (*Juniperus sabina*)
Juniper is in the Cupressaceae family and is an evergreen shrub that reaches the size of a green-leaved tree. It is a self-developing plant that is used as an ornamental outdoor plant. Poisoning is scarce due to the bitter taste of the plant. While ingestion poisoning may occur in cattle, poisoning in dogs and cats is extremely rare. The substances responsible for poisoning are the essential oil, gums, and resins found in the plant. Symptoms include salivation, diarrhoea (occasionally hemorrhagic), and shortness of breath. No specific treatment is available; administering activated charcoal to prevent absorption of the ingested herb may be helpful for treatment (Pages et al., 1989; Vostinaru et al., 2020).

Lily (*Lilium spp.*)
Lily is in the Liliaceae family and has colourful flowers. Many varieties are available, such as tiger lily, Easter lily, and Japanese lily. Just a few flowers or leaves pose a health risk to cats, the most susceptible species. Especially, the aqueous extract of flowers and leaves is nephrotoxic and toxic to the pancreas (Rumbeiha et al., 2004). The bulb parts of the plant contain alkaloids that cause kidney failure, especially in cats, while dogs are more resistant to this condition. Lily can cause acute kidney failure leading to death of animals (Langston, 2002). Symptoms begin within 24 hours of ingestion and include vomiting, depression, polyurea, proteinuria, polydipsia, glucosuria, and azotemia. Histologically, acute necrosis in proximal convoluted tubules and degeneration in pancreatic acinar cells occur in the kidneys. In case of poisoning, early decontamination of the plant with emetic drugs within at least 2 hours after ingestion or administration of activated charcoal and liquid therapy as soon as possible and this should be continued for at least 48 hours (Brady and Janovitz, 2000).

Meadow (*Iris sibirica*)
Meadow iris in the Iridaceae family and is found in gardens. The flowers are yellow, violet or white. The poisonous substances in the plant are the alkaloids found in the bulbs and the glycoside iridin, which is an irritant and causes diarrhoea. Clinically, symptoms specific to gastroenteritis with hemorrhagic diarrhoea are observed and symptomatic treatment is recommended in case of poisoning (Severino, 2009).

Mistletoe (*Viscum album*)
The plant is in the Viscacee family. This plant has green leaves and translucent white fruits that remain on the plant

throughout the winter. The leaves and stems contain many compounds such as alkaloids, glycosides, and saponins. In addition, it contains viscotoxins that exhibit cardiac and neurotoxic effects. Characteristic poisoning symptoms are gastrointestinal disorders such as vomiting, diarrhoea, and sialorrhea. Also, neurological symptoms include mydriasis, ataxia, fatigue, and hypersensitivity, while effects on cardiovascular function include hypotension. In case of poisoning, symptomatic and supportive treatment is recommended (Valle and de Carvalho, 2021).

Narcissus (*Narcissus spp.*)
Narcissus is a decorative plant with yellow or white flowers belonging to the Amaryllidaceae family. The dog is a commonly affected species as it can chew or ingest the plant, but calendula toxicosis can also occur in cats (Saxon-Bury, 2004). The bulb parts of the plant are the most poisonous as they include alkaloids such as galantamine and lycorine. However flowers and leaves can also pose a risk to pets. In poisoning, symptoms appear early and include vomiting, diarrhea, anorexia, abdominal pain, and sialorrhea. However, if the amount ingested is high, animals may show lethargy, ataxia, bradycardia, hypothermia, depression, and hypotension until they fall into a coma. Large amounts of around 15g can kill a dog. There is no specific treatment and it is recommended to apply symptomatic treatment and induce vomiting (Bilgili et al., 2020).

Oleander (*Nerium oleander*)
Oleander is in the Apocynaceae family and is a shrub plant widely grown in the Mediterranean basin. Oleander is a quite poisonous plant and all parts of it, especially its leaves, are poisonous to pets. Consuming a few leaves is lethal to pets. However, poisoning is not common in cats and dogs. Oleander includes many glycosides such as rosagenin, neriatosside, nerioside, and oleandroside which have cardiotoxic effects similar to digital glycoside. Poisoned animals show diarrhea, vomiting, heart block, hypercalcemia, hyperkalemia, and hypomagnesemia. Treatment is symptomatic and administration of ephedrine, atropine, and propranolol gives good results (Langford and Boor, 1996; Caloni et al., 2013).

Rhododendron (*Rhododendron ferrugineum*)
Rhododendron is in the Ericaceae family and is widely used to decorative in gardens and parks. Rarely, cats and dogs are poisoned by this plant, while sheep and goats are the most frequently poisoned species. The toxic parts of the plant are the leaves, which contain a grayanotoxin that causes anorexia, vomiting, hypersalivation, colic, tachypnea, and tenesmus followed by bradypnea in animals. Poisoned animals may also have kidney and liver failure. Symptomatic treatment is recommended in poisoning. (Puschner et al., 2001; Jansen et al., 2012).

Rosaceae family
This family has many of the most common fruit trees such as peach, cherry, apricot, apple, and plum. They can rarely pose a risk to pets; this is due to the seeds or seeds of the fruit being swallowed by pets playing with them. The seeds and leaves of the fruits may be toxic because they contain cyanogenetic glycosides (such as prunasin, amygdalin, and prulaurasin). Clinical signs such as tremor or ataxia, foaming at the mouth, shortness of breath and convulsions are observed a few minutes after ingestion. Cyanide inhibits cytochrome oxidase and cellular respiration; As a result, the administration of sodium nitrate, which forms methemoglobin, which binds with cyanide-forming cyan-methemoglobin, and sodium thiosulfate, which converts cyanides to thiocyanate, may be beneficial in cases of poisoning (Severino, 2009; Bates, 2018).

Rubber (*Ficus elastika*)
The rubber is in the Moraceae family and has oval glossy green leaves. Rubber is used not only in the decoration of houses but also in the decoration of gardens that can grow as large as a tree. Toxic compounds are found in the leaves and stem and form latex that causes digestive disorders such as vomiting and diarrhea. Sometimes kidney damage is present in addition to mucosal, skin and digestive system lesions. The prognosis is generally favorable and treatment is symptomatic (Lucia, 2021).

Silk tree (*Albizia julibrissin*)
The silk tree or mimosa is in the Leguminosae family. Pets may accidentally eat the seeds, in such cases, different symptoms such as vomiting, colic, hemorrhagic diarrhoea, tetanic spasms, tachycardia, and convulsions may occur. Cylindricaluria and proteinuria may also be available. The poisonous part in the plant is the lectin phytohemagglutinin. Symptomatic treatment is recommended in poisoning (Severino, 2009).

Theobroma cacao fruit
Theobroma cacao fruit in the Sterculiaceae family and includes theobromine, which primarily affects the heart. Cardiovascular effects (hypertension, tachycardia, and arrhythmias), gastrointestinal effects (diarrhea and vomiting), and nervous effects such as tremors, agitation, seizures, and hyperactivity may occurred following ingestion of large quantities of the fruit. In severe poisonings, death may occur due to heart failure (Cortinovis and Caloni, 2016). Stabilization is important in animals. Methocarbamol or diazepam can be used for tremor and mild contractions, and barbiturates can be used for severe contractions. Propranolol or metoprolol can be used for tachyarrhythmias and hypertension, atropine for bradyarrhythmias, and lidocaine for refractory ventricular arrhythmias. Diuresis can be applied to preserve cardiovascular functions and accelerate urinary excretion of methylxanthines (Yurdakök-Dikmen, 2020).

Tongue cane (*Dieffenbachia picta*)
Tongue cane, which is one of the ornamental plants that is often used for decorative plant at home, can pose a risk to the health of pets. The plant originates from South America and takes part in the Araceae family. Its large elliptical leaves are green with a white variegation. The poisonous parts of the plant are the leaves, stem, and roots and contain a very irritating liquid rich in calcium oxalate crystals (Loretti et al., 2003). Calcium oxalate crystals facilitate histamine release due to damage to mast cells. However, calcium oxalates are irritating to the mucous membranes and cause severe pain in the mouth, paralysis of the tongue, salivation, and dysphagia. Symptoms mainly affect the digestive system (stomatitis and rough edema), skin (toxic erythema or vesicular rash), respiratory system, and kidney, resulting in the death of the animals following ingestion of many quantities of herbs. In the treatment, symptomatic treatment is performed and it is recommended to give antihistamine, to rinse the mouth with water or sodium bicarbonate solution. It is also good

practice to remove plant residues from the animal's stomach by administering emetics if ingestion has occurred within the last two hours (Pedaci et al., 1999; Dip et al., 2004).

Yew (*Taxus baccata*)

Yew is a shrub plant growing wild in mountain and sub-mountain regions. It is the most dangerous plants for pets. A cardiotoxic alkaloid called taxine, found in seeds, leaves, and bark is responsible for its toxic effect. Although large animals are the most commonly affected species, pets may also be affected by the toxic substances of the plant. Most characteristic symptoms are the found in nervous system. After an early period of arousal characterized by agitation and muscle tremors, a state of depression is observed with extinction of respiratory frequency. Often pets die without showing any symptoms, but postmortem diagnosis is easy due to the presence of leaf fragments in the stomach contents. Since the development of poisoning is very rapid, there is no effective treatment. Also, heptaminol (an amino alcohol classified as a cardiac stimulant) given at an early stage can be an effective measure. In addition, the administration of analeptics and sliders may be beneficial (Cope et al., 2004; Tiwary et al., 2005).

CONCLUSION

Toxicity may vary depending on the types of plants as well as the parts taken, the vegetative period, and environmental conditions (irrigation, soil type, temperature, etc.) in which the plant is located. Therefore, it is important to consider these aspects when approaching the patient in case of poisoning to establish an appropriate therapeutic strategy. There is usually no specific treatment for plant poisonings, but knowledge of the plant species involved is very useful for rapid decontamination and symptomatic/supportive care and medical attention. However, knowing the plant species can provide information that helps to initiate a rapid and focused response. It also makes a difference in determining the survival rate in case of poisoning and the quality and speed of recovery.

Conflict of Interest

The authors declare that they have no competing interests.

Authorship contributions

Concept: E.D., S.I., Design: E.D., S.I., Literature Search: E.D., S.I., Writing: E.D., S.I.

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