of places in the stem also suggests a method of rapid multiplication. In an experiment using the Florida zamia (1), plants were cut into a series of 2 cm thick sections. These, together with the root and stem remnant and the stem apex with its leaves, were planted in sand in the way already described for rooting dug plants. After 4 months, 68% of those treated with fungicide and 60% of those not treated had developed roots. In another year, all these had 1 to 6 shoots, each with 1 to 3 leaves, and were full, although rather stunted, specimens.

When the stem of a mature plant is rooted, a number of roots are initiated giving a strong root system. Dehgan and Johnson (4) have cut off the roots of seedlings of zamia and with a variety of treatments have grown back many more roots, which have the potential of giving much faster seedling growth. Response to nitrogen and potassium fertilization of seedlings and larger plants is also appreciable (8).

Does cycad propagation really deserve the reputation for difficulty and slowness which it has acquired? The answer must be yes, at present, with respect to seed propagation and growing from stem pieces and, with the restrictions on collecting, the question is largely academic as far as establishing plants from the wild is concerned.

Work in progress in a number of places may improve the situation, however. Cycads are proving to be tricky in tissue culture, but the experimental work which will eventually disclose the balance of plant growth substances that control differentiation, root growth, leaf initiation and cone formation is already suggesting chemical materials to use in the manipulation of the growth of whole plants. Gibberellic acid soaking of seeds to enhance germination is already in use, and researchers at the University of Florida are working with growth substances to increase the number and quality of roots in seedlings, to speed up early growth and to bring on flushes of leaf growth at more frequent intervals. These techniques together with a better understanding of the plants' fertilizer needs, are giving saleable plants of zamia from seed in about half the time that it used to take.

As the experimental work gives a better understanding of how cycads grow, it may well be that our perception of them as a slow growing group will change. Nurseries will see them as a profitable item and our landscape will benefit from having these interesting and useful plants readily available.

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SCREENING OLEANDER CULTIVARS FOR RESISTANCE TO WITCHES' BROOM[1,2,3,4]

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Abstract. **Selection of resistant cultivars is the most economical approach to the control of witches' broom, the most serious disease of oleander** (Nerium oleander) **in the south Florida landscape. The fungus which causes the disease,** Sphaeropsis tumefaciens, **was isolated from naturally infected oleander and grown on autoclaved, 5- to 10-mm-diameter oleander stems for 4 to 6 weeks under continuous fluorescent lighting. The fungus-colonized bark was fragmented in sterile deionized water with a blender, and the resulting slurry was swabbed onto the apices of young oleander plants. Fifteen plants each of 18 cultivars were inoculated in November 1980 and in March and July 1981. Plants showing symptoms were recorded biweekly through August 1981. None of the cultivars was immune to the fungus, but the cultivars, Hardy Pink and Isle of Capri, had few symptoms until July while symptoms in other cultivars were abundant in May.**

Oleanders (*Nerium oleander* L.) have become popular landscape plants because they are colorful, fast growing, and require little maintenance. The most important limitation to their success in Florida is the witches' broom disease. West (4) recognized the disease in 1937, and Ridings and Marlatt (1) later showed that the disease was caused by the fungus, *Sphaeropsis tumefaciens* Hedges. At present the only known control for the disease is pruning (1), but this practice is not always practical or effective in heavily infected plants or in large plantings. Chemical control is not practical because of a lack of information on appropriate chemicals and the timing of applications.

A serious epidemic of the disease has developed during the past 2 years and has increased the need for selection of

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[1]Florida Agricultural Experiment Station Journal Series No. 3511.
[2]Ms. C. Hall Thomas and Ms. S. Williams contributed technical assistance for these studies.
[3]Use of trade names in this report does not imply endorsement of the products named or criticism of similar ones not named.
[4]For English conversions of metric units, see the table provided at the beginning of these Proceedings.

oleander cultivars resistant to the pathogen. Field observations by the author and nurserymen suggested that the compact cultivars rarely acquired the disease. Thus, the work presented in this report was initiated with some optimism. The objective of this study was to identify potentially resistant cultivar(s) by comparing the susceptibility of different oleander cultivars to *S. tumefaciens*.

Methods and Materials

Isolates of the fungus were obtained from diseased oleander and bottlebrush (*Callistemon viminalis* G. Don) tissues on acidified potato dextrose agar (3). One isolate from oleander and two from bottlebrush were tested for pathogenicity by the procedure of Ridings and Marlatt (1), except that V-8 juice agar (V8) (2) was used to produce the inoculum instead of potato dextrose agar. Three shoot apices on each of two 2-year-old plants were inoculated with each isolate. Three shoot tips on each plant treated with a slurry of blended, sterile V8 served as controls. Witches' broom (WB) symptoms developed during 10 weeks following inoculation only on shoots treated with oleander isolate, 79-59, which was selected for all screening inoculations.

Inocula of isolate 79-59 were produced for the screening tests on 5- to 10-mm-diameter oleander stems autoclaved in 9-cm-diameter petri dishes with moist filter paper on the bottom. Six to seven stem segments approximately 7 cm long were prepared in each petri dish, and eight to ten petri dishes of inoculum were used at each inoculation. The autoclaved oleander stems were infested with either conidial suspensions or mycelial mass transfers of isolate 79-59 and incubated under continuous fluorescent lighting. The colonized bark of 4- to 6-week-old cultures was removed from the wood and fragmented in sterile deionized water (approximately 20 ml/petri dish) in a blender for 45 seconds. The resulting slurry contained macroconidia and mycelial fragments of the fungus and was applied with a sterile cotton swab to the apices of the experimental plants. The plants were then immediately covered with a clear plastic tent which was removed 72 hours later. No wounding of the plants occurred.

The eighteen oleander cultivars tested were obtained as cuttings from a collection at the Agricultural Research and Education Center in Fort Lauderdale. The cuttings were rooted in sterile sand under intermittent mist, transplanted in a steam-sterilized potting mix containing peat moss, cypress tree shavings, sand, and perlite (7:5:2:5 by volume) amended with 5.8 kg dolomite, 3.6 kg Osmocote® (14-14-14 resin-coated fertilizer) and 0.9 kg Micromax® per m^3 in 10 cm square pots, and were 10 weeks old at the first inoculation. After inoculation, the plants were completely randomized on raised benches under 63% shade cloth. Symptom development was recorded at biweekly intervals. The plants were transplanted to sterilized peat-sand (1:1) soil mix in 15-cm-diameter (approximately 3 liter) pots when they were 6 months old.

Ten plants of each cultivar were inoculated at the first inoculation (November 4, 1980). All ten plants plus 5 more were inoculated on March 3, 1981. Inoculated plants not showing symptoms were reinoculated on July 15, 1981.

Results and Discussion

Swelling lateral buds that preceded WB formation were characteristically pink to red in the pink- and red-flowered cultivars and white to pale green in the white- and yellow-flowered cultivars. The affected nodes were sometimes swollen when the WB began to grow. The basal portions of the WB shoots were swollen, and in the red- and pink-flowered cultivars, were colored red. Wilt and eventual death of the WB shoots followed necrosis of the basal tissue. The necrosis frequently spread and resulted in cankers that girdled the stem from which the WB emanated. The time from first swollen buds of WB to death of the WB and/or parent shoot varied from two weeks to more than three months.

One plant of 'Hawaii' developed WB symptoms in December 1980. No new symptoms were apparent on any test plant until the end of March 1981, and new symptoms continued to appear through the duration of the experiment. The first count of plants with symptoms was made in May 1981, and evaluations were made at biweekly intervals during the remainder of the experiment.

The cultivars, Hardy Pink and Isle of Capri, appeared resistant to the fungus through June (Table 1). However, by the end of August there was little difference among cultivars in the number of plants with symptoms.

Table 1. Cumulative number of oleander plants showing witches' broom symptoms following inoculation with *S. tumefaciens* on 11-4-80, 3-3-81, and 7-15-81.

Cultivar	No. of plants with symptoms[a] May	June	July	Aug.
Hardy Pink	1	1	7	9
Isle of Capri	1	4	7	10
Calypso	2	6	10	10
Sister Agnes	3	6	11	13
Sealy Pink	4	6	8	9
Yellow	4	6	12	14
Texas Var.	5	6	7	7
White	5	7	11	12
Mrs. Roeding	6	8	12	13
Apple Blossom	7	10	10	10
California Pink	7	8	12	13
Double Dark Pink	7	10	10	10
Hawaii	7	11	14	14
Hardy Red	8	9	9	9
Jannoch	9	11	12	12
Compact cultivars:				
Dwarf Salmon	8	10	10	10
Pink Dwarf	7	10	11	11
Petite Salmon	7	10	12	13

[a]A total of 15 plants inoculated.

The results of these studies indicate that all of the cultivars tested were susceptible to *S. tumefaciens*. A significant level of resistance could not be identified in any cultivar. These results are contrary to the field observations that compact cultivars rarely have WB symptoms. In these studies the compact cultivars were among the first to show symptoms. It is possible that a "field" resistance that is associated with the compact cultivars was overcome by the repeated and high inoculum levels in our tests or that some unknown mechanism for avoiding the fungus exists in a field environment.

The long delay in symptom development observed in 'Hardy Pink' and 'Isle of Capri' suggests the possibility of resistance. Evaluations at lower inoculum levels and in field plantings in areas with high levels of disease incidence may help to define the relative resistance of these cultivars.

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