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DOUBLE FLOWERED AMARYLLIS

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Abstract. **Inheritance of the double-flowered trait in amaryllis is one model for the introduction of new genes into tetraploid populations where most available germ plasm is diploid. Partially fertile triploids have allowed new traits to be added, but at a comparatively slow pace via what might be termed a gene bridge. Advantages of breeding among diploids in this genus include both a higher rate of incorporation of the new trait and a shorter generation time. Selected diploids can then be treated for polyploid induction.**

The original wild-type double-flowered amaryllis was found in Cuba and described as *Hippeastrum equestre* var. *plena,* Herb., 1821 (9). A synonym, *Amaryllis belladonna* var. *plena,* was applied by Traub and Moldenke, 1949 (10). These plants were not easily grown, so were rarely found except in the collections of specialists. Recently, what appears to be a more vigorous form has been discovered in another location. To protect the few remaining wild or escaped plants, the location of the latter will not be disclosed at this time.

Significant breeding of double-flowered amaryllis was accomplished by Capt. J. J. McCann in Punta Gorda, Florida (6, 7). It is remarkable that Capt. McCann has such success at this time because he used pollen of an apparent diploid (n=22) on garden hybrids (probably tetraploid, n=44). Such crosses rarely but occasionally set seeds. A clue that this was the way in which these double-flowered hybrids were produced is found in Capt. McCann's original report, "The progeny of these later crosses, I regret to say, have not produced as good flowers of the double type as the first series (6)."

Capt. McCann noted that an abortive stamen or two was produced by the double-flowered species with a small amount of pollen but those plants produced no seeds. Careful observation of the floret shows that such anther tissue usually occurs on a petal-like structure. In the recently discovered form, an occasional anther on a filament is formed.

It appears then that stamens converted to petal-like structures contribute to the doubleness of the florets. However, there are more petaloid structures than would be accounted for by the stamens plus perigone. The ovary of the double form is extremely reduced with little or no stigmatic tissue. If found, the stigmatic tissue usually is not functional. It would appear that ovary, stylar and stigmatic tissue contribute to additional petaloids and thus account for the lack of seed formation reported by Capt. McCann.

Capt. McCann's observations also indicate that the trait is inherited as a dominant. However, data is not yet available to demonstrate whether or not this is a simple Mendelian inheritance pattern. If, as it appears, the early McCann hybrids were triploids, these apparently had partial fertility. But even a Mendelian trait would be diluted in subsequent crosses involving tetraploids (1, 2).

Breeding of double-flowered tetraploids has been continued on a small scale, mostly by amateurs using McCann hybrids as a source of the trait and with essentially the original techniques. Although it is a rather simple task to emasculate and pollinate a normal single-flowered type with pollen from a McCann or semidouble form, rewards have not been sufficient to encourage much activity in this area of breeding.

Recent reports (5, 8) indicate that many amaryllis species are diploid. Therefore, it seems that the germ plasm of these plants has been neglected or has at best made a disproportionately small contribution to the tetraploid hybrids. In the light of the above and other published chromosome information, perhaps the history of the tetraploid hybrids should be re-examined insofar as the contribution of the various species is concerned. A partially fertile triploid might easily contribute little more than floral color or some other easily followed traits to subsequent tetraploid populations. And, since the double form breeds as a diploid, this may be a useful tool in evaluating inheritance in this genus.

Diploid plants have been pollinated with the pollen of the recently-discovered form. It is predicted that the inheritance pattern of the double-flowered trait can be determined from such crosses. Furthermore, if the trait turns out to be Mendelian, the resulting progeny should be as fully double as the wild type. Interesting combinations should be found in combination with the germ plasm of other species suggested for an amaryllis breeding program (1, 4).

The diploid species and their hybrids offer the potentials of producing smaller flowered types when breeding of other genera such as *Gladiolus* seems to be following a similar path. The largest flowering plants are often too large for the average home or apartment. Diploid amaryllis offer a particular advantage to the breeder in that such hybrids can often be flowered from seed in as little as 18 months. The time from seed to first flowering in the tetraploid forms is usually about 3 years.

Breeding of the existing garden hybrids can offer fascinating and educational results. Those unfamiliar with breeding techniques need take only the precaution of removing anthers before pollen is shed unless a self pollination is desired. In amaryllis, pollen may be shed just as the buds begin to open. The stigmatic surface is generally ready for pollination 2 or 3 days later. Freshly shed pollen can be stored in a household refrigerator for a month or longer.

Selected species and their hybrids are being increased so that these will be available on a commercial basis. Certain diploids have also been treated with colchicine (3) where it appears that these offer traits of potential in tetraploid amaryllis breeding. So, although amaryllis hybrids have been known for over 175 years, it is only recently that we have assembled information which enables us to plan breeding programs for a maximum output of desired forms. The lottery of genetic recombination is unchanged but the results now favor those who minimize randomness on the input to the system.

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PLANTS WITH DANGEROUS SPINES OR THORNS

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Climatic conditions in Florida are favorable for growing many tropical, subtropical and even some northern plants. Many plants are native while many more have been introduced from other lands. A great number of the introduced plants contain toxic agents causing stomach poisoning or skin rashes. Some are armed with dangerous spines or thorns capable of causing serious puncture wounds, scratches or abrasions as well as blindness if a person or animal should come in contact with them. The "Citrus Eye Disease," a fungi species of *Fusarium* and *Cephalosporium*, is an example. If a citrus worker's eye is struck or brushed by a twig or branch of the tree, infection that sets in may cause blindness.

Many plants with spines or thorns are included in landscaping home grounds. Spines or thorns are imperfectly developed, leafless branches of woody plants which taper to a fine point. Spines often are produced in leaf axils, but may also develop at the apex or tip of a large leaf. Examples are *Yucca* spp. and *Agave* spp.

Some spines are straight and others are curved or hooked. The latter is common on leaves of palms—*Washingtonia*, native palmetto and *Acoelorrhaphe wrightii* (Paurotis).

Spines may also vary in shape, size, rigidity, thickness, length and location on plant. Other structures not classified as spines or thorns, that are capable of causing irritation if handled or brushed against are "burs" and "awns."

Burs occur on the exterior portion of seeds or fruits. Examples are sweet gum and sandburs. Awns are sharp structures produced on grasses and small grains. These structures are found in seed head region or "glumes" of plants—often labeled the "beard." Barley, rice, wheat and other grains have such structures.

The following plants have spines or thorns on some portion of the plant.

Acacia spp.; Family: Leguminosae. Acacias are small trees or shrubs grown in central and south Florida. Most species have yellow globular flowers. Foliage varies from delicate feathery types to broad, large forms. A number of species have strong stout spines, others needle-like spines varying in length. Spines are located along trunk and branches.

Agave Americana (Century Plant); Family: Amaryllidaceae. Agave is found in many homegrounds throughout the state. It has large, thick, silvery-gray leaves up to 6 feet in length and 7-8 inches wide. When plant is 10 years old, it produces a very tall flower spike with greenish flowers. Shortly after flowering, plant shrivels up and dies. Tip of leaf has a dark, stiff spine. Leaf margins are also armed.

Aloe spp.; Family: Liliaceae. A low growing succulent plant grown in central and south Florida and used as an ornamental. It produces bright red or yellowish flower spikes. Leaves are mottled with green background and white blotches, and contain stiff, spiny-toothed margins. Foliage is used for burns and other skin ailments.

Amaranthus spinosus (spiny amaranth, pigweed); Family: Amaranthaceae. A common weed in cultivated soil. Leaves are light green; flowers unattractive on a spike. Spines are approximately one-half inch in length and are located in leaf axils.

Araucaria Bidwilli (Monkey puzzle tree); Family: Araucariaceae. A tall, evergreen tree with spiral branches, glossy dark green leaves and large cone shaped fruit. Plants are grown in central and south Florida. Leaves have sharp tips. When dry, leaves harden and spiny tips are more dangerous.

Asparagus Sprengeri; Family: Liliaceae. A vine or ground cover with short, narrow leaves. Flowers are small, pale pink in color and fragrant. Mature fruit is a red berry. Sharp scale like structures are located along branches.

Bombax malabaricum; Family: Bombacaceae. A large tall tree grown mainly in south Florida. Leaves are deciduous, compound, up to 7 inches long. Large red flowers are produced during winter. Tree trunk is covered with stout spines. As tree gets older, spines lose some of their sharpness.

Bougainvillea spp; Family: Nytaginaceae. Large evergreen vine with colorful flowers (bracts) during most of the year. Plant is grown in Central and South Florida. Branches are armed with strong, long, sharp spines.

Cacti spp.; Family: Cactaceae. This large family contains more than 1300 species. Most plants are succulent with inconspicuous leaves. Plants vary greatly in size and shape. Many species produce large, attractive flowers and berry-like edible fruits. Spines cover most of plants surface.

Carissa spp. (Natal plum); Family: Apocynaceae. Several carissas are used as landscape plants, in central and south Florida. They are available in low growing ground covers to large, tall shrubs. White star shaped flowers produce plum-like edible fruits. Leaves are dark green, reniform or kidney-shaped and contain milky sap. Double spines are located at leaf axils or joints.

Citrus spp.; Family: Rutaceae. Most citrus is grown for its edible fruit; a few for ornamental purposes. Flowers are primarily white, but may have a reddish tinge when in bud stage. Leaves are glossy, dark green, and usually with a winged petiole. Spines are two or more inches in length, especially on juvenile growth and water sprouts. Short spines may be found on older growth.

Crataegus spp.; (Hawthorn); Family: Rosaceae. A shrub or small tree grown mostly in north Florida. Several native species are also available. Flowers are white, not too fragrant and produce small apple-shaped fruits. One inch spines are present along branches.

Chaenomeles japonica; (Flowering quince); Family: Rosaceae. A deciduous shrub grown primarily in north Florida. Flowers are orange-red, fruit is yellow and edible. Spines are located at leaf axils.

Duranta repens; (Golden dewdrop); Family: Verbenaceae. A large, evergreen shrub with cascading branches and