Plants that Affect the Gastrointestinal Tract (Part I)  (9-Aug-1999)

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Proteins-Synthesis Inhibiting Lectins ("Toxalbulmins")

*Abrus Precatorius* (Crab's Eye, Precatory Bean, Rosary Pea, Jequirity Bean)

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<tr>
<th>Major Species</th>
<th>Usual Time of Onset</th>
<th>Usual Duration (if survives)</th>
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<tbody>
<tr>
<td>Horses, small animals</td>
<td>12 - 24 hours</td>
<td>Few days; often lethal</td>
<td></td>
</tr>
</tbody>
</table>

Family - Leguminosae

Images

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

Description

- Plant - Perennial vine, climbing on other plants, 10 - 20 feet tall.
- Stem - Woody, green when young, slender.
- Leaves - Alternate, opposite, pinnately divided, compound. Leaflets are small, oblong, in 8 - 15 pairs and 1/2 inch long.
- Flowers - Numerous inflorescences in leaf axils along stem. Racemes, 1 - 3 inch long. Flowers are many, small, red to purple or occasionally white.
- Fruit - Legume pod, 1.5 inches long, covered with fine hairs, contains many seeds, hard ovoid, 3/8 inches long. Seeds are bright, glossy, scarlet with jet black mark which covers 1/3 of the seed including the scar of attachment and the seeds are 0.2 - 0.3 inches long. The pod is somewhat septate between the seeds.

Habitat

Tropical locations such as Mexico and India. In the USA in central and southern Florida. Fence rows, citrus groves, occasionally cultivated as a screening vine or for the seeds which are made into rosaries and necklaces.

Toxic Principle

- The heat labile phytotoxin (a lectin, also termed a toxalbumin), abrin.
- The glycoside, baric acid.

Mechanism of Action

Protein synthesis inhibition by the toxalbumin.

Toxicity

- General:
  - Seeds are most toxic, seed coat retains the toxin, therefore if ingested whole, toxicosis is unlikely, toxicosis results from having chewed the seeds.
- Human:
  - Abrin is one of the most toxic compounds known and less than 1 masticated seed is sufficient to kill an adult human being.
  - Ingestion of 0.00015% of BW may be lethal.
  - Severe illness occurred after drinking tea in which 1 seed had soaked for 15 minutes.
  - Poisoning has occurred from a pricked finger while stringing the beans.
- Horse:
  - 14.8 ml (0.5 oz) of powdered seed produces clinical signs while 59 - 118 ml (2 - 4 oz) is lethal.
  - Humans and horses are more susceptible than are goats, cattle, and dogs.

Signs

- General Signs:
  - Oral and esophageal irritation, similar to caustic burns, seen by 2 hours.
  - Severe gastrointestinal irritation.
  - Nausea and vomiting, also dehydration.
  - Trembling, tachycardia.
  - Coma, hemolytic anemia, oliguria and sometimes uremia.
  - Incoordination to paralysis.
  - Circulatory collapse and death.
  - Nonfatal cases may proceed to secondary infections.

- Humans:
  - Hallucinations have occurred in children, in addition to the above signs.

- Horses:
  - Latent period.
  - Loss of appetite.
  - Violent purgation.
  - Elevation followed by depression in temperature.
  - Incoordination and sometimes paralysis.
Toxicosis may be seen to occur in 2 general stages.

1. Initial stage (2 - 24 hours after dosing), characterized by oral, esophageal and gastric irritation.
2. Late stage (1 - 10 days), in which the following may occur:
   - Ocular hemorrhage (retinal and/or scleral).
   - Increased capillary permeability.
   - Hypotension and sometimes shock.

- CNS hemorrhage may also occur in some animals.
- Renal failure may be acute in some cases.

Lesions

- Inflammation and ulceration of the GI tract.
- Visceral hemorrhage and small thrombi formation.
- Multifocal necrosis in parenchymatous organs.
- Splenomegaly and multifocal necrosis in germinal centers of lymphatic organs.
- Possible hemolytic anemia and generalized petechial hemorrhage throughout the body.
- Possible hemagglutination.

Diagnosis

Identification of seeds of *Abrus precatorius*, evidence of consumption and appropriate clinical signs and lesions.

Treatment (Applies to Toxalbumins [Phytotoxins] in General)

- Induce emesis unless contraindicated by the condition of the animal.
- Maintain (or establish) respiration.
- Endotracheal intubation preceding gastric lavage.
- Activated charcoal with a saline cathartic, e.g., magnesium sulfate.
- Maintain fluid and electrolyte balance.
- Oral antacids to alleviate local irritation.
- Ascorbic acid increases survival rates.
- If there has been significant hemolysis, forced alkaline diuresis has been suggested to prevent nephrosis.
- If severe hemolytic anemia, consider exchange transfusion where possible.

Note - Drilled seeds as in necklaces are very toxic.

Prevention

Reportedly immunization via increasing doses is practiced in India.
Rosary Bean - The twining stem, the 3-foliate leaves, the legume flowers, the hairy seed pod, and the attractive red and black beans characterize this unusual plant.
**Ricinus Communis** (Castor Bean, Castor-Oil-Plant, *Palma Christi*)

**Family** - Euphorbiaceae (spurge family)

**Images**

**Description**

- *R. communis*:
  - Plant - Large, glabrous, annual, shrub-like herb, 3 - 10 feet tall.
  - Stem - Stout, thick, reddish, green, or purple.
  - Leaves - Alternate, simple, large, palmately veined and lobed, peltate, 4 - 32 inches in diameter. Petiole is stout.
  - Flowers - Imperfect, unisexual, in clusters, no petals; calyx is 3 - 5 parted; no corolla, stamens are numerous and ovary is 3 celled.
  - Fruit - Capsule - 3 seeded, spiny. Seeds - 1 cm long, smooth and glossy, black or mottled with grey or brown.

**Habitats**

- Native to tropics (Africa), now commercially grown in the USA in Illinois, Missouri, Kansas, Oklahoma, Oregon and California.
- Naturalized in the south, i.e., Texas, where winters are mild. Occurs in disturbed areas, roadsides, dumping grounds, barnyards of warmer areas of USA but confined to planted sites in cooler areas.
- Used as ornamental outside in summer in midwest, etc., and less often as a houseplant.
- Toxicosis not only associated with plant, but most often with seed and seed products.

**Toxic Principle**

- Ricin is the principal toxin, and is a phytotoxin (a lectin, also termed a toxalbumin). Toxalbumins are very toxic proteinaceous compounds of plant origin.
- Ricin is 100 times less toxic orally than parenterally; the difference is apparently not a result of the effects of trypsin or pepsin.
- Orally, ricin is readily absorbed from the stomach and intestine.
- Ricin is water soluble and not present in castor oil.
- Being a protein, and a fairly large molecule, ricin is heat labile. In castor bean cake, meal, etc. the ricin is generally inactivated by heating. Aging also reduces toxicity.
- Ricin may comprise up to 3% of the seed weight.
- Another phytotoxin in castor bean, ricinine, is reportedly goitrogenic. The importance of this compound is not clearly established.

**Toxicity**

- LD50 in the rabbit is 40 µg/kg, which indicates that ricin is one of the most toxic compounds of plant origin.
- Cattle: 14 ounces of beans may be lethal, beans at 0.2% of BW may cause toxicosis.
- Horses: Even more susceptible than cattle, beans at 0.01% of BW may cause toxicosis.
  - **Note** - The susceptibility of sheep and hogs approximates that of cattle. Also, small animals are quite susceptible.
- Humans: One to 3 beans may be lethal.
- Ducks: The LD50 in ducks approximates 3 - 4 beans.
- Hens: Are fairly resistant to ricin.
- Poultry general: Beans at 1.4% of BW may cause toxicosis.
- All parts of the plants are toxic, but especially the seeds.
- Acts as an antigen and protective antibodies may be elicited. Primarily of research rather than practical importance.
- Seeds, presscake or meal (if inadequately processed) and foliage are poisonous.
- Castor oil is not poisonous.
- "Presscakes" from castor beans alone or mixed with linseed cakes have caused the most problems in cattle. Ricin is also excreted in the milk, which can cause it to have purgative properties.
- It has been suggested that anaphylactic reactions may occur in all species.

**Mechanism of Action**

- Binds to galacto-lipid and galacto-protein components of plasma membranes which leads to toxin internalization and cell death.
- In some cell types, at least in rodents, a second mechanism of toxin internalization relies on binding of mannose components in the ricin molecule (mannose receptor on the cell membrane).
- Protein synthesis inhibition by the A-subunit of ricin. Reported mechanisms of ricin are enzymatic de-adenylation of ribosomal RNA, and thus inactivation of 60S ribosomes.
- Recent studies suggest that the primary action of ricin is to act via a ribonuclease activity.

**Signs**

- Signs appear after a characteristic lag period of a few hours to days, usually onset is between 12 hours and 48 hours.
- Nausea, gastrointestinal irritation, abdominal pain, diarrhea which is often bloody, tenesmus, dehydration and at postmortem severe inflammation of the stomach and intestine.
- Anorexia, cessation of ruminating.
- Excessive thirst.
- Weakness, muscle twitching.
- Dullness of vision, convulsions, dyspnea, opisthotonus, coma and death.
- Sometimes clonic convulsions and decreased tendon reflexes are described.
- After convulsions, death may result from paralysis of the respiratory center - artificial respiration may not preserve life for long because of rapid onset of concurrent vasomotor paralysis.
- Clotting time may be prolonged, possible hypoprothrombinemia.
- Cyanosis.
- In ducks, there is an ascending paralysis which may be confused with botulism.
  - Sometimes thousands of ducks are poisoned. Also geese.
- Horses:
  - Trembling, sweating, dyspnea, incoordination.
  - Vigorous heart contractions.
  - Shivering, cold extremities.
  - Depression, increased body temperature.
  - Weak pulse.
  - Constipation or diarrhea, convulsions.
- Cattle:
  - Diarrhea stained with blood.
- Pigs:
  - Frequent vomiting.
- Poultry:
  - Depression.
  - Roughened feathers, droopy wings.
  - Greyish wattles and combs.
  - Egg production ceases.
  - Moultig may begin.
  - Emaciation.
  - Death.
- Humans:
  - Chewing may cause burning sensation in mouth and pharynx.
  - Vomiting and severe abdominal pain.
  - Diarrhea, thirst, and blurred vision.
  - Perspiration, trembling, weakness.
  - Convulsions and death.
Clinical Pathology and Lesions
- There may be leukopenia and a left shift at about 16 hours postdosing.
- Phytotoxins may cause hemagglutination but this has not been demonstrated to be a reliable finding in the field.
- Hypoglycemia possible.
- Catarrhal to hemorrhagic gastroenteritis.
- There may be petechial serosal hemorrhages on the viscera in body cavities and in the subepicardium.
- Lesions in the liver and kidney generally include swelling and in birds, yellow discoloration (fatty liver) and hemorrhage.
- Mesenteric lymph nodes are usually edematous.
- Pulmonary edema sometimes occurs.

Diagnosis
Identification of *Ricinus* or products thereof, evidence of consumption and appropriate signs and lesions.

Treatment
- Early - Use an emetic in appropriate species followed by activated charcoal and a saline cathartic unless contraindicated; e.g., due to marked diarrhea.
- A gastrointestinal tract protectant such as kaolin-pectin and fluid therapy are used as indicated. Appropriate fluid and electrolyte therapy can greatly increase chances of survival.
- Ricin is not dialyzable.
- Judicious use of anticonvulsants if indicated.
- Monitor renal and hepatic function and electrolyte - Fluid balance.
- Maintain (or establish) respiration, fluid, and electrolyte balance.
- Oral antacids to alleviate local irritation. Ascorbic acid increases survival rates.
- Forced alkaline diuresis has been suggested to prevent nephrosis.

Prevention
- Do not plant castor bean plants where animals (or children) may have any access whatsoever.
- Clip heads before they mature when used as an ornamental.
- Moist heat destroys ricin, but does not prevent allergic reactions to castor oil.
- Allow castor-oil-cake to stand or heat treat before feeding.

Comments
- True immunity may be produced through increasing doses of the poisonous principle.
- Passive immunity may be conferred by the injection of antisera.
- Castor bean poisoning in USA is infrequent.
- Wild and cultivated castor beans are of the same species and both are toxic.

*Castorbean* - Note the large digitately lobed leaves, the clusters of male flowers (above) and female flowers (below) on the seed stalk, and the spiny seed pod and mottled seed (enlarged, lower right).
**Robinia**

*Robinia pseudoacacia* - Black or yellow locust, false acacia

*R. viscosa* - Clammy locust

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### Family

Leguminosae (pulse or bean family)

### Images


### Description

- **Plant** - A small tree but sometimes up to 75 feet tall, deciduous.
- **Stem** - Trunk straight, long, slender, coarse, brown bark, spines are scattered on young branches and are unbranched resembling large rose thorns.
- **Leaves** - Alternate, pinnately compound, spikes short 1/4 - 1/2 inch long, unbranched; leaflets are entire, elliptical, opposite and in 3 - 10 pairs, 1 -2 inches long.
- **Flowers** - Leguminous, white, showy, racemous, drooping 4 - 8 inches long, with 5 petals, irregular and white. Five sepals and 10 stamens.
- **Fruit** - Pods, thin, brown, 2 - 4 inches long, straight, flat and many seeded.

### Habitat

- Eastern and central USA, southern Canada.
- Native to the central-eastern states.
- Dry woods, thickets, roadsides, sometimes forms dense stands in clearings and old pastures.
- Occasionally placed as an ornamental.

### Toxic Principle

- The heat labile, phytotoxin, robin.
- Also the phytotoxins robitin and phasin.
- Glycosides are also present such as robitin as is the alkaloid, robinine, however generally the phytotoxin (toxalbumin) robin is regarded as the primary compound involved.

### Mechanism of Action

Protein synthesis inhibition by the toxalbumins.

### Toxicity

- Black locust is not necessarily always toxic; fatal cases are rare but recovery requires several days or weeks. The flowers are not toxic, but the bark, sprouts, pods and foliage are all toxic. Livestock are most often poisoned because of stripping off of bark (especially when they are tied to the tree), or from grazing on sprouts or from eating small branches from recently felled trees.
- **Horses:**

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<td>Horses, cattle</td>
<td>Hours</td>
<td>Days, potentially lethal</td>
<td></td>
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- 0.1% of body weight (BW) of aqueous bark extract is toxic; also 0.04% of BW of powdered bark is toxic.
- Cattle:
  - Cattle are about 1/10 as sensitive as horses.
- Poultry:
  - Have been poisoned by eating leaves.
- Children:
  - Have been poisoned by sucking young twigs.
- Sheep:
  - Are also sometimes poisoned.

**Signs**

- Delay of 1 - 1.5 hours before onset of clinical effects.
- Anorexia, lassitude, stupor and depression, or hyperexcitability.
- Weakness (posterior paralysis in horses and cattle).
- Laminitis in horses.
- Nausea and vomiting.
- Coldness of extremities.
- Pupillary dilation.
- Dyspnea, tachycardia, weak and irregular pulse.
- Diarrhea which may be bloody, or constipation.
- Fatalities are rare but may occur within 2 - 3 days.

**Lesions**

- Inflammation and edema of the mucosae of the digestive tract.
- Poultry exhibit degenerative changes in the liver and kidney.

**Diagnosis and Treatment**

See *Abrus precatorius*.

**Comments**

Of 32 boys who ate inner bark of black locust fence posts in 1887, 2 were severely poisoned and became stuporous; however all eventually recovered.
Black Locust Note the pendulous flower clusters and flower (enlarged, upper left), the pinnately divided leaves, and the flattened pod and enlarged seed (lower right) of this popular ornamental tree.
**Phoradendron spp. and Viscum - Mistletoe**

*P. serotinum* - The American mistletoe used most for Christmas mistletoe, also called false mistletoe

*P. rubrum*

*P. tomentosum*

*P. macrophyllum*

*Viscum album* - European mistletoe or mistletoe

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**Images**

- *Phoradendron tomentosum* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.
- *Phoradendron macrophyllum* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.
- European mistletoe, *Viscum album* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.

- Oak mistletoe, *Phoradendron villosum* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.

**Description**

A semiparasitic evergreen shrub with greenish branches which form a dense bushy growth 1 - 4 feet in diameter. Leaves are opposite and simple, oblong to ovate and 0.5 - 1.5 inches long. Fruit is a small white or whitish-pink berry which covers a short spike at the base of the leaf.

**Habitat**

- Commonly parasitize oak, walnut, or other deciduous trees, southeast New Jersey to Florida west to Illinois and Texas, also in the far western USA.
- *P. serotinum* - Brought inside for Christmas season. Some have plastic berries in place of natural ones.
- *P. rubrum* - Southernmost Florida, Caribbean islands.
- *P. tomentosum* - Kansas to Louisiana, west to Texas and into Mexico.
- *Viscum album* - Sonoma County, California (originally imported from Europe: apparently not imported for Christmas; the primary mistletoe in Europe).

**Toxic Principle**

- *Phoradendron* spp. contain:
  - Phoratoxin, a toxic lectin (toxalbumin). Inhibits protein synthesis at the ribosomal level.
  - Amines of beta-phenylethylamine, choline, and tyramine (probably of less importance than the toxalbumin. Three or more berries are possibly lethal for a child.

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<td>Small animals</td>
<td>Hours</td>
<td>Days, potentially lethal</td>
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*Viscum album:*

- May decrease blood pressure due to a cholinomimetic effect.
- Viscumin - Toxic lectin (toxalbumin).
  - agglutinates RBCs *in vitro*.
- Viscotoxin - Peptide with properties similar to viscumin but may also stimulate skeletal muscle and smooth muscle possibly by a direct effect. Some effects of viscotoxin are reversible *in vitro* by addition of calcium (apparently not tested *in vivo* at this time).
- Polysaccharides - Potential anticancer drugs.
- Commercial products (drugs) from *Viscum* spp.
  - Iscador ® - An "immunomodulatory" agent.
  - Helixador ® and Plenosol ® - Agents used most to alleviate human hypertension.
Toxicity
Potential cause of sudden death in browsing animals.

Signs
- Acute gastrointestinal upset, vomiting, nausea, diarrhea. The acute gastroenteritis may occur after a delay of several hours.
- Hypothermia.
- Polyuria.
- Mydriasis.
- Lay persons have used mistletoe as an abortifacient in humans which has led to poisonings and several fatalities. Does increase tonus of uterine muscle.
- Delirium, ataxia, coma or hyperesthesia, seizures, and opisthotonus may occur.
- Dyspnea.
- Bradycardia (may have adrenergic override with resultant tachycardia).
- Cardiovascular collapse with asystole (sometimes described as "digitalis-like") may occur with mistletoe toxicosis. Decreased blood pressure associated with Phoradendron in humans. It is unclear whether the cardiovascular collapse may be due solely to fluid and electrolyte losses related to digestive tract upset.
- Hemolysis sometimes in humans with Viscum poisoning.
- If death occurs, it usually takes place at approximately 10 - 16 hours after ingestion.

Treatment
- Removal of mistletoe from GI tract: emetic, lavage, enterogastric lavage (as conditions permit).
- Activated charcoal, saline cathartic.
- Atropine.
- If cardiac effects predominate treat symptomatically and supportively and only if signs fit should the veterinarian treat as for digitalis overdose and then with careful monitoring.
- Support: measures to correct fluid/electrolyte imbalances.

Oak Mistletoe (phorodendron coryae) - The paired oval leaves, the flowers embedded in the flower stalk (upper right), and the white sticky berries and grooved seeds (enlarged, lower center) are characteristic of this parasitic plant.
Irritant Oils

**Ranunculus spp. - Buttercups**

*R. sceleratus* - Cursed crowfoot  
*R. abortivus* - Small flowered buttercup  
*R. bulbosus* - Bulbous buttercup  
*R. repens* - Creeping buttercup  
*R. acris* - Tall field buttercup

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<tr>
<td>Herbivores</td>
<td>Hours</td>
<td>Days; infrequently lethal, poisoning is rare</td>
<td></td>
</tr>
</tbody>
</table>

**Family** - Ranunculaceae (crowfoot family)

**Images**

- Bulbous Buttercup, *Ranunculus bulbosus* - 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.
- Small flowered buttercup, *Ranunculus abortivus* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.
- Tall field buttercup, *Ranunculus acris* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.

**Description**

- *R. abortivus*
  - Buttercups (also called Crowfoot plants) are erect, except for one creeping species.  
  - Six inches to 2 feet tall with hollow stems.  
  - Perennial or annual herbs with 2 kinds of leaves: petiolar basal leaves, palmately arranged, roundish, with scalloped edges; and alternately placed stem leaves that are stalkless, deeply divided and made up of 5 narrow lobes, often 3 pointed.  
  - Solitary flowers are yellow, 1/4 inch or less in diameter, and have 5 petals and 5 sepals. After the flowers wither, numerous seeds form uniovular heads at the top of the flower stalks.  
  - Other common species are similar, except that the ditch buttercup (also called cursed crowfoot) has divided basal leaves. Other species have larger flowers and 3 lobed leaves.

**Habitat**

- Throughout the world and United States, but most problems occur in the northern USA and Canada.  
  - *R. sceleratus* - Northern USA and Canada, low wet places and marshes.  
  - *R. abortivus* - Eastern USA, pastures and open woodlands: The most common species in Illinois.  
  - *R. bulbosus* - Northeastern USA, meadows and pastures.  
  - *R. repens* - Northern USA and Canada, Pacific coast, infrequent or locally common in low wet pastures and meadows.  
  - *R. acris* - Eastern USA and from western British Columbia southward to Oregon, pastures and meadows.
Toxic Principle

*Ranunculus* spp. contain the glycoside, ranunculin from which the poisonous principle, protoanemonin is released when the plant is crushed by virtue of enzymatic action which is activated by crushing. Protoanemonin is a volatile, yellow oil with a lactone moiety which is extremely prone to undergo spontaneous polymerization to yield the innocuous anemonin. Protoanemonin is a bitter tasting oil.

Susceptible Species

Cattle are more susceptible but horses, goats, and swine also may be poisoned.

Toxicity

- Plants contain 0.3% - 2.5% protoanemonin on a dry weight basis.
- The highest concentration of protoanemonin is present at the beginning of flowering.
- Protoanemonin is volatile, so it does not present a problem in hay.
- Most poisoning occurs in spring and early summer.
- The poisonous principle produces blisters if in contact with the skin.
- Relatively large amounts of the plant must be consumed before livestock develop toxicosis.

Signs

- General:
  - Salivation, reddened oral mucous membranes (may be severe).
  - Severe gastric irritation, colic, abdominal pain, anorexia.
  - Diarrhea or black fetid feces.
  - Depression or excitement, muscle trembling, twitching of the ear and head muscles, which may proceed into general excitement and convulsions or "paralysis".
  - Bradycardia.
  - With exposure to *R. acris* blisters and inflammation around the mouth and gastric pain as well as vomiting may occur. Diarrhea may follow and muscle spasms may occur. Temporary blindness and convulsions may also occur.
- Swine:
  - May become prostrate and remain down for 2 - 3 days before death.
- Sheep:
  - Acute death.
- Cattle:
  - Bitter milk or reddish discoloration of milk from exposed cows. Blood stained urine and blindness have occasionally been reported.

Lesions

- Oral tissues may be fiery red.
- Severe inflammation of the stomach and intestinal tract.
- Hemorrhage into the lumen of the digestive tract.
- Pulmonary congestion and ecchymoses.

Diagnosis

Identification of *Ranunculus*, evidence of consumption and appropriate clinical signs and lesions.

Treatment

- Dilution with milk and egg white are recommended and if burns are not severe it may be appropriate to use an emetic or lavage depending on species and the absence of clinical signs. Activated charcoal with a saline cathartic should be given. Appropriate supportive care to control dehydration, electrolyte imbalance, etc. may be indicated.
- Note -
  - American Indians considered the seeds harmless and used them for food.
  - Due to the almost immediate onset of the irritant action, animals tend to avoid the plant; however some animals seem to develop a liking for buttercup.
Buttercup - Colorful, usually yellow, flowers and large basal leaves are characteristic of this herb.
Smallflower Buttercup, *Ranunculus abortivus* L. - 1, young plant; 2, plant in bloom; 3, mature receptacle bearing seeds; 4, seeds. **Annual** or **biennial**, reproducing by seeds. **Stems** slightly hairy, slender, branched from base, 6 to 20 inches (15 to 50 cm) tall. **Lower leaves** round, bright green with round-toothed margins, borne on long petioles coming from base of plant. Upper leaves on shorter petioles, divided into 3 to 5 leaflets with somewhat toothed margins. **Flowers** small, yellow, with small oblong petals. **Seeds** produced in round heads, numerous, flattened with very small curved beak, dull, wrinkled, yellowish-brown. **Found** in lowland meadows, pastures, and fields. The plant has no forage value and may poison livestock.
Tall Buttercup, *Ranunculus acris* L. - 1, plant in bloom; 2, seed head; 3, seeds. Perennial, reproducing by seeds. Stems erect, branched above, hairy, 1 to 3 1/2 feet (30 to 106 cm) tall. Leaves alternate, hairy, palmately divided into narrow segments. Flowers usually bright yellow but sometimes cream-colored, with 5 to 7 petals. Seeds numerous, dark brown, about 1/8 inch (3 mm) long, minutely pitted, flattened, with hooked beak; formed in a rounded head. Found in pastures; does not persist in cultivated crops. This plant contains an acrid juice which is somewhat poisonous if eaten by livestock, often blistering the mouth and intestinal tract.
**Caltha - Marsh Marigold**  
*Caltha palustris* - Marsh marigold, cowslip  
*C. natans*  

<table>
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<tbody>
<tr>
<td>Herbivores</td>
<td>Hours</td>
<td>Days; infrequently lethal, poisoning is rare</td>
<td></td>
</tr>
</tbody>
</table>

**Family** - Ranunculacea (Crowfoot family)

**Images**

- Marsh marigold, *Caltha palustris*. 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. -
- Marsh marigold, *Caltha palustris* - 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. -
- Marsh marigold, *Caltha palustris* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org. -
- Floating marsh marigold, *Caltha natans* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org. -

**Habitat**

Worldwide distribution in the northern hemisphere; native in the northeastern USA, Canada to Alaska and south to Virginia, westward to Iowa. Swamps and wet meadows.

**Toxic Principle**

Very acrid plant, contains protoanemonin (see Ranunculus handout for signs, lesions, treatment). May also contain an alkaloid and a glycoside.

**Toxicity**

- Fresh tops are poisonous, also stems.  
- Dried or thoroughly cooked plant is reportedly not toxic.  
- All parts may be toxic.  
- Apparently distasteful to livestock.  
- Dermatitis may result from prolonged contact.

**Note** - Most marigolds are not regarded as toxic, thus marsh marigold is an exception.
**Phytolacca - Pokeweed**

*Phytolacca americana* - Pokeweed, scock, garget, pigeonberry

*(P. decandra)*

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**Family** - Phytolaccaceae (pokeweed family)

**Images**

- Pokeweed, *Phytolacca americana* - 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.
- *Phytolacca decandra* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.

**Description**

- *P. americana*

  - Plant - Tall, distinctive, perennial herb, 9 feet tall, strong smelling.
  - Stem - Stout, glabrous, purple or green, very branched, smooth, succulent, 3 - 10 feet tall.
  - Leaves - Alternate, petiolate, entire, ovate, simple, regular, base and tips are acute, no stipules, 5 inches long, red veined.
  - Flowers - Inflorescence racemose, terminal, drooping; flowers numerous, small, white, or greenish; no petals, 4 - 5 sepals, white or greenish, 10 stamens, separate, ovary superior.
  - Fruit - Ten seeded, inky crimson juice, shiny, purple berry, in grape like clusters but with more rigid stalks and more space between the berries, large, lenticular, glossy, black with endosperm.
  - Rootstalk - Large, fleshy, thick, taproot.

**Habitat**

Maine and Ontario to Florida, Texas and Arizona. Common in recent clearings and open places in woods, along borders of woods, barnyards, lowlands, roadsides and especially rich moist soils.

**Toxic Principle**

- Saponins, believed to be the primary toxic constituents, are present in the berry juice and other parts.
- Other toxic constituents have also been identified including the alkaloid phytolaccine (in small amounts) and the alkaloid phytolaccotoxin, as well as a glycoprotein.

**Mechanism of Action**

- Saponins presumably dissolve cell membranes. *In vitro* they are used as hemolysins.
- Saponins are bitter tasting and have tendency to cause (honeycomb) foaming in water.
- Saponins are glycosides. Because the aglycone moiety is nonpolar, while the carbohydrate moiety is water soluble, they have strong detergent properties.

**Susceptible Species**

Cattle and sheep, but occasionally poisoning occurs in horses, goats and swine.
Toxicity

- All parts of the plant are toxic, especially the roots, shoots and unripe berries.
- The toxicity of the berries decreases as they mature.
- In some species, the emetic dose of powdered root is about 1 gm.
- Fatality has resulted from consumption of the root.
- In man, 10 raw berries may cause serious toxicosis.
- Two or 3 uncooked berries may be fatal to a child.
- The seeds are almost as poisonous as the roots.
- Dilution and possibly degradation in the rumen may explain the absence of some of the toxic effects seen in ruminants.
- The consumption of young shoots is widely regarded as safe provided that they are boiled, with 2 changes of the water.
- The plant is regarded as bitter and therefore unpalatable to animals.
- Poisoning is rare, but occurs in the spring when roots may be pulled and when forage is scarce.

Signs

- Burning sensation in the mouth immediately after consumption.
- Other signs usually commence about 2 hours after consumption.
- Nausea, vomiting, severe cramps, watery diarrhea (often bloody).
- Weakness.
- Blurred vision (humans).
- Dyspnea, perspiration.
- Spasms, prostration, tremors.
- Terminal convulsions, may be present and death reportedly due to respiratory paralysis may occur in about 6 hours.
- Swine:
  - Unsteadiness, inability to rise, wretching.
  - Jerking movements of the legs.
  - Subnormal temperature.
- Cattle:
  - Same general signs plus a decrease in milk production.

Lesions

- Mild to severe gastroenteritis, local hemorrhagic, sometimes ulcerative gastritis is worst lesion. Congestion of the liver, dark discoloration and swelling.
- Peripheral blood plasmacytosis has been reported.

Diagnosis

Identification of *Phytolacca*, evidence of consumption and appropriate clinical signs and lesions.

Treatments

- Evacuation of the gastrointestinal tract, activated charcoal and a saline cathartic.
- Control dehydration, seizures, and if necessary institute artificial respiration.

Prevention

- Eradicate the plant; burning, pulling.
- Plant corn or soybeans on the area for at least 2 years.
- 2,4-D when plants are young.

Comments

- Young shoots may resemble and taste like asparagus.
- In 1965, it was considered by some to be the most common plant poison in children.
- The juice of the berries has been used as a magenta dye, hence the name ink berry.
- The berries, when ripe, have been used by some persons in the making of pies.
- Severe incidents of poisoning in swine have been reported in Indiana and Alabama.
**Pokeweed** - The large, oval, pointed leaves; clusters of flowers (single flower, enlarged, lower left); purplish fruits; and shiny black seed (enlarged, lower left) are characteristic of this attractive, but poisonous, plant.
**Saponaria spp.**  
*Saponaria officinalis* - Bouncing bet, soapwort  
*Saponaria vaccaria* - Cow cockle

### Family - Caryophyllaceae (pink family)

### Images
- Bouncing bet, *Saponaria officinalis* - 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.
- Bouncing bet, *Saponaria officinalis* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.
- Cow cockle, *Saponaria vaccaria* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org.

### Description
- *S. vaccaria*
  - Plant - Glabrous, erect, annual herb.
  - Stem - Jointed, opposite, branched.
  - Leaves - Entire, glaucous, palmately veined, ovate to lanceolate, no petioles.
  - Flowers - Conspicuous in terminal cymose clusters; petals pale red; calyx of 5 sepals, green, tubular, 5-toothed, 5 angled; corolla has 5 petals, white, pink or faint red; 10 stamens, 2 styles.

### Habitat
- Introduced from Europe and is present throughout the northern USA as a weed, especially in northwestern USA and western Canada. Found in spring wheat and flour containing screenings.
- Bouncing bet is a perennial weed found in roadsides and waste places.
- Cow cockle is an annual, which is troublesome in grain crops of NW USA.

### Toxic Principle
- Both plants contain large amounts of saponins, which froth when extracted with water. The saponins are soluble in water and alcohol.
- The sapotoxins of these saponins are similar or identical to those of corn cockle (*Agrostemma githago*).
- Hydrolysis of the saponins yields sugars and sapogenins, a group of physiologically active substances.

### Toxicity
- The toxic material is contained in highest concentration in the seeds. Most animals refuse to eat the seeds and avoid grains or screenings containing them.
- Feeding of the plant itself to sheep in an amount of 3% of the BW caused death within 4 hours; the plant weight being expressed on a dry-weight basis.

### Signs
- Irritation of the digestive tract, vomiting, nausea, diarrhea.
- Slowed or rapid breathing.
- Unsteadiness, ataxia, coma.
Diagnosis

Identification of *Saponaria*, evidence of consumption, especially of seeds (microscopy of feed and/or stomach contents), appropriate clinical signs and lesions.

Treatment

Evacuate gastrointestinal tract, activated charcoal and a saline cathartic, demulcents, supportive therapy.

Comment

Poisoning is very rare.

Pink Family, *Caryophyllaceae*

*Bouncingbet*. *Saponaria officinalis* L. - 1, lower part of plant; 2, flowering stems; 3, flower; 4, mature seed pod with part of calyx removed; 5, seed. *Perennial*, reproducing by seeds and short rhizomes. *Stems* stout, jointed, erect, 12 to 24 inches (30 to 60 cm) tall, clustered, smooth, and usually unbranched. *Leaves* opposite, smooth, entire, 2 to 3 inches (5 to 7.5 cm) long, about 1 inch (2.5 cm) wide, without petioles. *Flowers* in conspicuous clusters at the tops of the stems; about 1 inch (2.5 cm) across with 5 pink or white petals, and with base enclosed in a tubular calyx about 3/4 inch (1.9 cm) long. *Seed pod* narrowly egg-shaped, pointed, containing numerous seeds, enclosed by calyx. *Seeds* flattened, dull black, kidney-shaped, about 1/16 inch (1.5 mm) long, surface covered by curved rows of minute knobs. *Found* along roadsides, in waste places, and on ditch banks. Originally grown in gardens as an ornamental, from which it has spread. In pioneer days, used as a soap substitute, the stems and rhizomes making a foamy solution when bruised in water.
Description

• A conspicuous tall, silky, grayish winter annual (starting growth from seed in the fall, maturing and forming seed and dying the next summer), to 3 feet tall.
• Leaves opposite, 2 - 4 inches long, without petiolo or stipules, linear to lanceolate; stems and leaves bearing a conspicuous covering of white hairs.
• Flowers showy, solitary, about 1 in. across, terminating long slender pedicels; calyx 5-parted, conspicuous; corolla of 5 pink to purple petals.
• Fruit a capsule, bearing numerous black seeds each about the weight of a wheat grain.
• Seeds covered with rows of small warts.

Habitat

• Introduced from Europe and found throughout the United States as a serious weed of cultivation wherever winter wheat is grown.
• Occasionally found in winter rye and other crops and on roadsides.
• Selected strains are cultivated in flower gardens.

Toxic Principle

The sapogenin githagenin is contained in the seeds and amounts to 5 - 7% of their weight.

Toxicity

• A lethal dose in cattle and hogs was about 0.1 - 0.25% of the animal's weight of ground seed and about twice that of whole seed indicating that the seed coat may have reduced the rate or extent of absorption.
• The incidence of poisoning has been almost eliminated by modern harvesting machinery that removes the seeds.
• The primary hazard lies in the feeding of wheat screenings.

Signs

• Gastrointestinal upset, severe gastroenteritis.
• Poultry usually avoid but 0.2 - 0.5% of BW of seed is lethal to young birds.
• Older birds are somewhat more tolerant.
• Poisoned birds develop a "cheesy" exudate in the mouth and diarrhea.
• Horses and cows have been lethally poisoned.

Diagnosis

Feed microscopy (I.D. seed) plus appropriate signs and lesions.

Treatment

See Saponaria handout.
Pink Family, Caryophyllaceae

**Corn Cockle.** *Agrostemma githago* L. - 1, plant in flower; 2, seed pod enclosed by the ribbed calyx; 3, seed. **Winter annual,** reproducing by seed. **Taprooted,** shallow. **Stems** rough, hairy, erect, 2 to 3 feet (60 to 90 cm) tall, swollen at joints, branching slightly. **Leaves** opposite and jointed at base, slender, hairy. **Flowers** large, purple, with narrow, green sepals longer than colored petals. **Seed pod** holding several seeds, enclosed in a 10-ribbed urn-like calyx. **Seeds** black, about 1/8 inch (3 mm) in diameter, triangular, covered with rows of sharp tubercles. Seed poisonous and therefore highly objectionable in grain used for milling or feed. **Found** especially on cultivated land and in association with fall-sown grain crops.

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**Hedera Helix - English Ivy**

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</tr>
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<tr>
<td>Most species</td>
<td>Hours to days</td>
<td>Days, potentially lethal</td>
<td></td>
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</table>

**Images**

- English Ivy, *Hedera helix* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org . -

**Description**

- Common cultivated vine used as ground cover, on sides of buildings as house plant or standing erect as a shrub.
- Leaves - Typical plants have dark green, leathery, 3 - 5 lobed, maple-like leaves. Horticultural forms may possess round or sometimes long lobed leaves often with white streaks or predominantly white coloration with green streaks.
- Flowers - Inconspicuous whitish to greenish flowers in small round clusters appearing late in the growing season.
- Roots - Anchoring aerial roots may be noted in plants that grow up the sides of buildings.
- Fruit - Persistent, pea-size, black, bitter-tasting berry with 3 - 5 seeds.

**Habitat**

- Grows hardily throughout most of the USA.
- Potted varieties are common indoors.

**Toxic Principle**

- Hederagenin, a triterpenoid sapoin.
- All parts are toxic; poisoning occurs from eating the berries or other plant parts.

**Signs**

- Diarrhea and vomiting occur early.
- Followed by excitement, dyspnea.
- Fever may occur.
- "Convulsions", coma may occur.
- Death (rare).

**English Ivy** - Note the shiny 5-lobed leaves; the twining stems with root clusters for attachment; the flower, fruit, and seed (enlarged, lower right); and the star-shaped hairs (lower center) of this attractive plant.
**Sesbania spp.**

*Sesbania drummondii* - Drummond sesbania, poison bean, senna bean, rattlebox, rattlebush, coffee bean, sennie bean

*S. punicea* - Coffee bean, purple rattlebox, daubentonia, brazil rattlebox

*S. vesicaria* - Bagpod sesbania, bladderpod, coffee bean

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<td>Herbivores, fowl</td>
<td>Hours to days</td>
<td>Days to week, potentially lethal</td>
<td></td>
</tr>
</tbody>
</table>

**Family** - Leguminosae (pulse or bean family)

**Images**

- Drummond sesbania, *Sesbania vesicaria* - 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.

**Description**

- *S. drummondii:*
  - Plant - Perennial shrub or small tree.
  - Leaves - Alternate, pinnately compound; leaflets are oblong, narrow, and 1/2 - 1 inch long.
  - Flowers - Yellow, showy, slender (1/2 inch across), in loose racemes.
  - Fruit - Legume pod, oblong, compressed longitudinally, 4-winged 2.5 - 3.5 inches long, seeds are separated by transverse partitions.

- *S. punicea:*
  - Plant - Perennial shrub or tree up to 12 feet tall.
  - Leaves - Alternate pinnately compound; leaflets which are oblong and 3/4 - 1 inch long.
  - Flowers - Showy, red, orange or scarlet (3/4 - 1 inch) dense racemes.
  - Fruit - Legume pod, oblong, compressed longitudinally, 4-winged, 2 - 3 inches long on a stalk up to 1/2 inch long.

- *S. vesicaria:*
  - Plant - Erect annual, often grows in clumps.
  - Stem - Bright green, erect, slender, woody, straight.
  - Leaves - Alternate, pinnately compound; leaflets number 20 - 52, are narrow, oblong, waxy green, 3/4 - 1.5 inches long and broad.
  - Flowers - Yellow or bright red, in long peduncled axillary racemes of 2 - 5.
  - Fruit - Legume pod, pendate, elliptical, wingless, somewhat compressed, 2 seeded.

**Habitat**

- *S. drummondii* - Coastal plain from Florida to Texas; Mexico. Previously cultivated fields; sandy soils; seasonally wet, waste places; often found growing in shallow water.
- *S. punicea* - Northern Florida to Louisiana; cultivated in Florida; introduced from Mexico. Ornamental introduced into USA and now naturalized on ditch banks, fence rows and waste places.
- *S. vesicaria* - Coastal plains from North Carolina and Florida to Texas. Rich soils; damp soils along streams; old fields; overgrazed pastures; disturbed waste places.
Toxic Principle

- Saponins are believed to be the primary toxic constituents.
- Primary gastrointestinal damage results with possible hemolysis if enough saponin absorbed.

Susceptible Species

Fowl, sheep, cattle and goats.

Toxicity

- General:
  - Seeds retain toxicity for a number of years.
  - Irritates the GI tract, allowing more rapid absorption of plant constituents.
  - Green seeds are more toxic than mature seeds, but both are toxic.
- S. vesicaria
  - Fowl:
    - One hundred seeds are toxic and 150 may be lethal.
    - 1.13 - 2.0% of BW of seeds caused rapid death.
    - Seeds fed at a rate of 5 - 20 per day caused death in 2 - 7 weeks.
    - Two hundred seeds fed at one time caused death in 1 week.
    - Two percent of BW of leaflets caused no overt toxicity.
  - Sheep:
    - Minimum lethal dose of seeds in 0.05% of BW
    - signs occur by 24 hours and death in 56 hours.
  - Cattle:
    - 0.15% of BW of seeds produced subacute toxicosis and death after 14 days.
    - Two percent of BW of seeds produced signs in 24 hours and death in 2 days.
    - Most cattle losses occur in fall and winter when the stem still carries the pods.
    - Cattle may develop craving for the seeds, but plants are usually distasteful.
- S. drummondii
  - Less than 2 oz of seeds may be lethal to large animals.
  - Leaves and pods are less toxic.
  - Sheep:
    - Approximately 1 oz of seed is a lethal dose.
    - 0.1% of BW is a minimum lethal dose.
    - 0.07% of BW caused clinical signs.
- S. punicea:
  - Fowl:
    - Nine seeds per bird was lethal to 3 of 5 hens.
    - 0.63% of BW of seeds caused 100% mortality to chicks.
  - Sheep:
    - 0.1% of BW of seeds caused fatalities.

Signs

- General:
  - Signs usually appear a day or so after consumption, up to 2 days.
- Fowl:
  - Prostration, diarrhea, light scaly comb when fed in smaller amounts, to dark (congested) combs when fed in large amounts.
- Sheep, Cattle:
  - Anorexia, depression, arched back, uneasiness, hemorrhagic diarrhea but sometimes constipation occurs.
  - Rapid, shallow breathing, fast, irregular pulse (shock).
  - Coma and death.

Lesions

- Fowl:
  - Necrotic enteritis and with less severe toxicosis, inflammation.
• Necrosis of the gizzard.
• Fatty degeneration of the liver.

• Sheep:
  • Gastroenteritis posterior to the rumen.
  • Degenerative changes in the gastric and mesenteric lymph nodes.
  • Liver and kidneys become congested and friable.
  • Dark, tarry blood with small thrombi.
  • Hemorrhage.

• Cattle:
  • Severe, hemorrhagic abomasitis and hemorrhagic enteritis in the small intestine.
  • Hepatic and renal degeneration, sometimes hepatic necrosis.
  • Sprouted seeds may be found in the rumen.

Diagnosis

• Identification of *Sesbania*, evidence of consumption, especially of seed, appropriate clinical signs and lesions.

Treatment

See other *Saponaria* handout.

Prevention

Avoid contact with the plant and avoid seed year round. Remove and destroy developing pods from ornamental bushes. The herbicide 2,4-D may be used to control young plants. *S. vesicaria* may be mowed if abundant.

*Hemp Sesbania.* - Note the long, pinnately divided leaflets, the pea-shaped flowers, and the long slender pod and rectangular plump seed (enlarged, lower left) of this unusual legume.
Purgative Glycosides

*Helleborus Niger* - Christmas Rose

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<td>Days, poisoning is rare</td>
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Images

- Christmas Rose, *Helleborus niger*. 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. -
- Christmas Rose, *Helleborus niger* - Google Image Search. - To view this image in full size go to the IVIS website at www.ivis.org. -

Common garden perennial considered poisonous by the major authors from Dioscorides to the twentieth century, but few documented cases of poisoning are on record, especially in this century.

Toxic Principle

Contains purgative glycosidic principles.

Signs

- May produce gastric distress and other effects in animals and human beings.
- Secondly nervous effects also may be observed.

**References**

*Ricinus Communis*


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