Vitamin D - Containing Plants

1. *Cestrum diurnum* - Day blooming jessamine, wild jasmine, day cestrum, or Chinese inkberry.
   - Member of the nightshade family (*Solanaceae*).

Images

- Day blooming jessamine (*Cestrum diurnum*) - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.

Poisonous Principle

In contrast to other members of this family, *C. diurnum* owes a significant aspect of its toxicity to its content of 1,25-dihydroxy-vitamin D-glycoside.

Toxicity

- Activity of *C. diurnum* is about $3.0 \times 10^3$ IU vitamin D/kg dried leaf.
- Disease has been produced in pigs fed 3% *Cestrum* leaf meal in the diet and in sheep administered 0.5 g/kg BW per day for 4 days.

Habitat

- Plant was introduced from West Indies. In warmer parts of the USA (California, Texas, Florida, Hawaii), it is grown as an ornamental plant.
- It has escaped cultivation in south Florida.
Susceptible Species

- Poisonings have been reported in Florida in cattle and horses.
- Syndrome has been experimentally reproduced in swine and sheep.

Clinical Signs and Clinical Pathology

- Horses:
  - Affected horses lose weight over a period of 2 - 6 months.
  - Become stiff and are reluctant to move, developing a short, choppy gait. Reluctance to move especially when turning. Flexor and suspensory ligaments are sensitive to palpation.
  - Slight to moderate kyphosis.
  - Elevated pulse and elevated respiratory rates.
  - Clinical signs may reach an end point which can persist for years.
  - In affected animals, serum calcium is elevated (11.4 - 16.7 mg/dl), but serum phosphorus is normal.
- Cattle:
  - Clinical signs of *Cestrum* poisoning in cattle are very similar to those seen in horses. Progressive lameness and chronic wasting predominate. Serum calcium is elevated to values of ≥ 14 mg/dl.

Lesions

- Horses:
  - Soft tissue mineralization (calcification) from hypervitaminosis D is widespread in arteries (aorta 2 - 3 fold thickening), ligaments, and tendons. Calcinoses of the forelimb flexor tendons is more severe than the pelvic limb. Suspensory ligaments of all limbs calcified. Renal and lung calcification is not a hallmark of this disease. Left atrium is most severely calcified part of heart. Generalized osteoporosis from retarded osteocytic osteolysis has been reported.
  - Emaciation.
  - Parathyroid chief cells (C-cell) hyperplasia.
- Cattle:
  - Osteoporosis and parathyroid chief cell (C-cell) hyperplasia.
  - Soft tissue calcinoses involving tendons, ligaments, and vessels may be similarly involved.
  - Glomerular fibrosis and interstitial fibrosis of the kidneys occur. Hyperplasia of the zona glomerulosa of the adrenal gland.

2. *Solanum malacoxylon*

Images

- *Solanum malacoxylon* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org. -

- Disease has been known as "Manchester wasting disease" and, in Hawaii, "Naalehu disease", (rough translation is "covered with grey ashes").
- The disease syndrome is associated with ingestion of the leaves and stems of the *S. malacoxylon* plant.

Poisonous Principle

Plant contains a molecule similar to or identical to 1,25-dihydroxy vitamin D with a carbohydrate moiety. The glycoside is then cleaved to the active form of vitamin D *in vivo*.

Toxicity

- Activity of vitamin D in *S. malacoxylon* is about 1.3 X 10^9 IU vitamin D equivalents per kg dried leaf.
- A level of 1.5 - 3.0% dietary *S. malacoxylon* will induce calcinoses.

Susceptible Species

The disease syndrome has been reported in sheep and cattle. Other animals are susceptible experimentally. Adult cows are more susceptible than are calves.
Clinical Signs and Clinical Pathology

- Reported clinical signs include progressive emaciation, joint stiffness, and weakness.
- Serum calcium elevations (as well as a moderate increase in serum phosphorus) occurs.

Lesions

Aortic calcification (intima and media) as well as all major and minor blood vessels occurs. Mineralization of the heart, lungs, and kidneys may also develop. Hyperostosis may lead to bone thickening. A dark basophilic band (possibly mucopolysaccharides) separates new bone growth from pre-existing bone.

3. Tricetum flavescens

Images

- Tricetum flavescens - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.

Soluble Oxalate - Containing Plants - Beta

Beta vulgaris - Beet, sugar beet, fodder beet, mangel, mangel-wurzel, mangold.
Family - Polygonaceae (buckwheat family).

<table>
<thead>
<tr>
<th>Specific Agents</th>
<th>Major Species</th>
<th>Usual Time of Onset</th>
<th>Usual Duration (if survives)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beets (Beta)</td>
<td>Herbivores</td>
<td>Few hours to weeks</td>
<td>Weeks to permanent damage; potentially lethal to often lethal</td>
</tr>
<tr>
<td>Curly dock (Ramnus)</td>
<td>Herbivores</td>
<td>Few hours to weeks</td>
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</tr>
<tr>
<td>Lamb's quarters (Chenopodium)</td>
<td>Herbivores</td>
<td>Few hours to weeks</td>
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<tr>
<td>- Kochia Scorpia</td>
<td>Herbivores</td>
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</table>

Images

- Beet, Beta vulgaris - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.
- Sugar beet, xBeta vulgarisxxx - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.
- Fodder beet, Beta vulgaris - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.
- Mangel, Mangel-wurzel, Beta vulgaris - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.
- Mangold, Beta vulgaris - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.

Habitat

USA; England; Scandinavia: used as forage, fodder.

Toxic Principle

- Nitrate.
- Oxalate.
- Perhaps another substance.

Susceptible Species

Sheep, cattle, probably others.
Toxicity

- Ingestion of sugar beet tops after the beet roots have been harvested may cause death losses in livestock.
- Concentrations of KNO₃ are as high as 8.8% on a dry weight basis.
- Nitrate concentration may be increased by treatment with 2,4-D.
- Oxalate concentrations may reach 12%.
- Wilting before feeding decreases toxicity, but does not affect the oxalate content.
- Various strains of fodder beets are fed (roots are fed) in England and Scandinavia.

Clinical Signs

- Ingestion of fodder beets has been associated with an increased probability of hypocalcemia in dairy cattle.
- In sheep, rumen ammonia levels increase after eating beets but ruminal acidosis (overload) seems to be the main concern.

Rheum - Rhubarb

*Rheum rhaponticum* - Rhubarb, pie plant
Family - Polygonaceae (Buckwheat Family)

<table>
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<td>Few hours to weeks</td>
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Images

- Rhubarb, *Rheum rhaponticum*. Source: Cornell University, Poisonous Plants Informational Database (www.anisci.cornell.edu/plants/index.html). - To view this image in full size go to the IVIS website at www.ivis.org . -
- *Rheum rhaponticum* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org . -

Description

A stout, perennial herb, 6 - 30 inches high. The stalk has a concave surface on one side, similar to celery, but less pronounced. The leaves are heart-shaped and 20 - 50 cm (8 - 20 inches) long by 20 - 40 cm (8 - 16 inches) wide. The leaves are basal, long stalked and divided on veined, finger fashion; the green or red leafstalks are sheathed. The leafstalks are roundish about 1.2 - 2.5 cm (1/2 - 1 inch) wide, and there are 5 primary veins from the basal leaf. The flowers are greenish-white, numerous, dense and in clusters. Deeply rooted. Roots tend to occur in clumps.

Toxic Principle

- Oxalic acid, calcium and potassium oxalates.
- Possibly other toxic principles.

Susceptible Species

All, especially livestock.

Toxicity

- Oxalic acid is corrosive, and contact may cause skin and gastrointestinal irritation. The leaf blades, and not the edible petioles contain the toxin in quantity. Cooking does not destroy the toxin.
- Swine eating the leaf-blades have died.
- Humans have been poisoned from eating the cooked leaf blades. Only a small amount of the leafblade has caused significant poisoning.
- Rhubarb is considered one of the most dangerous of all plants in a garden.
Signs and Effects

- **Swine:**
  - Staggering, excessive salivation, vomiting, and death in convulsions.
- **Humans:**
  - Frequently, there is a lag period of about 24 hours.
  - There is severe pain in the abdomen and accompanying cramps. Nausea, vomiting, and weakness occur.
  - Electrolyte imbalance, especially a refractory hypokalemia takes place.
  - Breathing becomes labored, and muscle tremors occur.
  - Internal bleeding and nasal bleeding may ensue.
  - Renal signs include: oliguria, anuria, albuminuria, hematuria, ketonuria, and increased BUN.
  - Convulsions and coma followed by rapid death may develop. Death has occurred 3 - 5 hours after the onset of clinical symptoms. Tetany may occur if severe hypocalcemia ensues, but frank tetany is rare.

Lesions

- Hemorrhage.
- Oxalate nephrosis especially in the lower nephron; dilated tubules, epithelial degeneration.
- Corrosive changes in the gastrointestinal tract.
- Cerebral edema.

Notes - The petiole (stalk of the leaf) is edible and is commonly used in pies and jams. During WWI, in an effort to conserve food, an official recommendation in England was to utilize the leaf blades as well as the petioles. Severe poisoning and death resulted.

Treatment

Administer oral lime water (calcium hydroxide), milk, calcium gluconate, or calcium lactate. Then, use an emetic if there is no evidence of impending convulsions, coma, severe corrosion, or other contraindication. This will tend to form insoluble calcium gluconate before it is brought back up either with the emetic, or by the use of lavage if emesis is contraindicated. Activated charcoal will also be of benefit and a saline cathartic may be used if there is no evidence of corrosive effects. When gastrointestinal effects persist after treatment, however, demulcets, such as milk, should be administered. IV fluids, with added bicarbonate are indicated and the animal should be monitored and managed for renal failure as well as electrolyte imbalances, especially hypocalcemia.

Rhubarb - Note the large fan-shaped leaf blade and fleshy leaf stalk of this excellent pie plant. The flowers and seeds are rarely produced.
**Halogeton**

*Halogeton (Halogeton glomerulatus)*

**Family** - Chenopodiaceae (goosefoot family)

**Images**

- Halogeton (*Halogeton glomerulatus*). Source: Cornell University, Poisonous Plants Informational Database (www.ansci.cornell.edu/plants/index.html). - To view this image in full size go to the IVIS website at www.ivis.org.

**Description**

- *H. glomeratus*
- Plant - Annual herb, resembling Russian thistle, 1 - 2 ft. tall.
- Stem - Reddish or purplish, branched at base, basal curvature of each branch is characteristic.
- Leaves - In clusters, round, fleshy, wiener-shaped, tipped with a bristle-like hair, 1/2 inch long.
- Fruit - In fall, fruit clusters hide leaves, enclosed in five wing-like brackets.

**Habitat**

- Native to Eurasia (imported into USA).
- Spreading, especially in Nevada, but also in parts of Utah, Wyoming, Idaho, Colorado.
- In arid and semi-arid regions of the upper intermountain areas of the Rocky Mountains of the USA.
- Overgrazed parts of ranges, along roadways, burned and abandoned fields.
- Salty soils such as dry lake beds.

**Toxic Principle**

Sodium and potassium oxalates.

**Susceptible Species**

Sheep, cattle, horses, swine.

**Toxicity**

- General.
  - 30% oxalate in leaves (dry weight).
  - 10% oxalate in seeds (dry weight).
  - 3% oxalate in stems (dry weight).
  - Excretion is rapid thus the toxic dose must be eaten in a short time for toxicosis to occur.
  - Plants may be more palatable when covered by frost.
  - Poisoning is most frequent in the fall due to the plant's increased toxicity and the decreased amount of other forage availability.
  - 6.9% oxalate is considered nontoxic.
- Sheep.
  - 0.99 - 1.21 g oxalate/kg body weight is lethal if 20 - 30% is absorbed into blood steam.
  - If fed low doses for 4 days, the rumen bacteria become conditioned, resulting in 30% increase in the lethal dose.
  - Sheep fed *Halogeton* (containing 6% oxalate) did not develop a negative calcium balance.
**Signs**

- Sheep.
  - Chronic cause of death is uremia.
  - Acute death caused by hypocalcemia.
  - Toxicosis is noted within 2 - 6 hours of ingestion.
  - Dullness, weakness, reluctance to move, slobbering.
  - Incoordination, prostration.
  - Labored, rapid breathing.
  - Tetanic contraction of limbs.
  - GI motility is depressed.
  - Convulsions may occur.
  - Coma, shock, and death usually occur within 9 - 11 hours of the onset of clinical signs.
- Cattle.
  - Locomotor difficulty when driven.
  - Frontlegs are more affected than back legs.
- Swine.
  - Diarrhea.
  - May bleed to death from severe GI hemorrhage.

**Pathology**

- Hemorrhagic rumenitis in some sheep. Gastrointestinal hemorrhage in swine.
- Diagnosis is confirmed by the presence of numerous, nearly transparent crystals in the renal tubules. There is also severe congestion in all parts of the kidney and there may be albumin in the tubules. Renal lesions may be grossly evident, comprised of radially arranged white streaks.

**Diagnosis**

Evidence of consumption of *Halogeton*, appropriate clinical signs, and lesions.

**Prevention**

- Oral dicalcium phosphate may be provided for animals likely to ingest *Halogeton* (to form insoluble, poorly absorbed calcium oxalate). Given in ration at 3 parts salt to 1 part dicalcium phosphate-free choice. Or, 5% concentration in alfalfa pellets, 0.25 - 0.5 lb per sheep per day.
- Crested wheat grass will improve range and crowd out the *Halogeton*.
- Treatment of hypocalcemia with intravenous calcium gluconate does not correct all of the clinical signs.

**Note**

- As oxalate consumption increases, feed consumption decreases.
- In 1962, in one outbreak, 150 cattle died from eating *Halogeton* in Nevada.
Halogeton Glomerulatus

Early Distribution of Halogeton (spreading)
Halogeton is often mistaken for Russian thistle. The stems are tinged with red or purple, and are branched at the base. The leaves, which grow in little bunches along the stems, are round, fleshy, and wiener shaped. The seeds are usually enclosed in winglike bracts, which almost cover the plant at maturity. The plant belongs to the goosefoot family. A distinctive characteristic of halogeton is a small single hair, about one-twelfth of an inch long, that grows on the end of each leaf.

Sarcobatus - Black Greaseweed

*Sarcobatus vermiculatus* - Black greasewood, chico.

**Family** - Chenopodiaceae (goosefoot family)

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**Images**


**Description**

An erect, woody, spiny, highly branched, deciduous perennial shrub, which has smooth, whitish bark, becoming grey with age. The leaves are alternate, yellow to bright green, and develop a reddish cast with age. Leaves are narrow, thick, almost round in cross-section, succulent, and 1.2 - 2.5 cm (1/2 - 1 inch) long. The male flowers are cone-like, crowded in a terminal spike and are 1.2 - 3 cm (1/2 - 1.2 inches) long. The female flowers are axillary, inconspicuous and below the male flowers and there is a cuplike calix. The fruit is ovoid, (0.3 - 0.5 cm (1/8 - 1/5 inches) long, surrounded by a pale brown, lobed, peppery, tough wing 0.8 - 1.2 cm (1/3 - 1/2 inches) across.

**Habitat**

Alberta to North Dakota, South to Texas, California and Mexico, semiarid regions of the Great Basin. Alkaline soils, flatlands, flood plains, dry washes, and gullies.

**Poisonous Principle**

Sodium and potassium oxalate (4:1).

**Susceptible Species**

Sheep are more susceptible than cattle.

**Toxicity**

- The total oxalate concentration varies from 10 - 22% of the dry weight and exists as soluble salts.
- The oxalate content is greatest in the leaves and increases with maturity of the plant.
- Cattle are rarely poisoned under range conditions.
- Oxalate concentrations highest in late summer.
Clinical Signs, Lesions, Prevention

Same as for *Haloegeton*.

*Amaranthus* spp. - Pigweed

*Amaranthus retroflexus* - Rough Pigweed, Redroot Pigweed
*A. palmeri* - Redroot Pigweed
*A. gangeticus*

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<td>Swine, cattle</td>
<td>Days to weeks</td>
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Family - Amaranthaceae (Amaranth Family)

Images

- Pigweed (*Amaranthus* spp.). Source: Cornell University, Poisonous Plants Informational Database (www.anisci.cornell.edu/plants/index.html). - To view this image in full size go to the IVIS website at www.ivis.org . -
- Pigweed, *Amaranthus retroflexus* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org . -

Description

- Annual reproducing by seeds
- Stems erect, branching above
- Leaves alternate, simple with long petioles, ovate or rhombic, with a wavy margin.
- Flowers in dense thick spikes, crowded in a close, stiff terminal panicle. Flowers are polygamous, small and green with 3 stiff, spine-like persistent bracts, 4 - 6 mm long; calyx with 5 sepals, 5 stamens, and 1 pistil which is 1-celled.
• Fruit is a utricle, opening with a lid. Seed is lens shaped, ovate, 0.9 - 1.3 mm long, glossy and black.

Habitat

• *A. retroflexus*:
  • Native to the American tropics but now found throughout the USA; especially common in the Midwest. Canada from Prince Edward Island, west to the Pacific Ocean.
  • Roadsides, fields, barnyards, and other areas rich in organic matter; Disturbed pastures.
• *A. palmeri*:
  • Sandy soils of Mexico, California, Arizona, Texas, and southwest Kansas.

Toxic Principle

• Unknown agent causes perirenal edema, nephrosis.
• Oxalate (up to 30%, dry weight): Leaves have 3 times as much oxalate as the stems.
• Nitrate (concentrations at different life stage range from 0.04 to 2.9%).
  • The nitrate content of the plant is fairly constant throughout.
  • Green plant at rapid stage of growth (0.066% KNO3).
  • Plants that stop growing due to inadequate moisture (0.828% KNO3).
  • Plants that wilted due to lack of moisture (2.874% KNO3).
• Hay contaminated by pigweed can be dangerous.

Susceptible Species

• Swine are most often poisoned, especially when newly introduced to the plant.
  • Pigs with continuous access to this plant rarely eat enough to be poisoned.
• Growing calves, cattle.
• Sheep may also be affected.

Clinical Signs

• Swine (Perirenal Edema Syndrome).
  • Swine (30 - 150 lb) raised in confinement and given access to contaminated pasture often experience perirenal edema.
  • Posterior incoordination, weakness, trembling, and knuckling at the pasterns with onset at 5 - 10 days after initial ingestion.
  • Affected pigs are alert and appetite usually remains good initially.
  • The abdomen is often distended.
  • Often pigs subsequently develop coma and die within 48 hours after the onset of clinical signs.
  • Mortality (5 - 50%) has occurred.
• Cattle.
  • May also experience nephrosis, dyspnea, and depression.

Lesions

• Retroperitoneal edema in the perirenal connective tissue is the most striking finding in many animals. Edema is often present in the ventral abdominal wall and perirectal area.
• Kidneys are normal or small in size and pale with subcapsular petechiae.
• Edema fluid may be blood tinged.
• Toxic tubular nephrosis, degeneration of proximal tubules.
• Necrosis and dilation of the convoluted tubules and a large number of proteinaceous tubular casts, some may have oxalate crystals.
• Calves tend to have more free fluid in the thoracic and peritoneal cavities (straw colored). Renal tubular necrosis and cortical interstitial edema occurs.

Diagnosis

• Identification of *Amaranthus*, evidence of consumption, and appropriate clinical signs and lesions.
• Oxalate crystals in kidneys are not a consistent finding.
Treatment

- Remove animal from source of plant insult.
- Less than 10% of animals die after removal.
- Avoid stress, dehydration from any cause.

Prevention

- Mow, then spray with 2,4-D or similar herbicide.
- Spraying plants with 2, 4-D may intensify nitrate accumulation.
- Therefore, remove all animals from pasture for 1 week following spraying to avoid exposure to plants until they have dried out.
- Ruminal microflora may become adapted, thereby facilitating oxalate degradation, but whether this tends to protect cattle from toxicosis due to *Amaranthus* is not known.

Redroot Pigweed, *Amaranthus retroflexus* L. 1, lower stem and roots; 2, upper stem with leaves and flower clusters; 3, flower; 4, seed. **Annual**, reproducing by seeds. **Taproot** shallow, reddish. **Stems** erect, up to 6 feet (1.8 m) high, rough, branching freely if not crowded. **Leaves** dull green, usually at least 6 inches (15 cm) long when mature, ovate to lanceolate. **Flowers** green, small, in thick, stiff, paniculalike terminal spikes with many short, crowded lateral branches. Brachts much longer than sepals and utricles. Sepals longer than utricle, curved, rounded, often with small notch at end. **Seeds** shiny black, lens-shaped, ovate, notched at the narrow end, about 1 mm in diameter. **Found** in cultivated fields, yards, fence rows, and other waste places. Other species, such as smooth pigweed and Powell amaranth, are similar to redroot pigweed in morphology and weedy habits, and may often be found in the same area. Redroot pigweed is also commonly known as rough pigweed.
Quercus - Oak

Quercus gambelii, Q. harvardi, Q. marilandica, Q. stellata, Q. breviloba, Q. coccinea, Q. durandii, Q. pedunculata, Q. prinus, Q. robur, Q. rubra, Q. velutina - Oak

Images

- Quercus spp., Oak. Source: Cornell University, Poisonous Plants Informational Database (www.anisci.cornell.edu/plants/index.html). - To view this image in full size go to the IVIS website at www.ivis.org.
- Chestnut Oak, Quercus prinus - U.S. G.S. Northern Prairie Wildlife Research Center. - To view this image in full size go to the IVIS website at www.ivis.org.
- Quercus gambelii, Q. marilandica, Q. stellata, Q. coccinea, Q. durandii, Q. pedunculata, Q. prinus, Q. robur, Q. rubra, Q. velutina - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.

Description

- Plant - Woody, perennial, trees, or shrubs.
- Leaves - Alternate, entire, toothed or lobed; persistent or deciduous.
- Flowers - Staminate flowers; pistillate flowers solitary to clustered.
- Fruit - Acorn, 1 seeded, partly enclosed.

Habitat

- All parts of the United States.
- Poisoning may be more common in the southwestern states of Texas, New Mexico, Arizona, and Utah; Europe, New Zealand.
- Common in broadleaf forests, rangelands, dry to wet situations, sandy to limestone to clay soils.

Toxic Principle

- Unknown.
- Probably a gallotannin which is a combination of gallic acid and tannic acid.

Susceptible Species

- Cattle, sheep, goats, rabbits, chickens, guinea pigs, rarely horses.
- Swine seem resistant.

General

- All oaks should be considered potentially toxic.
- Buds, small leaves, flowers, and stems are palatable and poisonous.
- As the leaves mature, they become less palatable and animals are less likely to be poisoned.
- Most cases of poisoning occur when the leaves and buds are young and tender (spring).
- Acorn poisoning often occurs during a wet fall season following summer drought conditions. Acorn poisoning may occur in the fall or winter.
- Animals must usually eat oak leaves or acorns in large quantities for 2 - 4 weeks or longer prior to the onset of clinical poisoning.
- Animals have been poisoned by drinking water that had oak leaves soaking in it.
Cattle

- Cattle eating *Q. harvardi* in Texas have died within 24 hours after onset of clinical signs; however, animals are usually ill for 5 - 10 days to a month or longer.
- Yearling calves still nursing are usually more susceptible than adults.

Sheep

- Sheep have died within 1 - 3 days after the onset of clinical signs.
- Complete recovery seldom occurs in less than 2 - 3 weeks.

Horses

Poisoning occurs occasionally in horses.

Chickens

- A diet containing 0.5% tannic acid produced depressed growth and 5 - 7% mortality in 7 - 11 days.

Clinical Signs:
General Signs and Clinical Pathology Findings

- Abdominal pain, constipation, extreme thirst, edema, depression, frequent urination.
- Bloody diarrhea.
- Rapid but weak pulse.
- Elevated SGOT and SD enzyme activities; elevated BUN, creatinine, potassium.

Subacute Cases

- Atony of rumen, small hard feces.
- Feces may contain blood and black tarry diarrhea may occur in later stages.
- Anorexia, emaciation, weakness, prostration.
- Fast, weak pulse.
- Rough coat, dry muzzle, subnormal temperature, grinding of teeth.

Terminally

- The tail and perineum becomes stained with black feces.
- Hemorrhagic enteritis.
- Bloody feces containing diphtheritic membranes.
- Kidney damage is indicated by elevated BUN levels, lowered urine specific gravity, and poor renal clearance; urine may be dark.
- Death may occur within 24 hours after onset of clinical signs.

Lesions

- Gastritis and nephritis are major lesions.
- Pseudomembranes may form in the intestinal tract.
- Increased amounts of peritoneal and pleural fluids.
- Perirenal edema and hemorrhages with pale, swollen kidneys are characteristic.
- The proximal convoluted tubules of the kidneys may be damaged and abundant hyaline or granular casts may be evident.
- Gut lesions may resemble the "button ulcer" of hog cholera.

Diagnosis

- Identification of *Quercus* spp, evidence of consumption in large amounts, and appropriate clinical signs.
- The kidneys are often large and pale with petechial hemorrhages; elevated BUN, creatinine and serum potassium.
- Mucous and blood are commonly present in the voided feces.
Treatment

- Terminate exposure to oak, acorns, etc.
- Supplement feed.
- Blood transfusions if anemic; fluid therapy.
- Activated charcoal for recent ingestion (repeat daily).
- Avoid water deprivation, stress.

Prevention

- Children should be warned against chewing acorns.
- Cattle - 15% calcium hydroxide can be mixed in a pelleted ration to lessen hazard of acorn ingestion.
  - Cattle-supplement recommendation:
    - 1080 lb cottonseed or soybean oil meal.
    - 600 lb dehydrated alfalfa meal.
    - 120 lb vegetable oil.
    - 200 lb hydrated lime (10% calcium hydroxide).
    - Feed 1 - 2 lb/head/day.

Notes

- Cattle losses due to acorns in Missouri usually stop 1 - 2 weeks after a hard freeze.
- In April, 1935: 502 cattle and 426 sheep died in Sutton County, in southwest Texas, from eating leaves and buds of *Q. breviloba*. Drought caused other forage to be nearly absent.
- Annual losses in the southwest may approach 10 million dollars.
- Indians removed the outer shell and ground the kernels into meal, but the meal was then leached many times before eating.
BLACK OAK
Yellow-bark Oak.
*Quercus velutina* Lam.

NORTHERN RED OAK
*Quercus rubra* L.

PIN OAK
*Quercus palustris* Muench
**Lilium and Hemerocallis spp.**

*Lilium longiflorum* - Easter Lily

*Lilium lancifolium* - Tiger Lily

*Lilium spp.* - Other lilies including Japanese show lily, rubrum lily and Lilium hybrids

*Hemerocallis spp.* - Day Lily

### Images

- *Rubrum lily* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.

### Description

**Lilium**

- Root - Scaly bulb, not truncate, sometimes stoloniferous or rhizomatous.
- Leaves - Linear or lanceolate, whorled, horizontal or with recurred tips. Veins parallel. Petioles short or absent. Stem unbranched. Bulbils form in leaf axils or on lower part of stem.
- Flowers - Solitary and terminal or in terminal raceme or umbel, cup-shaped or bowl-shaped. Up to 30 cm in width 6 segments, spreading or reflexed each with a basal nectar-bearing gland. Six stamens. Fruit a 3-celled capsule containing many flat seeds in 2 rows per cell.

**Hemerocallis**

- Root - Fibrous or somewhat tuberous often with enlargements at each end.
- Flowers - Ephemeral, in clusters on long scapes, perianth funnelform to campanulate.
- Six segments uniting to form a narrow basal tube. Six stamens. Ovary 3-celled. Fruit a loculicidal capsule with 3 valves.

### Habitat

Lilies and day lilies are widely cultivated as ornamentals in gardens and as house plants.

### Toxic Principle

Unknown.

### Susceptible Species

- Toxicosis has been recognized in the cat.
- There is no evidence at this point, to indicate definitively whether or not other domestic species are sensitive.

### Toxicity

Toxicosis in cats has been reported after consumption of leaves or flowers of *Lilium or Hemerocallis* spp.

### Clinical Signs

Toxicosis in cats results in acute onset of gastrointestinal upset, reduced activity, and anorexia followed by renal failure developing 48 - 96 hours after ingestion. The syndrome appears to be associated with a high mortality rate if the animal is not treated.
Lesions

Renal tubular necrosis with preservation of the basement membrane.

Treatment

- Induction of emesis.
- Administration of activated charcoal.
- Saline catharsis.
- Fluid diuresis (2 - 3 times maintenance for at least 24 hours).

Notes - Aggressive treatment begun within 24 hours of ingestion (before renal failure occurs) has resulted in nearly 100% survival in preliminary studies. Once renal failure occurs the syndrome is potentially fatal. In one case, a cat survived when treatment was begun after the onset of lily-induced renal failure and the cat was treated via long-term peritoneal dialysis.

Orange Day Lily (*Hermerocallis Fulva L.*)

Family - Lily (liliaceae).
Growth Form - Perennial herbs from fibrous roots.
Stems - Upright, smooth, up to 6 feet tall.
Leaves - Basal, elongated, tapering to a point, up to a 1/2 inch broad.
Flower Arrangement - Flowers several, in terminal clusters.
Flowers - Orange, up to 6 inches long.
Perianth - 6-parted, united below into a tube.
Stamens - 6.
Pistils - Ovary superior; style long and slender.
Fruits - Capsule oblong, smooth, up to 2 inches long.
Habitat - Roadsides and open, disturbed areas.
Range - Throughout the state.
Time of flowering - June to August.
Note - The name Day Lily comes from the fact that each flower opens for only one day.
### Additional Toxicants

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<th>Specific Agents</th>
<th>Major Species</th>
<th>Usual Time of Onset</th>
<th>Usual Duration (if survives)</th>
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<td>Hybrid Sudan or Sudan Grass (Sorghum spp.)</td>
<td>(See Toxicants that Cause Paralysis)</td>
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<td>[Indirect effect of equine cystitis - ataxia syndrome (ascending infections)]</td>
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<td>Cocklebur (Xanthium)</td>
<td>(See Poisonous Plants that Affect the Liver)</td>
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### References

**Vitamin D - Containing Plants**

2. See reference section for *Cestrum* spp. *Jessamines* and for *Solanum* spp.

**Amaranthus spp. - Pigweed**


**Lilium and Hemerocallis spp.**


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