

Virus Diseases of Orchids

symptoms, spread, host range, distribution, and control practices determined by experimental transmissions

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Viruses affect at least 10 different orchid genera.

The symptoms produced by viruses in orchid plants are diverse, depending upon the virus, the kind of orchid and the environmental conditions. Among the symptoms which suggest virus infection are: local lesions of dead or dying tissue, partial or complete rings of lighter or darker than normal tissue, light and dark green mottle and streaking of the leaves, yellowing of parts of the leaves, dying of the leaves or portions of leaves, malformation of the leaves or flowers, stunting of the plant, and breaking or variegation in the color of the flowers.

Virus diseases increase among orchid plants in two ways. The most common is probably by division and backbulb propagation from plants already carrying virus. The prevalence of vegetative propagation in orchid culture makes this practice a major means of virus perpetuation and distribution when the plants being divided are already infected.

The second—and natural—means of spread is by insects. Although spread of orchid viruses by insects appears to be less common than by vegetative propagation, it is of great fundamental importance, because in nature only the insects appear capable of introducing the virus into a previously healthy plant.

Experimentally, viruses can be transmitted to healthy plants in a number of ways, such as grafting and dodder transmission, mechanical inoculation—rubbing expressed juice from diseased plants onto the surfaces of healthy plants, usually in the presence of a fine abrasive such as carborundum powder—soil transmission, and by means of insect vectors.

Thus far, aphids are the only insects reported to transmit orchid viruses, but research in this field is still in its early stages.

Although orchid viruses can be transmitted experimentally to healthy plants by mechanical inoculation, no evidence has yet been presented to indicate that

virus spread occurs in greenhouses as a result of contaminated knives, or other tools.

Disease Prevention

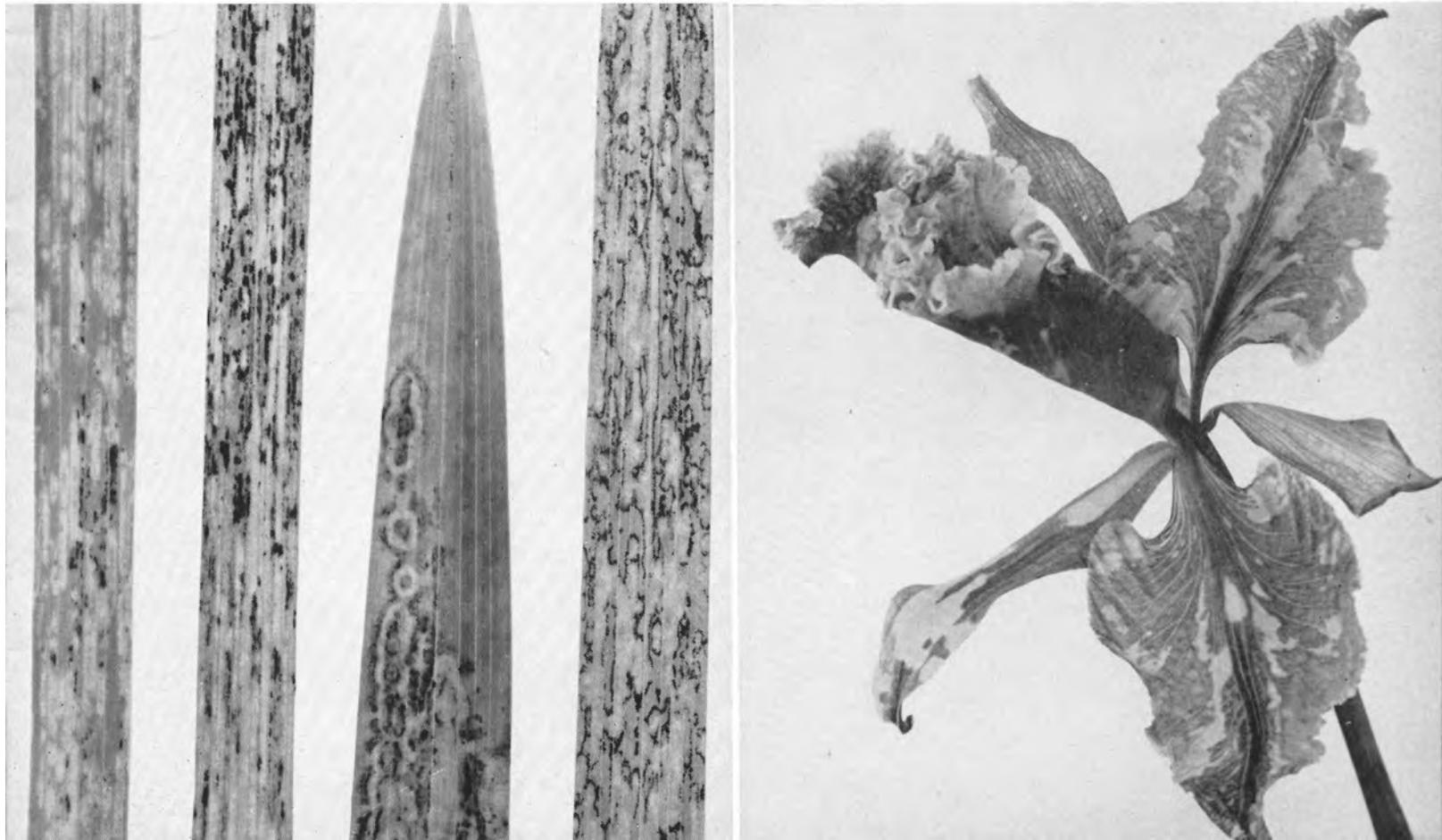
Failure to date to cure virus-infected orchid plants makes the control problem one of disease prevention rather than cure. Among the most important aspects of virus control are the following: 1, use of seedlings since virus is not known to be transmitted through the seed of orchids; 2, selection of virus-free propagation stock; 3, roguing and destruction or isolation of diseased plants; and 4, protection of healthy plants from infection through virus-carrying insects.

An important step in the control of orchid viruses is the careful selection of virus-free stock to be used in the multiplication of plants by vegetative propagation.

The role of insect vectors in virus

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Left: *Cymbidium* mosaic symptoms in *Cymbidium* leaves. Right: Typical symptoms of *Cattleya* flower breaking.



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spread can be reduced by eliminating as many virus reservoirs as possible and by protecting the healthy plants from infective vectors.

Plants which develop virus breaking in the flowers should be destroyed or isolated from the healthy stock. This is particularly important during the time plants carry exposed flowers or flower buds because these are the tissues in which aphids feed most readily.

Control of the insect vector population can be accomplished by timely application of proper insecticides, by keeping orchid houses as nearly insectproof as possible, and by the elimination from the orchid houses of weeds and other host plants.

A few viruses of nonorchidaceous plants can be inactivated in their hosts by heat treatment without seriously injuring the plants. However, most plants are killed at temperatures lower than those required to inactivate the virus. Attempts to cure *Cattleya* and *Cymbidium* of virus infection by hot water treatment have been unsuccessful.

Cattleya Flower Breaking

One of the most serious virus diseases of orchids in California is *Cattleya* Flower Breaking which is characterized by variegation—breaking the color—of the flowers of *Cattleya* and such bigeneric and trigeneric hybrids as *Laeliocattleya*, *Brassocattleya*, and *Brassolaeliocattleya*. Two distinct viruses occur in *Cattleya* and both are capable of causing flower breaking.

In addition to the abnormal color patterns induced in the flowers, virus may cause some malformation of the floral parts such as rolling and twisting of the sepals and petals. Such distortion is most commonly associated with very pronounced and coarse breaking and not with the milder forms.

The green peach aphid, *Myzus persicae*, is known to be a vector of the virus from *Cattleya* to *Cattleya*. The common orchid aphid, *Cerataphis lataniae*, has thus far failed to transmit virus.

The host range of the virus includes 28 species and hybrids of *Cattleya*, 15 of *Laeliocattleya*, four of *Brassocattleya*, and two *Brassolaeliocattleya*. The species found infected most frequently are *C. mossiae* and *C. trianae*.

The two viruses causing breaking in *Cattleya* flowers have different host relationships. One is transmissible to *Cymbidium*, but not to *Odontoglossum grande*. The other virus produces ring-spot symptoms in *O. grande* in about two weeks, but requires approximately one

year to cause diamond mottle symptoms in *Cymbidium*.

Cattleya flower breaking apparently spreads in the native forest areas because mosaic is present in some of the *Cattleya* plants imported from tropical America upon their arrival in the United States. The disease is recognized primarily by the flower breaking, the leaf symptoms frequently being overlooked or absent. Since orchids are normally shipped when not in flower, it is probable that unknowingly diseased plants have been shipped to all parts of the world where orchids are grown. The disease is definitely known to occur in Hawaii and several localities in the United States.

Cymbidium Mosaic

A second important virus disease of orchids in California, *Cymbidium* mosaic—or black streak disease—is probably the most common virus disease known in orchids.

The symptoms vary considerably in pattern and severity. Symptoms appear first on the new growth about six weeks after infection as small, inconspicuous, elongate chlorotic areas. Frequently these are initially confined to the leaf blade on one side of the midrib. After a few days the spots and streaks become more sharply defined. Within one to three weeks the affected area enlarges as a pale chlorotic patch approximately $\frac{3}{4}$ " long, occasionally containing small streaks of darker green tissue. Subsequent growth shows increasing contrast between the light and dark green areas, and within three or four months sufficient symptom-bearing tissue has grown to make the disease conspicuous.

Within six months after infection, black spots and streaks sometimes appear on the under side of the older infected leaves. Necrosis in the youngest leaves usually appears only in very severe cases. Leaves having severe and extensive necrotic areas are dropped prematurely.

The effect of the disease on the general growth and vigor of the plants is variable. Some plants show definite but relatively mild symptoms, while on others the amount of chlorotic and necrotic tissue is so great that growth is severely retarded. There is no evidence that mosaic plants throw off the virus, but the mottling, which is so evident on the young leaves, sometimes becomes inconspicuous in old leaves.

Cymbidium mosaic virus causes no breaking in the color or malformation of the flowers but flower production is affected indirectly as a result of the retarded growth suffered by the plant.

Transmission of the virus causing *Cymbidium* mosaic—in several *Cymbidium* species as well as in some of their hybrids—is undoubtedly due to the

natural activity of insect vectors. Preliminary work indicates that aphids are capable of transmitting the virus.

In California the rate at which *Cymbidium* mosaic spreads among previously healthy plants appears to be slow or very sporadic. An inspection made of 13,000 individual seedlings grown for one to five years in a lathhouse or in the open ground revealed none to be infected despite the fact that diseased plants had been growing in relatively close proximity—a few feet or yards—the entire time. However, in the same localities, hybrids produced 20 to 25 years ago had acquired the disease.

Other Viruses

Viruses also have been transmitted experimentally from the following orchids: *Dendrobium nobile*, *Laelia anceps*, *Odontoglossum grande*, *Oncidium rogers* and *Vanda Miss Joaquim*.

Symptoms which are apparently caused by virus have been observed on the following orchids but experimental transmission has not yet been accomplished: *Lycaste aromatica*; *Miltonia roezlii*; *Stanhopea*; *Vanda caerulea*; and *Catasetum*.

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Leaf mosaic symptoms caused in *Cattleya* by flower breaking virus. Left, on a young shoot; right, on mature leaf.

