

## A WORD OR TWO ABOUT GARDENING

### **When enjoying a Miami-Dade landscape please, please don't eat the daisies**

For those who aren't of the 'boomer' generation, the plea to not eat the daisies belongs to the words of a 1960's popular song. The lyrics do not mention a specific daisy, but one would be ill advised to chew on the attractive African daisy *Osteospermum ecklonis* which contains poisonous cyanogenic glycosides. However, guessing if this or that daisy or any other plant might be edible is not the answer. The simple rule is not to eat any part of any plant growing in any landscape, including your own, unless you're absolutely sure as to its safety. Young children, who account for 85% of medical emergencies involving poisonous plants, are readily attracted to colorful flowers and fruits. This, together with a penchant for putting things in their mouth, places them at particular risk of plant poisoning. As a parent, make an inventory of landscape and house plants – better still if you have an idea of their toxicity. If there is an emergency, knowing what was ingested will greatly assist those responding in expediting the most appropriate course of treatment.

The remainder of this article reviews familiar, and some not so familiar, poisonous plants found in Miami-Dade, and the toxins they possess. Particular attention will be given to fruits and flowers that might tempt the curious. First, some further on cyanogenic glycosides. **Glycosides** are found mostly in plants, and in general consist of a non-carbohydrate portion joined to one or more sugars. The non-carbohydrate portion is termed an **aglycone**; in **cyanogenic glycosides** this is a class of compounds known as **cyanohydrins**. When ingested, cyanohydrins slowly release hydrogen cyanide.

Cyanogenic glycosides are found widely in the **Rosaceae**, including many of the most important temperate climate fruits particularly stone fruits (*Prunus spp.*) such as cherries, plums, peaches, apricots and almonds. Highest concentrations (principally as **amygdalin**) are found in the seeds; however unless they are first chewed accidental ingestion poses a negligible risk. The **loquat** is the one fruit tree in the Rosaceae that is quite popular with local backyard growers. In 2002 chewed loquat seeds were the cause of animal fatalities at a Florida theme park. The **West Indian cherry** *Prunus myrtifolia*, native to Miami and endangered in the wild is sometimes used as an attractive small shade tree. Both the leaves and seeds (fruit an inedible small black drupe) are poisonous containing both amygdalin and prunastin. Confusion over names may arise with the edible acerola (*Malpighia glabra*) which is also sometimes referred to as West Indian cherry.

The native **elderberry** *Sambucus nigra ssp. canadensis* (**Adoxaceae**) contains a glycoside (**sambunigrin**) closely related to amygdalin. Amounts appear to vary between individual plants; in general immature fruits and leaves contain more sambunigrin than ripe berries. Cooking the fruit (small black drupes), as in preparing jellies, eliminates most of the cyanide.

**Cardiac glycosides**, so named because of the profound effect they exert on heart muscle, possess a more complex structure. The aglycone portion comprises a tetracyclic steroid with an attached lactone ring (cyclic ester). Depending on the lactone ring, the aglycone portion is classed as either a **cardenolide** (of plant origin) or **bufa-dienolide** (mostly of animal origin). Cardiac glycosides consist of an aglycone to which 1 to 4 simple sugars are joined. Their

toxicity, a function of the configuration of the steroid part of the molecule, involves inhibition of the enzyme that controls sodium/potassium transport in heart muscle cells. This causes a build-up of calcium leading to increased contraction of heart muscle and potential heart blockage. Gastro-intestinal symptoms including nausea, vomiting and abdominal pain often precede the cardiotoxic effects.

***Nerium oleander* common oleander** is the most widely grown of several cultivated members of the **Apocynaceae** containing cardiac glycosides. Familiar as a poisonous shrub in ancient Greece (documented by Theophrastus the 'father of botany'), oleander is native to the Mediterranean basin and despite its toxicity, widely used for landscaping in warm climate areas of the world. Given its widespread use, fatalities from oleander ingestion are surprisingly few, even when deliberately consumed as a means of suicide. It may be a safe choice for your yard, but exercise caution where children are concerned. All parts of the oleander contain oleandrin with leaves containing the highest concentration; however there can be as much as a sixty fold difference depending on cultivar and growing conditions. Oleanders having red or pink as opposed to white flowers have been found to contain higher levels of cardiac glycosides, and levels increase as plants flower. Lesser amounts of several other cardenolides have been described from various plant parts of oleander.

While *N. oleander* can be grown in warm temperate climates, ***Thevetia peruviana* yellow oleander** has a more tropical distribution. Compared to 30-40 years ago, yellow oleander is not as widely grown locally, though in other tropical and sub-tropical areas of the world it is still quite common. Whereas leaves are most often implicated in poisoning with *Nerium*, it is the seeds of *Thevetia* that are most commonly consumed. Unlike *Nerium*, which has tufted seeds in a cylindrical pod (follicle), the fruit of *Thevetia* is a more inviting, soft fleshed drupe containing a single large seed. These contain the cardiac glycosides **thevetin** and **neriifolin**; ingesting one seed can be fatal for a small child. The seeds are believed to bring good luck (*T. peruviana* is also referred to as the lucky nut tree) and sometimes strung together as a necklace. Fatalities involving either *Nerium* or *Thevetia* are comparatively rare and are usually the result of intentional consumption, especially the use of yellow oleander as a means of suicide in India and SE Asia.

**Milkweeds (*Asclepias* spp.)** and **giant milkweed, *Calotropis gigantea***, both also in the Apocynaceae, will be familiar to butterfly gardeners. Caterpillars of monarch butterflies concentrate cardenolides when feeding on milkweed as protection against bird predation. Milkweed latex contains several cardenolides, with those in ***Asclepias curassavica*, scarlet milkweed** and *C. gigantea* being especially toxic. There appear to be no documented US records of human poisoning, though milkweeds do on occasion cause poisoning of livestock including horses. Also in the Apocynaceae and especially rich in toxic cardenolides are several other species found in Miami-Dade landscapes, including ***Cryptostegia grandiflora*** (purple allamanda), ***Adenium* spp.** (desert rose), ***Beaumontia* spp.** (Heralds trumpet), ***Pachypodium* spp.**, includes so-called Madagascar palms, ***Acokanthera* spp.** (wintersweet) and ***Strophanthus gratus*** (climbing oleander). The latter is a scandent shrub (growing to about 25' with support), which produces clusters of pale pink flowers with a delicate rose-like fragrance; ***Strophanthus preussii*** is grown for the unusual flowers, the tips of the corolla lobes are extended into long twisted streamers. *Strophanthus* spp. contain **strophanthins**, cardiac glycosides of which **ouabain**, widely used as a heart stimulant prior to digitalis, is extracted

from seeds of *S. gratus*. Digitalis is also a cardiac glycoside, found not in the Apocynaceae but the foxglove *Digitalis purpurea* (Scrophulariaceae). Cultivars are occasionally seen locally as short-lived cool season bedding plants.

**Wintersweet** is of interest since it is mistakenly described in 'Poisonous Plants' (Frohne and Pfänder 2005) as having become naturalized in Florida (the USF Atlas of Florida Vascular Plants shows no listing for any *Acokanthera* spp). An early introduction to Florida (one of many by the Reasoner Bros), wintersweet has been all but ignored despite having attractive leathery foliage, dense cymes of sweet scented white flowers and exhibiting excellent drought and salt tolerance. No doubt this is in large part attributable to the acokantheras reputation as poisonous plants (contain numerous toxic cardenolides, principally acovenosides as well as ouabain). There is some confusion as to the identity of the above original introduction though it would appear to have been *Acokanthera oblongifolia* (syn. *A. spectabilis*). The fruit of *A. oppositifolia*, a purple 1-2" berry, is claimed to be edible, but only the pulp (not seeds) and only when ripe. The fruits of *A. oblongifolia*, even when ripe are quoted as causing fatalities in children. Warnings as to toxicity vary: the UK Horticultural Trade Association's labeling code of practice lists wintersweet as only 'harmful' (both oleander and lantana rate a more serious warning as to toxicity). However California Poison Control considers wintersweet as a major poison likely to cause organ damage or death.

*Acokanthera* is very closely related to *Carissa*. **Natal plum** *Carissa macrocarpa*, a large, densely branching, drought tolerant, spiny shrub, is a long time favorite of Miami residents. The fruit is similar in size and shape, if not always color, to that of wintersweet, but differs in being edible. Continuing disregard of wintersweet renders accidents involving its colorful fruit or poisonous sap highly unlikely. Attitudes could possibly change as pressure grows to reduce landscape water use, increasing the demand for a wider selection of attractive, drought tolerant plants.

As was stated above most **bufadienolides** are of animal (particularly amphibian) origin being first described in toxic skin secretions of toads of the genus *Bufo*. The marine toad *Bufo marinus*, an introduced pest species to Miami-Dade, is responsible for poisoning of local cats and dogs. Bufadienolides have also been found in plants, principally a few South African members of the **Crassulaceae** – *Cotyledon* spp., *Tylecodon* spp. (both of primary interest to succulent enthusiasts) and more familiar to local gardeners, *Kalanchoe* spp. Weedy species such as *Kalanchoe delagoensis* (**mother of millions**) and *Kalanchoe daigremontiana* (**devil's backbone**) appear to be more toxic than *Kalanchoe blossfeldiana* (**florists' kalanchoe**), cultivars of which are popular as dry season bedding plants in South Florida. Kalanchoe poisoning is mostly a livestock problem, though concern has been expressed over several incidents involving dogs.

Plants are an important source of dietary protein (e.g., beans, cereals and nuts), but some **plant proteins** (most now referred to as **lectins** but historically as **toxalbumins**) are among the most toxic compounds known. Most familiar is **ricin**, a glycoprotein found in seeds of the **castor bean plant** *Ricinus communis* (Euphorbiaceae), native to NE Africa into the Middle East, but now found worldwide in warm climates. Found throughout Florida and prohibited in Miami-Dade as an invasive plant, *R. communis* is becoming less common locally. Formerly used for its large palmately lobed leaves (similar to the rice paper plant, *Tetrapanax papyfera*)

as a coarse, fast growing, landscape shrub/small tree. The globose fruits are red, covered with soft spines and contain three ¾" mottled seeds; the latter's resemblance to a tick is the source of *Ricinus* (Latin for tick). Not only are the fruits eye-catching but the seed has an appealing taste (likened to a filbert) and a single well chewed seed can deliver a lethal dose of ricin. The ricin molecule is made up of two chains; chain B is a lectin (proteins that bind to cell surface sugars) and facilitates entry into the cell where chain A irreversibly inhibits ribosomal activity (the cells protein synthesizing machinery). Symptoms of poisoning are non-specific: nausea, vomiting, and diarrhea; depending on the dose of toxin progressing to dehydration, seizures, circulatory collapse, major organ failure and death. Castor bean plants are more likely to be found growing in undeveloped and abandoned sites, areas parents should already be warning children to avoid.

Ribosome inhibiting proteins (RIP) are found in many other plants but most exhibit slight if any toxicity since uptake from the gut is limited. The **sandbox tree** *Hura crepitans*, an exotic, large, fast growing shade tree with a spiny trunk, and also an euphorb, occurs sporadically in south Florida. The seeds contain **phorbol esters** and several lectins/RIP's (including curcin, likened to ricin but less toxic). More familiar are *Jatropha* spp. which contain various lectins, curcin, cytotoxic phorbol esters and a purgative fatty acid. All of the species in cultivation are drought tolerant and thrive on poor soil making them of use in low maintenance landscaping. The seeds pose the most toxic hazard particularly those of *J. multifida*, **coral plant**, and *J. curcas*, **Barbados** or **physic nut**. The former is far more ornamental (striking red inflorescence) while the latter is now rarely used for landscaping but has stimulated interest, some locally, as a source of bio-fuels. The fruits are green to yellowish rather fleshy capsules, and as with *R. communis* contain three, pleasant, tasting seeds.

The seeds of *J. podagrica* **gout plant** are also poisonous, but the fruits are smaller and the seeds explosively ejected from the capsules as they dry, with an audible pop. The gout plant makes an attractive succulent with its bottle shaped stem. **Peregrina**, *J. integerrima*, a less succulent, red flowering shrub, is locally the most popular of all the jatrophas and although poisonous the seed capsules are far less conspicuous. Toxicity of *Jatropha* seeds is due principally to phorbol esters, which cause acute irritation of the gut mucosa, the associated blood loss leading to dehydration and possible death. A previous article on plant induced contact dermatitis mentioned the role of phorbol esters as irritants in euphorbs, including the **manchineel**, *Hippomane mancinella* a native tree of limited occurrence in coastal wetlands. The fruit, which resembles a crab apple, also contains phorbol esters and causes severe and painful internal poisoning.

**Toxic proteins** are found in other groups of plants, notably the Fabaceae (bean family). **Abrin**, found in the seeds of the **rosary pea** *Abrus precatorius* is similar in structure and mode of action to ricin (binds to and penetrates cells where it inhibits protein synthesis). Rosary pea is listed as a noxious weed by the Florida Dept. Agriculture, so in area landscapes is most likely to be found as a volunteer. A fast growing vine with pink, pea-like flowers it is not especially eye catching until pods form and split to reveal bright scarlet seeds with a black hilum. As far as children are concerned, this is a plant that needs to be removed before it has a chance to set fruit; the seeds are just too inviting and have been responsible for several fatalities in Florida. Fresh seeds are more dangerous (easier to chew) than dried seeds which develop a hard seed

coat and may be voided without symptoms. Although lacking ricin's notoriety, abrin is at least as toxic and has also attracted attention as a chemical warfare agent.

**Alkaloids** are a large and varied assortment of naturally occurring, basic, nitrogen containing compounds (more than 10,000 have been identified), the vast majority of which are found in flowering plants. Most are derived from amino acids, those found in poisonous plants, being classified according to chemical structure into one of ten broad groups. Irrespective of structure a feature of most toxic alkaloids is to impede normal functioning of the central nervous system. A given group of alkaloids usually occurs within a restricted range of plant families. The **indole alkaloids** (derived from the amino acid tryptophan) are the largest group; if ingested symptoms range from profuse sweating, nausea and chills to mental confusion, seizures and respiratory failure. The majority of those known to be toxic occur in the **Apocynaceae**, with *Ochrosia* spp. and *Kopsia* spp. of potential local concern because of their colorful but highly poisonous fruit.

*Ochrosia elliptica* (**pokosola**), a small, slow-growing, somewhat shrubby tree with attractive foliage, produces clusters of fragrant white flowers followed by bright red, usually closely paired, fleshy drupes. It is occasionally found in local landscapes being both drought and salt tolerant. The latter feature suits *O. elliptica* to coastal sites, however in such situations it can become invasive (the fruits float) and for that reason landscape use in Miami-Dade should be restricted to inland areas. The colorful fruit is highly ornamental, but could prove all too inviting for children necessitating appropriate care as to where the tree is placed. Although the plants themselves differ in appearance, the fruit could be confused with the edible bright red fruit of **Natal plum** (see above). Several indole alkaloids have been identified in the fruit of *O. elliptica* of which **ellipticine** is best known; it is able to uncouple energy metabolism, inhibit cholinesterase, and act as a mutagen (alters DNA).

Neither *Kopsia fruticosa* **shrub vinca** nor *Kopsia arborea* **pin-mala** (maybe listed under the synonym *Kopsia pruniformis*) are widely grown as yet, though both make handsome additions to the landscape. The former, a large shrub with pale pink periwinkle-like flowers and 1" green to purplish fleshy drupes; the latter a small tree bearing clusters of white tubular flowers with long narrow petals, followed by striking dark blue fleshy drupes. They are regarded by some as having the most attractive foliage of any of the cultivated Apocynaceae; the opposite leathery leaves are glabrous and bright bluish green, with those of *K. arborea* turning a vivid crimson as they reach senescence. Both are available from a few area nurseries. Be aware if you decide to purchase one of the kopsias that *O. elliptica* has in the past been mistakenly offered as *Kopsia arborea*. As with *Ochrosia*, exercise care as to where you install *Kopsia*. The fruit is not only eye catching but highly poisonous (contains several novel indole alkaloids) and sure to tempt curious children.

Ellipticine occurs in other members of the Apocynaceae, including *Tabernaemontana* spp., of which *T. divaricata* **crepe jasmine** is an old south Florida favorite (sometimes also known as Florida gardenia). Crepe jasmine contains several other indole alkaloids, however it poses far less of a risk to children as it rarely produces fruit (a slender pod like follicle) in Florida. Some members of the *Tabernaemontana* such as *T. ventricosa*) and *T. pandacagu*) do form unusual and/or colorful fruits but these are not grown in Florida. *Rauvolfia* spp. (e.g., *R. serpentina*, **Indian snakeroot**) are rich sources of several toxic indole alkaloids. These include **reserpine** (psycho-active, depresses blood pressure) and **ajmaline** (alters electrical conductivity of heart).

Most grow as small shrubs/trees, with white, fragrant, diminutive flowers followed by small colorful berries, preferring part shade, and moist organically rich soils. Growth is poor on limestone which may help explain why at least in Miami-Dade they are rarely found. The USF- ISB Plant Atlas lists *Rauvolfia tetraphylla* (**devil's pepper, be-still tree**) as an escape in Palm Beach County. *Rauvolfia* seeds are available from on-line sources – plant used by herbalists.

The **Solanaceae** (**potato family**) is rich in alkaloids, including **hyoscyamine** (which in dried plant tissue undergoes a subtle conformational change to **atropine**, a less active form), **scopolamine**, **solanine** and last but not least, **nicotine**. Hyoscyamine/atropine is most often associated with the herbaceous perennial *Atropa bella-donna* (deadly nightshade) an exotic species of limited distribution in the US (it has not been found in Florida). The name is derived from Atropos, one of the three Greek goddesses of fate who 'cut the thread of life'.

Hyoscyamine and scopolamine both belong to the **tropane alkaloids**, esters of tropane, a basic, nitrogen containing, bicyclic organic compound derived from the amino acid ornithine. Initially both alkaloids produce similar symptoms, more pronounced with hyoscyamine: dry mouth, hyperthermia, reduced bowel motility, urine retention and rapid heartbeat. Scopolamine differs in having a much more pronounced effect on the central nervous system resulting in drowsiness, hallucinations, amnesia (which has attracted attention of the criminally inclined) and in higher doses delirium, paralysis and death. Scopolamine achieved notoriety at the beginning of the cold war regarding its potential use as a 'truth serum' but the information so obtained was of uncertain veracity due to hallucinatory side-effects.

In area landscapes tropane alkaloids are found in brugmansias and possibly also in cestrum and brunfelsias (see below), three popular solanaceous shrubs. The **brugmansias** (**angel's trumpet**) are admired for their large, pendent, trumpet shaped flowers, in a variety of soothing pastel colors, frequently with enticing night time fragrances. While most plant poisonings, apart from aroids (such as *Dieffenbachia*), usually involve the consumption of fruits/seeds, it is the brugmansia flower that attracts attention. Moreover it is not young children that are the usual victims, but older children through misuse of the flowers for potentially dangerous recreational purposes. At least one community in Central Florida prohibited brugmansias in the mid 1990's for landscape use after the plant was involved in a rash of poisonings involving area adolescents.

**Brugmansias** contain more scopolamine than hyoscyamine and levels vary depending on plant part/maturity, highest concentrations being found in flowers, young leaves and immature fruits. This concurs with the optimal defense theory: plant toxins are distributed so as to protect 'high value' parts (e.g., flowers, immature fruit and new or damaged leaves from pests rather than fully ripe fruit or senescing leaves). Hence the symptoms of poisoning can vary depending not only with the plant part consumed (as described above for oleander) but with its maturity.

The **brunfelsias** include species with white (lady of the night) or purple (yesterday, today and tomorrow) flowers. There have been several reports of animal poisoning involving brunfelsias, most of which involved dogs but no humans so far. The symptoms described which included vomiting and/or diarrhea, dementia, tremors, seizures and death are consistent with alkaloid poisoning. Some references list tropane alkaloids but this has not been confirmed and the one toxic compound that has been isolated so far is a pyrrole alkaloid (pyrrole-3-carboxamide from *B. grandiflora*) also the principal toxin of another solanaceous plant the cupflower

*Nierembergia hippomanica*. The fruits, fleshy capsules containing many small seeds, appear to be especially toxic and the ingestion of only small amounts of plant material was sufficient to result in severe symptoms. For this reason caution is warranted where brunfelsias are planted in locations frequented by young children. Locally the white-flowering species such as ***Brunfelsia nitida*, *B. densifolia*, *B. americana*** and ***B. densifolia*** readily set fruit, which to a child could be mistaken for small green to orangey tomatoes. California Poison Control regards ***B. grandiflora*** as a highly toxic plant, in Miami-Dade the most widely grown of the purple flowering species. I have not noticed fruit set locally (could well reflect differences in pollinators compared to afore mentioned species).

In Miami-Dade the **day cestrum, *Cestrum diurnum*** is a prohibited, invasive plant, but is still commonly found as a volunteer, while the **night blooming cestrum, *C. nocturnum*** is a not uncommon landscape plant notable for its intense nocturnal fragrance. The former has dark purple to black berries, the latter white berries both of which are succulent and contain many seeds. Immature fruits contain **solanine** (a **glyco-alkaloid**, see succeeding article in this series) while atropine-like symptoms have been associated with consumption of ripe fruits, though there appear to have been no specific tropane alkaloids identified to date. Instances of human poisoning are rare, though the juicy berries could be tempting to small children. Various *Cestrum* spp., including *C. diurnum* contain a steroidal glycoside dihydroxycholecalciferol, structurally related to Vitamin D but far more potent. It causes calcification of internal organs, a potential problem for livestock where animals have access to *Cestrum* foliage.

There are several plants with fruits that could be a potential problem with children, though probably more so for domestic animals. The fruit of the attractive, small, native tree ***Sapindus saponaris*, soapberry** has orangey brown, fleshy drupes that contain several poisonous saponins. The bitter taste of the fruit should limit the amount ingested, plus saponins are both poorly absorbed and become less toxic as they pass through the gut. If sufficient fruit is consumed symptoms could include nausea, vomiting and/or diarrhea.

**Sky flower, *Duranta repens*** is a popular shrub with yellowish orange, juicy drupes that are reported to contain coumarins, iridoids (monoterpene lactone intermediaries in the formation of alkaloids) and a pyridine alkaloid. Symptoms, mostly based on animal poisoning, include vomiting, diarrhea and intestinal bleeding as well as seizures. Related to sky flower (also in Verbenaceae) **common or shrub lantana *Lantana camara***, a noxious weed widespread throughout Florida, is cause for more serious concern in particular for livestock where it causes severe liver damage. Human poisoning, mostly young children, has resulted from consumption of the fruits (drupes) which are most toxic when green, becoming less so as they ripen violet to black. The principal toxins are believed to be triterpene esters with symptoms ranging from vomiting and diarrhea to dizziness, labored breathing and coma, depending on the amount consumed. Also in the Verbenaceae, **beautyberry *Callicarpa americana*** is a popular Florida native shrub grown for the highly ornamental reddish purple drupes clustered along the length of flowering stems. Although now considered too astringent to be edible, they were consumed in the past; there appear to be no published records of poisoning due to beautyberry.

While the above plants can be harmful if not fatal, a few readers may recognize that some have, or continue to offer, important therapeutic benefits, and have a long history of medicinal use in many parts of the world. One important focus of present day medical research is the

potential for modifying plant toxins as a means of selectively destroying cancer cells. Toxins that have evolved as a significant part of a plant's defensive arsenal against both herbivorous animals, in particular insects, and diseases, offer us weapons to resist the scourge of cancer. Please though, don't grow any of these plants for purposes of self-medication – enjoy them for their aesthetic qualities.

You can bring plants to the Miami-Dade Extension Office for identification before tasting them. For suspected plant poisoning call Miami Poison Control 1-800-222-1222, not the Miami-Dade Extension Office. Once more I thank Jeffrey Bernstein, M.D., Medical Director, Poison Control Center Miami Office, for his critical comments.

Next time, a consideration of edible plants grown in Miami-Dade, which under certain circumstances can be harmful.

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