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BREEDING, GROWING AND OBSERVING DIEFFENBACHIA SPECIES AND SEEDLINGS[1]

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Abstract. **A detailed look at the flower structure and pollination methods of** Dieffenbachia **is presented. Observations are also made on apparent fertility levels and appearance of different species and seedlings. The importance and potential of producing new types of** Dieffenbachia **through breeding are discussed.**

Dieffenbachias, also called dumbcanes, are one of the most important groups of ornamental tropical foliage plants (1). Their overall attractiveness and tolerance to interior conditions have contributed greatly to making them a cornerstone of the foliage industry. Several of the most popular varieties are mutations or "sports" from the species *Dieffenbachia maculata* (Lodd.) (formerly *D. picta* Schott). The beautiful outward appearance of these plants serves to mask heir uniform genetic make-up and, coupled with the commercial practice of asexual propagation, large populations of identical plants have been produced. The lack of genetic diversity in dieffenbachia is disturbing particularly when considering the potential susceptibility to epidemics of disease or pests. A planned breeding program is one method of increasing the genetic diversity of dieffenbachia. Such a program has recently been initiated at the ARC-Apopka.

Interspecific hybridization with Dieffenbachia was recorded before the turn of the century in Europe (2) and more recently seeds have been obtained from self-pollinations of *D. maculata* cv. Exotica (3). *Dieffenbachia* x Bausei Hort. and *Dieffenbachia* x memoria-Corsii Fenzi are 2 interspecific hybrids currently in the foliage industry. Although less common, *D.* x splendens Bull is also reported as a hybrid (2). All 3 hybrids have *D. maculata* as 1 parent (Table 1). Other commercial cultivars of dieffenbachia are "sports" from *D. maculata* or *D. amoena* Bull. These 2 species supply a major part of the genetic diversity of commercially grown dieffenbachias today. *Dieffenbachia Oerstedii* Schoot is also in the trade but to a lesser degree than *D. maculata* or *D. amoena*. Such information further illustrates the need for broadening the genetic base of Dieffenbachia through breeding.

Table 1. Reported interspecific hybrids of dieffenbachia.

Hybrid	Cross
D. x Bausei	*D. maculata* x *D. Weirii*
D. x memoria-Corsii	*D. maculata* x *D. Wallisii*
D. x splendens	*D. Leopoldii* x *D. maculata*

One of the first steps in breeding any group of plants is to study the floral structure. A member of the Araceae family, dieffenbachias have inflorescences consisting of a spadix and a spathe (Fig. 1). The spadix is an upright central axis covered with several minute petalless flowers. Male flowers are grouped at the apex of the spadix and the female flowers at the basal end. The spathe is a leaf-like bract attached near the base of the spadix. It encloses the spadix until anthesis when it unfurls and exposes the male portion of the spadix.

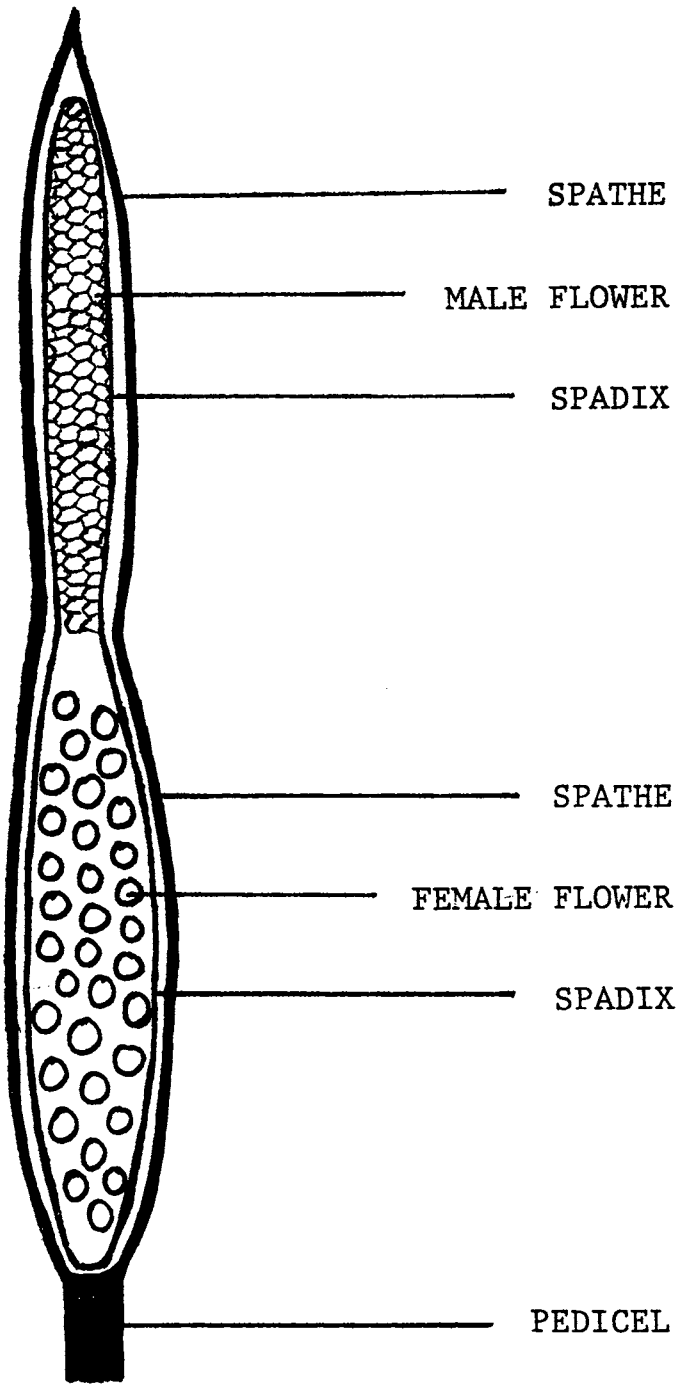

Fig. 1. Typical *Dieffenbachia* inflorescence with front of spathe cut away to show the spadix.

Diffenbachias have a nocturnal flowering habit. The spathe begins to unfurl near dusk or a little later exposing

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the male portion of the spadix and indicating that the female flowers will be receptive later that night or early the next morning. Female receptivity may be indicated by increased stickiness of the stigmatic surface (3). In previous work (3) excellent seed set was obtained on flowers pollinated between 6 and 10 a.m. We have obtained seed set from pollinations made between midnight and 9 a.m. Currently, records are being kept on the timing of all crosses made in an attempt to ascertain the best time of pollination. In our work, pollinations made in the morning (from 7 to 9) have produced seed as well as those made earlier in the day.

Dieffenbachias are dichogamous; the female flowers are receptive at a different time than when the male flowers shed their pollen. In nature, this prevents self-pollination. Normally, the male flowers shed their pollen within 1-2 days after the spathe initially unfurls. By this time, the female flowers are no longer receptive. Therefore, pollen must be collected and transferred between separate flowers of the same or different plants. When it is shedding pollen, gently cut off the male portion of the spadix with a razor blade (just above the female portion) and brush the pollen into a jar or dish. The pollen may be transferred to the stigmatic surface of the flowers using a small camel hair brush or your finger tips. Either instrument will work better if first moistened by touching the sticky surface of the stigma. Pollen will then stick to the brush or finger and will come off when touched to the stigmatic surface. Care should be taken during pollination not to damage the stigma as this could reduce seed set.

Before pollinating a flower, remove the spathe by cutting along the edges with a razor blade. Removing the spathe makes pollination much easier and, if left on, the spathe will close and normally the spadix will rot.

If a pollination is successful, the ovaries will begin to turn darker green and begin to swell within 3 weeks. They will continue to increase in size changing from green to cream-colored to bright red when mature, approx 10-12 weeks after pollination (3). Dieffenbachia seeds germinate readily in peat moss after removing the outer fleshy cover of the fruit. Young seedlings are non-variegated and green until 4-8 months after germination at which time their mature variegation patterns appear (3).

The study of flower structure and pollination techniques is only a small part of breeding. Plants must first be collected and grown on to flowering. At this time, it is unknown what factor or factors induce flowering in dieffenbachia. In central Florida, the general flowering period for most dieffenbachias is April, May and June. *Dieffenbachia amoena* is an exception as it normally flowers in July and August. Needless to say, it would be desirable to induce *D. amoena* to flower at the same time as the other species. Future research will focus on photoperiod, dormancy, fertility and other factors which may affect flowering. In the meantime, to bridge the gap between flowering dates, dieffenbachia pollen may be stored in a refrigerator to prolong its viability before use in pollinations. How long the pollen will remain viable in storage is unknown at this time.

Once a plant is in bloom, it is possible to assess its fertility and crossability with other species. The remainder of this paper contains observations concerning individual species and populations of seedlings. Attempts are made to describe the plant's growth habit, desirable breeding traits and apparent fertility and crossability as determined so far.

Dieffenbachia amoena

This is the largest of the dieffenbachias and normally flowers in July and August in central Florida. However, pollen production is sporadic and slight. Indications are that it may be polyploid in nature, and this may hinder its crossability with other species. It would be desirable to combine the robust growth habit of *D. amoena* with the more colorful species such as *D. maculata* cv. Perfection. No successful crosses have been made using *D. amoena* as male or female to date.

Dieffenbachia x Bausei and *D.* x memoria-Corsii

Both plants are interspecific hybrids made in Europe before 1900. While flowering at irregular intervals throughout the year, these plants have not produced pollen or been involved in successful crosses as females at this station. Dissection of anthers reveals the presence of normal appearing pollen in relatively small amounts, but it has not been shed at anthesis. Each plant is desirable for breeding—*D.* x Bausei for its stunning foliage color and *D.* x memoria-Corsii because of its apparent tolerance to interior environments and cooler temp.

Dieffenbachia cvs. Exotica and Perfection

These plants have produced pollen and seeds at this station. Occasionally, the pollen production is spotty but generally it is good. The foliage color patterns and compact growth habit makes these plants desirable for breeding stock. It is too early to make any statements about inheritance of these traits. There are some indications that *Dieffenbachia Hoffmannii* is the progenitor of one of these mutants.

Dieffenbachia Seguine (Jacq.)

A good pollen producer, although it has not yielded seeds as a female. Mainly valuable for its leathery foliage and could be used to increase foliage substance of the more highly colored types. These plants have strong stalks but do not sucker as much as would be desirable. It has been used as a male parent in crosses with *D. maculata* types at this station.

Dieffenbachia maculata and *D. maculata* cv. Rudolph Roehrs

Dieffenbachia maculata has been 1 parent of all the interspecific hybrids reported to date (2). We have not had plants in flower at this station yet, but the fertility is well reputed. By using both these plants as parents, we hope to find the genetic nature of the genetic change of *D. maculata* to *D. maculata* cv. Rudolph Roehrs as well as to combine the vigor of these plants with qualities of other selections.

Seedling Population "711"

These are inbred seedlings resulting from self-pollination of *D. maculata* 'Exotica'. The fertility of these plants is variable. Some seeds have been produced, but only occasionally and in very small amounts. Pollen production is generally poor, however, in some cases it has been good. It is impossible to say if the variability in pollen or seed production is genetic, environmental or a combination of both. There was no obvious appearance of inbreeding depression in these seedlings as far as growth rate is concerned. Variation in leaf variegation patterns and growth habit indicate potential for selection of desirable types (3).

A 'Sport' of *Dieffenbachia maculata* cv. Perfection

This plant has been labelled "007". It is more vigorous than its parent, but does not make a very attractive plant. Most growers rogue them out as they are somewhat leggy. However, this plant produces exceptional amounts of pollen and more seed than any other plant we have worked with to

date. One feature which is desirable is the bright striped petioles. Also, the flowers are larger than other *D. maculata* types and are capable of higher seed production.

Seedling Population "752"

The 6 seedlings from a cross of "007" with an inbred seedling from population "711" are also excellent pollen producers (only 3 have flowered at this time). One of the seedlings (752-2) is also an outstanding seed producer yielding 5 seed pods on 1 plant. Apparently, the high fertility of the "007" parent has been passed on to the offspring.

Seedling Population "751"

These are 29 seedlings from self pollinations of "007". In contrast to the above population "752", these seedlings have little fertility. Many plants have deformed flowers and have not produced any pollen, even when grown in the same greenhouse as the "752" seedlings. In this case, it seems that inbreeding was detrimental to fertility of the subsequent offspring.

The information presented above is preliminary and derived from only 1 season of pollinating dieffenbachias. As more is learned by working with these plants some of our thoughts and ideas will undoubtedly change. Suffice to say that there are readily apparent differences in plants' tendency to produce pollen or set seed. For now, plants with high fertility levels are being increased to ensure adequate seed production. In the future, more species will be collected and screened for their suitability in breeding.

Recent Acquisitions

The plants below have recently been added to our collection and have not flowered at this station.

Dieffenbachia Seguine irrorata—Beautiful 2 tone green coloration, large leaf size but leaves tend to be wrinkled after unfurling. Hopefully, it can be combined with the white variegation pattern of *D. maculata.*

Dieffenbachia Leopoldii Bull.—Already reported to have been hybridized with *D. maculata.* Has a stunning white midrib which appears to almost glow. Would also be desirable to combine with *D. Seguine irrorata.* A slow grower, but may be due to virus.

Dieffenbachia maculata cv. Jenmannii—Plants with oblong leaves with feathery ivory stripes. The plants tend to have weak stems and to be somewhat leggy. Would be a good plant to cross with *D. Seguine* for increased sturdiness and substance.

Dieffenbachia Oerstedii—A delicate smaller leaved plant which tends to be slow growing. A good plant to cross with *D. Seguine irrorata* to obtain a smaller leaved version with more color and possibly faster growth.

Dieffenbachia humilus—Very narrow leaves. May be possible to develop dieffenbachias which approach aglaonemas in appearance but would be more colorful and faster growing.

The above characteristics of these plants are all readily observable. Other hidden traits such as disease or pest resistance are also extremely important. In the future we will be screening species for potential resistance to common plant pathogens and pests. Undoubtedly, as our collection of dieffenbachias grows, the chances of finding such desirable traits will also grow.

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COLD DAMAGE TO CYCADS AND PALMS AT FAIRCHILD TROPICAL GARDEN RESULTING FROM THE JANUARY 1977 FREEZE

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Abstract. **Eight hours of freezing temperatures, falling to 26° and 25° F (–3 and –4° C), were recorded at Fairchild Tropical Garden and Montgomery Foundation Research Center on January 19th and 20th, 1977. About 56 species of cycads and 350 species of palms are planted outside at these two locations. Only a few of the species of cycads escaped frost burn to the foliage, but all had fully recovered by midsummer. By October, some 44 palms of 23 species had been lost from the effects of the cold. However, all plants of only one species were lost from the garden, and even that species survived on private property across the street from the garden. Widespread browning of the foliage of unprotected palms resulted from the freeze, but the high survival rate can be attributed largely to the practice of planting palms known to be cold sensitive under the protective canopy of live oaks and other tall trees.**

Freezing began by 8:00 p.m. and lasted 12 hours on the night of January 19-20, 1977, at Fairchild Tropical Garden (FTG) and at Montgomery Foundation (MF) Research Center and nursery which are a mile away. A low of 26° F (–3.3° C) was recorded at FTG and a low of 25° F (–3.9° C) at the nursery. These are the lowest temperatures recorded since the tropical garden was established in 1938 for the preservation of all the world's cycad species and for the collection of palms and other tropical plants.

Very rare cycads from hot, humid tropics—like *Zamia skinneri* and the epiphytic *Zamia pseudoparasitica*—are kept in the Rare Plant House where they have winter protection. Various other species are being raised in the nursery greenhouses and shade house. About 56 species can be found planted outside. Of these, Florida's native *Zamia* species, *Macrozamia moorei, Encephalartos lehmanii, Cycas revoluta,* and *Dioon edule* are the only fully exposed species observed not having the slightest cold damage. *Macrozamia lucida, M. communis, Dioon purpusii,* and *Ceratozamia mexicana* planted under loquats or other trees also escaped injury.