Are There Toxic Plants in Your Classroom? A Resource for Teachers of Children with Exceptional Needs

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Abstract

In elementary and secondary classrooms, educators use plants for various reasons. Plants are often used during learning activities and science experiments. Also, educators frequently decorate their classrooms with plants to make the room more inviting and comfortable. Few new educators have been informed of the potential hazards of commonly known plants that have toxic characteristics. Because of this lack of knowledge, children may be harmed by touching or ingesting parts of plants found in the classroom. This article presents ten plants often found in the classroom that have toxic characteristics. Plants that are non-toxic and can be safely substituted in the classroom are also described.

Keywords

classroom toxins, plant toxins, phytotoxins, poisons, poisonous plants, special needs

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Plants are an integral part of the atmosphere and curriculum in many elementary and secondary classrooms. Educators frequently use plants as components of learning activities, science experiments and as classroom decorations to give the room a more inviting and comfortable atmosphere. Using plants is of concern because few new educators have been educated concerning the potential hazards of commonly known plants that have toxic characteristics. Because of this lack of knowledge, there is potential harm if children touch or ingest parts of the plants found in classrooms. Educators need the latest information concerning nontoxic plants in order to develop an appropriate educational environment that is both safe and pleasant. Without such information, the health and safety of children may be compromised.

Most plant poisonings occur in children who are of school age or younger.

According to Douglas (2005) it has been "estimated that 3.5% of all poisonings in the United States are due to plants" (p. 1). Most of these plant poisonings occur in children who are of school age or younger. The University of Nebraska (2005) stated plants are the third most common cause of poisoning among children in the United States after medicine and household chemicals. According to Watson et al. (2004), 74% of exposures to plant toxins occur with children less than 6 years of age and 12% with children ages 6 to 19. Thus it is important educators recognize which plants are nontoxic before they bring them into the classroom and also whether the plants found presently within their classrooms are considered safe.

Toxic Plant General Information

A toxic (poisonous) plant can be defined as one that has parts that contain "potentially harmful substances in high enough concentrations to cause chemical injury if touched or swallowed" (Manning & Manning, 1997). Plant toxin exposure occurs when the toxin is ingested and/or dermal contact occurs. A harmful reaction to any of these substances could include "allergic reactions ..., skin rashes or dermatitis ..., skin photosensitization and internal poisonings or irritations ..." (Douglas, 2005).

The toxicity within a plant is classified by level, i.e., "extremely, moderately, or minimally toxic" (Douglas, 2005). Toxicity varies according to the life cycle of the plant and can be different within members of the same plant family (Douglas, 2005). Additionally, the level of toxin within a particular plant may vary according to the location within the plant, i.e., the leaves of the potato are highly toxic while the tuber is edible. Individual reaction to plant toxins may be dependent on the amount and type of toxin and whether the toxin is ingested or contacts the skin. The age, weight, and sensitivity of the individual who is exposed to the toxin are factors to be considered in an individual's reaction.

In some cases one or more parts of the plant must be ingested in order for the plant's toxins to be released. The severity of the toxicity when a plant is ingested depends on the amount of plant material the individual eats as well as the type of toxin. The effects of the toxin depend on the amount ingested in conjunction with other specific characteristics of the individual, i.e., age, weight, metabolism, sensitivity to the toxin, etc. Thus, teachers must become cognizant of the possible toxic characteristics of the plants they are considering for use in their classrooms, as a prevention of "poisoning".

Toxic plants are often characterized by the type of toxin (poison) within the plant. In addition, the degree of toxicity of the toxin within the plant and its various parts is important to know. A number of different plant toxin categories exist. Three of the most well-known are described: polypeptides and amines, oxalates, and resins. Cornell University's Poison Plants Informational Database (2008) provides an expanded list of toxic agents in plants.

Polypeptides and amines. The first category includes the polypeptides and amines which are defined as "nitrogenous compounds such as phenylethylamine and tyramine" (Douglas, 2005). This group of toxins is exemplified by such plants as American mistletoe *(Phoradendron spp.)* and Jequirity bean *(Abrus precatorius)*.

Oxalates. A second category includes oxalates defined as "a poisonous, colorless crystalline organic acid, $HOOCCOOH \cdot 2H_2O$" (Answers.com, 2006). Examples of oxalates are philodendron (*Philodendron* sp.), peace lily (*Spathiphyllum* sp.), croton (*Codiaeum variegatum*), dumbcane (*Dieffenbachia* sp.), arrowhead plant (*Syngonium podophyllum*), and angel wings (*Caladium* spp.).

Resins. The third category of plant toxins are resins. Resins are "clear to translucent yellow or brown, solid or semisolid, viscous substances of plant origin" (Answer.com, 2006). Plant resins that are toxic on contact are the Pencil Tree (*Euphorbia tirucalli)* and the Poinsettia *(Euphorbia pulcherrima)*.

Selected Examples of Toxic Plants Found in Classrooms

Ten plants that could pose serious health risks to students have been selected from the three categories (polypeptides and amines, oxalates, and resins) to be further described. These plants were chosen because they are poisonous either by ingestion or dermal contact. They are often found in gift baskets, used for holiday decorations, or included as part of K-12 curriculum. An informal survey of K-12 classrooms in three school districts confirmed our belief that the selected toxic plants are prevalent in schools.

Table 1. Plants toxic if ingested

Common Name	Scientific Name	Toxic Plant Part	Toxin	Physical Symptoms
Arrowhead Plant (Nephthytis)	*Syngonium podophyllum*	Sap	Calcium oxalate crystals (mild to moderate toxicity)	Lips, tongue, & throat irritation; Severe pain if ingested
Caladium (Angel Wings)	*Caladium spp.*	All parts	Oxalate crystals (**highly** toxic)	Throat, tongue, & mouth irritation; Breathing difficulty; Vomiting, nausea, & diarrhea
Croton	*Codiaeum variegatum*	Leaves and sap.	Calcium oxalate crystals (minor toxicity)	If ingested, vomiting and diarrhea; dermatitis.

Table 1 (continued). Plants toxic if ingested.				
	Scientific Name	**Toxic Plant Part**	**Toxin**	**Physical Symptoms**
Dumbcane	*Dieffenbachia spp.*	All parts (esp. leaves and sap)	Calcium oxalate crystals (mild to moderate toxicity)	Burning & irritation in mouth & tongue; Paralysis of vocal cords; Death can occur
Jequirity Bean; Rosary Pea	*Abrus precatorius*	Seeds & beans (chewed)	Abrin (two polypeptide chains) (**high** level of toxicity)	One bean may be fatal; Irregular pulse; cold sweat; stomach pain; burning sensation in mouth & throat; Vomiting; Bloody diarrhea; Seizures; Trembling, & hallucinations; Kidney & liver damage; Abnormal heartbeat
Mistletoe	*Phoradendron spp.*	Possibly berries and leaves	Amines: beta-phenylethylamine & tyramine Confusion exists concerning toxicity.(varying levels of toxicity according to species)	Irritation to stomach & intestinal tract; Slow pulse, vomiting; May be fatal
Peace Lily	*Spathiphyllum sp.*	Sap	Calcium oxalate crystals. (mild to moderate level of toxicity)	Lips, mouth, and throat irritation; closure of airways; difficulty breathing
Pencil Tree; Milk Bush	*Euphorbia tirucalli*	Sap	Diterpine esters (mild to moderate toxicity)	Irritation to skin; Irritation to mouth, throat, & stomach
Philodendrun (including Pothos-Devil's Ivy)	*Philodendron sp. (Scindapsus aureus)*	All parts (esp. leaves & stems)	Calcium oxalate crystals (moderate toxicity)	Burning & irritation of mouth & tongue; Paralysis of vocal cords; Death can occur

Table 1 (continued). Plants toxic if ingested.

Common Name	Scientific Name	Toxic Plant Part	Toxin	Physical Symptoms
Poinsettia	*Euphorbia pulcherrima*	Leaves, stems, & milky sap	Euphorbine (Mild toxicity)—one site considered it as no longer toxic	Irritation to digestive tract; Irritation to skin; May be fatal

Table 2. Additional Readings for Identification and Information

Title	Reference
Acceptable Indoor and Outdoor Plants	www.safekid.org/plants.htm
Eisenstein, J. (1998). Toxic plants.	*Flower and Garden Magazine.*
Healthy Spaces Toxic Plant List	www.cfc-efc.ca/healthy-spaces/toxicplant_en.php
Merser, C. (October, 2004). Digging in: Ten tips on living with poisonous plants.	*House and Garden Magazine*, 130.
Plants Toxic to Animals	www.library.uiuc.edu/vex/toxic/toxic.htm
Poisonous Plants	www.bfhd.wa.gov/forms/fact/BFHD-E-0017.pdf
Poisonous Plants and Plant Parts	plantanswers.tamu.edu/publications/poison/poison.html
Safe Plants	www.calpoison.org
Stephens, H. A. (1980). *Poisonous plants of the central United States.*	Lawrence, KS: University of Kansas.
Toxic House Plant List	www.pioneerthinking.com/toxich.html
Toxic Plants Index	maxshouse.com/Toxic_Plants%20_Index.htm
A Department of Health (DOH) Guide to Toxic or Poisonous Plants	www.doh.wa.gov/hsqa/fsl/CRS/pdf/guideline_toxic_or_poisonous_plants.pdf

Each of the ten plants is briefly identified both with its scientific name and common name. A photo is provided to assist with identification. The toxicity level, the form of toxic exposure, and the type of toxin are described. These plants are alphabetically listed according to scientific name in the body of the paper and by common name in Table 1. Table 1 also lists the scientific name of the plant, the specific parts of the plant that are known to include the toxin, the type of toxin, and the physical symptoms of toxic exposure. See Table 2 for Internet sites where pictures and further information concerning toxic plants can be found.

Abrus precatorius. This first plant is commonly known as the Rosary Pea or the Jequirity Bean. It is one of the most dangerous plants that may be found in classrooms as part of Arts and Crafts activities. The red and black seeds are often threaded together to form attractive strings of seed beads. These seeds can be found in musical instruments such as maracas. The plant includes the toxin abrin (two polypeptide chains) and is considered extremely dangerous as death may occur when even one seed is chewed (Hardin, & Arena, 1974). Toxins may also enter the body by pricking the finger while stringing the seeds as beads. This plant (see photo below) should *not* be included in any classroom setting.

Caladium spp. Another plant of concern is Caladium (*Caladium spp.*), also known as Angel Wings. Caladium plants are quite decorative and are often included in floral arrangements. As a result, teachers may receive them as gifts and use them for classroom decoration. All parts of the plant are considered highly toxic because they contain oxalate crystals. Ingestion of any amount of the plant may result in irritation to the soft tissue of the mouth and throat resulting in breathing difficulty. Additionally, if swallowed, vomiting, nausea, and diarrhea may occur.

Spathiphyllum sp. This plant, known as peace lily, is often found as a decorative plant because it is tolerant in a variety of environmental conditions, and blooms easily and frequently. *Spathiphyllum* should be excluded from the classroom because its sap contains the toxin calcium oxalate crystals (AAPCC, 2004; Denver Plants.com, 2003). The level of toxicity is considered mild to moderate. Exposure to the sap may result in contact dermatitis, an irritation to the lips, mouth, and throat that in severe cases may result in closure of the airways and difficulty breathing. According to the AAPCC (2004), *Spathiphyllum* is the number one plant reported to the Poison Control Center in the United States for plant poisoning.

Dieffenbachia spp. This genus includes a plethora of plants including dumbcane, Mother-In-Law Tongue, and dieffenbachia. These plants are often in classrooms because of their beauty, longevity, and durability. All parts of this plant, especially the leaves and sap, are toxic when ingested. Calcium oxalate crystals are released through chewing. Toxicity is considered to be mild to moderate depending upon the amount ingested. Exposure may result in irritation, including burning of the mouth and throat, loss of vocal ability, and in severe cases, swelling of soft tissue leading to closure of airways may result. In some instances, superficial necrosis of tissues may also occur.

Codiaeum variegatum (croton*)* belongs to the genus *Euphorbiaceae* and is often confused with the genus *Croton.* As a result, it is commonly called croton. The croton is a colorful plant often seen in the classroom because of its beauty, hardiness, ease of growing, and frequent use in floral arrangements. Calcium oxalate crystals, if ingested, can cause vomiting and diarrhea. Contact dermatitis may also result from touching plant sap. The toxicity level is considered to be minor depending upon the amount of exposure.

Euphorbia tirucalli (pencil tree) and *Euphorbia pulcherrima* (Poinsettia). These two plants are of the same genus and are commonly used in the classroom for decoration. The pencil tree is attractive and easy to

grow and propagate. The Poinsettia is most frequently found in classrooms during the holiday season. New research indicates diterpene ester may be the irritant found in the milky sap or latex of the Euphorbia genus such as the pencil tree (Russell et al., 1997). A compound known as euphorbine may be the irritant found in the Poinsettia plant (Botanical, 2005). The toxicity level for both plants is considered to be mild to moderate. The chemical compounds, diterpene ester and euphorbine, are known to cause contact dermatitis, "an inflammatory response of the skin to an antigen or irritant", sometimes known as a skin rash (Michael, 2005). These two plants are especially hazardous because the toxin is released if the leaves or stems are damaged. This may occur inadvertently when brushing against the plant or if the plant is used in a propagation activity.

Philodendron sp. Plants in this genus include all varieties of p*hilodendron*, Pothos and Monstera. These plants are frequently included in floral gift arrangements, are easy to propagate, and are very durable. All parts of the *philodendron*, but especially the leaves and the stem, include the toxin calcium oxalate crystals. The toxicity level is considered moderate. Ingestion of plant parts may result in a burning sensation of the lips, mouth, and throat. More severe cases may result in swelling of soft tissue, closure of airways, and difficulty breathing.

Syngonium podophyllum. This American plant, also commonly known as the arrowhead plant, should not be confused with Nephthytis, an African plant with a similar physical appearance. Nephthytis has been assigned its own genus. Arrowhead plants should be avoided in a classroom setting because of the presence of calcium oxalate crystals within the sap. Toxicity levels are classified as mild to moderate. Symptoms are similar to those described for *philodendron.*

Phoradendron spp. Mistletoe is the common name for parasitic plants growing in North America, a seasonal plant used for decoration during the holiday season. Confusion exists within the literature (Krenzelok, Jacobsen, & Aronis, 1997) concerning mistletoe toxicity. It is generally considered to be extremely toxic but no data supports this belief. Because of this general belief and the enormous number of species with varying levels of toxicity, medical professionals tend to provide aggressive treatment following ingestion of any part of a mistletoe plant. Educators are therefore discouraged from including this plant in the classroom.

Benefits of including nontoxic plants are numerous.

Nontoxic Plants

Educators may be apprehensive about having plants in their classrooms because of potential harm to their students. Benefits of including nontoxic plants are numerous. Plants provide an opportunity for students to study plant growth and reproduction, to learn about the process of photosynthesis, to learn about plant classification, to identify the benefits of plants to humankind, to ensure that the classroom is aesthetically pleasing, and to provide children with the opportunity to learn responsibility through caring for plants. Therefore, educators are encouraged to replace toxic plants with nontoxic houseplants or herbs, instead of excluding plants from the classroom. Educators should be aware though that "*any plant* may cause unexpected reactions in certain individuals" (Douglas, 2005, p. 5). Following is a sample list of ten plants, including some

herbs, which are considered to be nontoxic and safe for use in classrooms (see Table 3). Table 3 includes suggestions for classroom uses.

Table 3. Nontoxic Plants

Common Name	Scientific Name	Suggested Classroom Uses
African Violet	*Saintpaulia* spp.	Decoration and propagation
Begonia	*Begonia* spp.	Decoration and propagation
Bird's Nest Fern	*Asplenium* spp.	Decoration; ecology: habitat, niche, and classification
Christmas Cactus	*Zygocactus truncates*	Holiday decoration and propagation
Coleus (Flame Nettle, Painted Nettle)	*Coleus blumei*	Decoration and propagation
Herbs: Basil Chives Oregano Rosemary	 *Ocimum basilicum* *Allium schoenoprasum* *Origanum vulgare* *Rosmarinus officinalis*	Decoration, propagation, and culinary use
Peperomia	*Peperomia* spp.	Decoration
Prayer Plant	*Maranta leuconheura*	Decoration; plant anatomy: veination
Spider Plant	*Chlorophytum comosum*	Decoration and propagation
Venus Flytrap	*Dionaea muscipula*	Decoration, ecology: habitat, niche, and nutrient attainment

Additional information about plants and their possible toxicity can be found on various Internet sites (see Table 2). Educators should take care when selecting plants as some plants are listed as safe in one listing and not safe in others. For example, Mother-in-Law Tongue, also known as Snake Plant, (*Sansevieria sp.*) is listed as a plant that may have both contact and ingested toxins in one list and is considered a safe plant in another site. In this case, it is suggested that the educator err on the side of caution and consider any questionable plants as toxic.

Recommendations For Educators

Recognition of specific plants that may be hazardous to children and adults in the classroom is important. This is especially true if the classroom includes students with developmental delays whose cognitive and behavioral characteristics may interfere with their understanding of the potential hazards of ingesting or touching plants. It is the responsibility of the educator to inculcate in students a respect for plants and their means of defense that may be harmful to humans and animals.

Educators should make sure that the plant is one that is safe and nontoxic before bringing it into the classroom. Any plant that is grown in a classroom should have a label that includes both the common name(s) and the scientific name. If plants are already being used in the classroom, the educator should

conduct research to identify the plant's toxicity type and level. Based on findings, educators can then determine the appropriate usage of a particular classroom plant.

It is also essential that educators are aware of the appropriate responses when a toxic plant is ingested. The first responses are to contact emergency medical assistance (that is, 911) and the child's parents. Educators MUST not attempt to induce vomiting, as this may cause further harm to the child. The educator should provide the medical team with the following information: the name of the plant, how much and which parts of the plant were eaten, the amount of time since the plant was ingested, the child's age, the symptoms that have been observed, and a description of the plant if the name is unknown (Hardin, & Arena, 1974). In most cases, the plant should accompany the child to the emergency room so that the plant toxin can be specifically identified and appropriate medical treatment can be provided.

If the child has an inflammatory skin reaction to a plant with which he/she has had contact, the educator should immediately flush the site with cold water for 20 minutes. If the plant toxin is in the child's eye, then washing with cold water for 20 minutes should accompany a request for medical assistance (Levy, & Primack, 1984). Skin reactions may not occur immediately but may be delayed depending on the sensitivity of the child to the plant's toxin. In this case the educator should notify the parents/guardians that their child has had contact with a plant that may result in skin irritation.

Summary

The introduction of plants into elementary and secondary level classrooms is used as an educational tool in learning activities and science experiments, as decoration, and to provide an inviting and comfortable environment in which to learn. But concerns have arisen about the practice of including plants because educators may not be aware of the toxic components and the subsequent hazards of using these plants. Safeguarding the classroom is the educator's responsibility. Educators are responsible for identifying the plants used in the classroom and any safety concerns with their use. If a concern is noted then the educator needs to remove the hazardous plants and substitute nontoxic plants.

In addition, educators are responsible for teaching children that:

- plants have evolved highly complex systems of defense against most of their natural enemies (e.g., insects, animals)
- these defenses make many plants unpalatable
- some can be fatal to the unexperienced forager. (Isnar, & McKay, 2005)

In summary, the primary responsibility of all K-12 educators is to provide children with a safe learning environment.

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Appendices: Toxic Plant Photos

Photo #1: *Abrus precatorius* (Rosary Pea or Jequirity Bean)

Photo courtesy of:
http://www.flickr.com/photos/deadmike/66180580

Photo #2*: Caladium* spp.(Angel Wings)

The following photographs, #2 - #10, courtesy of Retha M. Edens, Ph.D.

Photo #3*: Spathiphyllum* spp. (Peace Lily)

Photo #4*: Dieffenbachia* spp. (Dumbcane)

Photo #5*: Euphorbia tirucalli* (Pencil Tree)

Photo #6*: Euphorbia pulcherrima* (Poinsettia)

Photo #7*: Philodendron* spp. (Pothos)

Photo #8*: Syngonium podophyllum* (Nephthytis, Arrowhead Plant)

Photo #9*: Phoradendron* spp. (Mistletoe)

Photo #10: *Codiaeum variegatum* (Croton)