veins Mimosa Yellow$_{60}2/_2$ suffused with China Rose$_0$24/$_1$; base ground color, Mimosa Yellow$_{60}2/_2$ suffused with China Rose$_0$24/$_1$; tip ground color. Mimosa Yellow$_{60}2/_2$ suffused with China Rose$_0$24/$_1$.

Compact, fast grower, 25 percent sun; introduced by A. R. Christian, Miami.

13. *RUBYII* (Pink Marble)

Leaf very large, 10 3/8" X 4 7/8"; No. 8; petiole 2 1/2" X 1/4", Chrysanthemum Crimson$_8$24/$_1$; leathery; upper surface bullate, very undulate; lower surface heavily ridged; ground color approaches Ivy Green$_{000010}$60 fading to Spinach Green$_{00}$60; spotting and blotching Rose Opal$_0$22/$_1$, Mimosa Yellow$_{60}2/_2$; margin Rose Opal$_0$22; costa Indian Lake 826/$_3$; veins Indian Lake 826/$_3$; base ground color, Rose Opal$_0$22 fading to Rose Opal$_0$22/$_2$, Mimosa Yellow$_{60}2/_2$; tip ground color, Rose Opal$_0$22.

Compact, medium grower, 50 percent sun; introduced by Ralph Davis, Miami.

14. *SIBYL GRIFFIN*

Leaf large, 10 1/2" X 5"; No. 3; petiole 1 5/8" X 3/16", Maroon$_{10}$30; leathery, waxy; upper surface undulate; lower surface slightly bullate, ground color approaches Oxblood Red$_{008}$23, veins Lettuce Green$_6$61; ground color Ivy Green$_{000010}$60; spotting and blotching Indian Orange$_7$/3, Indian Orange$_7$13/$_3$; margin Cardinal Red$_8$22/$_3$ fading to Indian Orange$_7$13; costa Cardinal Red$_8$22/$_3$; veins Cardinal Red$_8$22/$_3$; base ground color, Cardinal Red$_8$22/$_3$ fading to Indian Orange$_7$13; tip ground color, Cardinal Red$_8$22/$_3$ fading to Indian Orange$_7$13.

Compact, fast grower, 75 percent sun; introduced by Alvin Cutler, Miami.

GLADIOLUS CORM TREATMENTS IN THE CONTROL OF FUSARIUM ROT

ROBERT O. MAGIE
Pathologist
Gulf Coast Experiment Station
Bradenton

Each year about 50 million gladiolus corms or "bulbs" on Florida farms are rotted by *Fusarium oxysporum f. gladioli* Snyder and Hanson. This fungus attacks gladiolus and certain members of the iris family. It lives in the soil for many years after diseased corms are planted. It also lives from year to year in corms and cormlets by which varieties are propagated. Infected corms often do not show any rot through one or more seasons; and it is these latent or dormant infections that make the disease so difficult to control (3).

Fusarium wilt diseases of other crop plants, with few exceptions, are controlled by planting disease-free seed in soil that is free of the fungus, or by planting resistant varieties. In gladiolus, satisfactory disease control often is not possible by the first method because disease-free planting stock is not commercially available. Therefore, moving to new land is only partly effective. Satisfactory control with resistant varieties is not entirely practical either, because the shipping quality of such varieties is inferior to that of the standard commercial varieties. Furthermore, even the most resistant varieties available eventually become diseased when grown for several years on soil containing the fungus (4).

The fungus that causes fusarium rot enters corms through roots and wounds. Infection may spread from the mother corm to the new corm and cormlets. Corms may rot at any stage of growth, but most rotting generally occurs during the curing and cool storage periods. Blowing warm air over corms during the first week or ten days after digging has helped in some cases to reduce losses from rotting in storage.

The most general method of controlling fusarium corm rot is chemical treatment of the corms before planting. Mercuric chloride solution was commonly used until 1944 when Creager (1) recommended a 15-minute dip in a solution of 1 pound New Improved Ceresan in 50 gallons of water, immediately before planting. That proved to be fairly safe and effective on all varieties and is still used by many growers. During the past five years, however, N. I. Ceresan has proven unsatisfactory in several cases and growers began to use other fungicides, to treat after harvest instead of before planting, and to put more emphasis on obtaining healthier corm stocks.

Florida Agricultural Experiment Station Journal Series, No. 192.

Chemical treatment of corms at the time of "cleaning" or removal of mother corms and roots was recommended (2) because some infections occur at that time. The control of storage rot has been best in those cases in which corms were treated immediately after being "cleaned" and passed over the sizer. One of the most effective treatments is a 10 to 15 minute soak in a solution of 2 pounds Dowicide B in 50 gallons of water containing 1½ cups of a wetting agent, such as Triton X100 or Tergitol No. 7.

Many growers have been reluctant to soak corms during the curing process. Several growers are following the recommendation of dusting the corms with Spergon immediately after the cleaning operation, with results generally less satisfactory than with the Dowicide B dip. It is believed that wider use should be made of the Dowicide B dip after cleaning the corms. It has been the most effective treatment in our tests and appears to be safe on all varieties. Planting stock and small flowering corms may be retreated before planting by soaking for 10 minutes in a solution of ½ pound N.I. Ceresan in 50 gallons. Larger corms do not generally require further treatment before planting unless the stock contains considerable infection.

The aim in treating corms is two-fold: first, to protect against infection, and second, to cure infections already present. Neither objective is fully realized because infections enter new corms from roots growing in infested soil and because latent infections are often too deep to be eliminated by surface treatments. Although latent infections are not always cured, many of them are held temporarily inactive until after flowers and new corms have been formed.

Even though corms are warm-cured, carefully sorted, chemically treated, and planted in new land, complete control of fusarium rot is not obtained on the large farms. Since fungicides applied to the surfaces of corms do not eliminate latent infections, it can be assumed that a systemic fungicide is needed: a chemical that will enter the corm or cormlet and kill the fungus without seriously harming the plant's growth. A few diseases of other plants are reported to be controlled by spraying the leaves or side-dressing the plants with solutions of systemic fungicides, both chemotherapeutants and antibiotics (5). Vascular fungus diseases have been more easily controlled by systemics than some other types of diseases. The gladiolus corm rot is a vascular disease and may be especially vulnerable to systemics because initial infections and latent infections are often located in vascular tissue near the base of the corm.

Methods and Materials

Chemotherapeutants and antibiotics were applied to gladiolus roots, corms, and cormlets in various ways designed to get the fungicides into the vascular tissues where the infections are located. The following methods were tested: 1) Plants were grown in water culture to which fungicides were added before inoculation with the fungus; 2) Sprouted corms were inoculated with fungus spores and held 4 days before roots were placed in solutions of chemicals for periods of 4 to 7 days; 3) Cormlets were soaked in solution while vacuum was applied to the container; 4) Solutions thickened with methylcellulose (15 cps. Methocel, 25 g. per liter) were applied to corms before planting; 5) Solutions were adsorbed on activated charcoal and mixed in planting furrow; 6) Corms were soaked in solutions or suspensions of the fungicides for three days before planting; 7) Plants were sidedressed with solutions each week; and 8) Roots of freshly harvested plants were placed in solutions so that transpiration of leaves might cause chemicals to enter vascular tissues by way of the roots.

Picardy variety was used in all tests. Corms and cormlets from infected stocks were used in field plots and were not inoculated. For greenhouse tests, a stock believed to be free of fusarium infection was used. Fusarium spore suspensions were sprayed on roots or applied to base of corm with needle while injuring the cuticle.

Results

When spores were applied to injured corm surface, corms tended to rot regardless of treatment. When roots, whether injured or not, were inoculated, disease development was too sparse to indicate significant differences between treatments. All attempts to develop a rapid method of screening systemic fungicides in the control of this disease failed. There is evidence that most of the root inoculations resulted in infections which remained latent during the course of the tests.

Vacuum treatment. Picardy cormlets from diseased corms were soaked in water 24 hours, then placed in fungicidal solution for 30 minutes, during one minute of which a vacuum of 22 pounds was maintained. They were held ten days before planting. Good disease control was obtained with 0.25 percent streptothricin HCl and with 0.08 percent Vancide F845 emulsified (dibromo diethyl malonate), but it was found by planting daughter corms the next season that latent infections were not entirely eliminated by these treatments.

Methylcellulose treatment, in which fungicides were made to adhere to corms, resulted in good disease control with 0.8 percent solution of experimental chemotherapeutant No. 1207 (2-norcamphanemethanol) and 0.1 percent solution of experimental chemotherapeutant No. 1182 (4-chloro-3, 5-dimethylphenoxyethanol). When these and other fungicides were adsorbed on activated charcoal and placed in the planting furrow, disease control was poor.

Prolonged soaking of corms (3 days) before planting resulted in good disease control with 0.02 percent solution of Crag fungicide 974 (3, 5 - dimethyltetrahydro - 1 3, 5, 2 H-thiodiazine-2-thione) and Orthocide 50 wettable (captan) 0.5 percent. The latter stunted the plants.

Weekly sidedressing of the plants with solutions, or pouring solutions over corms in open furrow at planting, resulted in only fair to poor control.

Table 1 gives the results of one test in which freshly harvested, whole plants of old Picardy stock were placed upright for 3 hours in shallow pans containing fungicidal solutions. Promising disease control was obtained with 0.05 percent Vancide F845, 0.01 percent CP4367 (2,2′,2″-nitrilotriethanol pentachlorophenoxyacetate), and 1 gram Phygon XL (2, 3-dichloro 1, 4-naphthoquinone) in 10 ml. ethanol diluted with 30 liters of water.

It was not determined whether latent infections were eliminated by these fungicides. The results, however, are such as to encourage further research with chemotherapeutants and antibiotics. They possibly offer a method of obtaining disease-free planting stocks which would be valuable in any disease control program.

A major handicap in research on this disease is the lack of a practical method of detecting latent infections in corms. A promising line of approach has been found in corm treatments that activate these infections, causing prompt rotting. Weak fungicides and certain bactericides used as pre-planting corm soaks have caused more rotting than in untreated corms. In a series of 60 pre-planting treatments on 25 large Picardy corms each, five treatments activated fusarium rot as shown in Table 2. Corms soaked 3 days in 0.25 percent concentration of Vancide F984W were all rotted within eight weeks after planting. Those soaked in 0.05 percent penicillin were all rotted before flowering. However, less than half of the untreated corms rotted and the symptoms were slight until after flower harvest.

Further evidence of fusarium activation by chemical treatment was found when corms were soaked in a series of concentrations of certain fungicides, ranging from fungicidal dosages to very dilute concentrations. At intermediate concentrations disease development rose to a peak and then fell to the level shown by untreated corms.

TABLE 1

Gladiolus fusarium control when roots of freshly harvested, whole plants are soaked in fungicidal solutions

Fungicidal mixture	Period of soak (Hours)	Flower production index	Number of sound corms harvested*
N.I.Ceresan 0.1%	1	60	11
Phygon XL 1 g., 10 ml. ethanol, 30 liters water	3	124	24
Phygon XL 1 g., 10 ml. ethanol, 60 liters water	3	61	8
Phygon XL 1 g., 10 ml. ethanol, 300 liters water	3	3	2
Spergon (48%) 1 g., 15 cc. ethanol, 3 l. water	3	30	12
Spergon (48%) 1 g., 15 cc. ethanol, 30 l. water	3	42	6
Monsanto CP 4367, 0.05%	3	83	19
Monsanto CP 4367, 0.01%	3	125	30
Monsanto CP 4370, 0.01%	3	63	13
Phenyl mercury fixtan, 0.05%	3	63	7
Vancide F845 emulsified, 0.05%	3	142	43
Vancide F845 emulsified, 0.01%	3	75	14
Control, untreated		22	0

* 50 jumbo Picardy corms were planted in each treatment.

TABLE 2
Activation of latent fusarium infections by pre-planting corm treatments
(25 large Picardy corms per treatment)

Fungicidal mixture applied just before planting	Period of soak (Hours)	Number of spikes harvested	Number healthy corms harvested
N.I.Ceresan ¼ %	¼	19	28
N.I.Ceresan ¼ % (1 day before planting)	¼	18	26
Vancide F845 0.05% emulsified	1	23	30
Crag 974, 0.1%	72	18	33
Crag 974, 0.02%	72	30	36
Hyamine 1622, 0.5%	72	17	26
Hyamine 1622, 0.1%	72	18	21
Hyamine 1622, 0.02%	72	9	9
52-P-76 (Hyman) 0.5%	72	6	5
Vancide F1042, 0.4%	72	0	4
Vancide F1042, 0.1%	72	10	13
Vancide F984W, 0.25%	72	0	0
Penicillin G (Potassium), 0.25%	72	12	9
Penicillin G (Potassium), 0.05%	72	0	0
Control, untreated		16	20
Control, untreated		15	19
Control, untreated		23	15

Satisfactory control of fusarium rot depends on several measures of control. Corm treatment alone is not sufficient. Because of the nature of the disease, it may never be possible to obtain economic control through chemical treatment only. Experience shows that corm treatment is often helpful in control but that maintaining healthy corm stocks is more important. A few growers have discontinued treating their corms and find that their production is not impaired. These and other growers are avoiding heavy losses from the disease by 1) replacing corm stocks every three or four years with the healthiest available corms grown from planting stock; 2) planting cover crops in two out of three years; and 3) using varieties with good disease resistance.

LITERATURE CITED

1. Creager, D. B. Treating gladiolus corms. Florists Rev. **97** (2517): 39-40. 1946.

2. Magie, R. O. and H. N. Miller. Gladiolus storage rot control. Florists Rev. **105** (2707): 27-28. 1949.

3. Magie, R. O. A new approach to control of gladiolus fusarium disease. Florists Rev. **107** (2759): 92-94. 1950.

4. Magie, R. O. Limitations of resistance to gladiolus fusarium disease. The Gladiolus Mag. **15** (4): 2, 36-38. 1951.

5. Sharvelle, Eric. Systemic fungicides in 1951: British investigations. Plant Disease Reporter 36 (2): 35-43. 1952.

USE OF DEMETON (SYSTOX) FOR CONTROLLING INSECTS OF ORNAMENTALS

L. C. KUITERT

Entomologist, Florida Experiment Stations

Gainesville

Entomologists have for some time, either in jest or in imagination, envisioned controlling insect pests by introducing a poison into the plant vascular system. The poison then would be carried to all parts of the plant, thereby making the plant toxic to the insects feeding on it. In 1933 the dream was partially realized when Gnadiger (1) described the results he obtained using selenium for the control of various species of red spider infesting greenhouse plants, including asters, gladioli, and carnations. From this beginning, selenium eventually came to be used by a small segment of nurserymen for controlling mites, thrips, aphids and foliar nematodes. Its use was restricted due to the fact that selenium cannot be used on food crops because of its extreme toxicity to warm blooded animals.

Shortly after World War II, Schrader (2) reported that a number of phosphatic compounds were readily absorbed by growing plants and that these were translocated to all parts of the plant rendering the plant juices and tissues poisonous to insects feeding thereon. One of these compounds is demeton (Systox) and it appears, on the basis of biological assay, although not conclusively perhaps, that it breaks down in 5 to 8 weeks when applied as a spray and in 2 to 3 months when applied to the soil. Because the desired factor is now supplied, a vast new field of insect control is opened having tremendous possibilities.