Quick Decline Virus

transmission tests indict the melon aphid as one vector of the disease

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The virus of citrus quick decline is transmitted by the melon aphid, *Aphis gossypii* Glover.

The melon aphid appears to be an inefficient vector. The first 20 tests, involving about 3,200 melon aphids, resulted in just two transmissions—which indicated an efficiency of about one in 1,600.

An efficiency of one in 1,600 means that on the average, only one insect in 1,600 moving from an infected tree to a healthy tree is able to infect the healthy tree. These figures are preliminary and probably will be changed by later results.

There may be other vectors such as the various treehoppers which are somewhat suspected, but as yet there is not enough convincing evidence.

The melon aphid breeds on citrus and on a very long list of other plants. It is the second most widespread aphid on earth so it will be found on citrus trees at least occasionally wherever they are grown. On citrus it lives only on the young leaves and buds. While the melon aphid has a considerable range of color—dark gray, tan, greenish, pale yellow—on some of its host plants, it is almost always dark gray when growing on citrus. In the field it may be easily confused with the black citrus aphid, the cowpea aphid and the bean aphid which also grow on citrus.

Transmission tests were conducted by feeding insects—of various suspected species—on trees infected with quick decline and then transferring them to small, healthy test trees.

The insects were confined to the trees in small sleeve cages. The first transmission tests were made under field conditions. Later, two large screened houses were built to protect the test trees from natural infection.

By November 1, 1950 312 species of insects and mites had been used in transmission tests. Individual insects and mites—totaling 411,435—were used in 2,185 transfer tests.

Particular care was taken to make adequate tests of the aphids that breed on citrus and of the leafhoppers most commonly found on orange trees. The aphids were suspected because the virus which causes the tristeza disease of South America—similar to the citrus quick decline in California—is transmitted by the brown citrus aphid, *Aphis citricidus* Kirkaldy.

Leafhoppers were suspected because most plant viruses that produce symptoms similar to quick decline are carried by leafhoppers.

Nursery trees of susceptible root-scion combination planted in the field show symptoms 15 or more months after inoculation. Smaller trees planted in the screen house show symptoms of varying intensity after three to 12 months. Following these symptoms the trees sometimes reach a condition of balance in which the symptoms are obscure. It seems probable that under certain weather conditions trees may reach this condition without showing recognizable symptoms. Apparently it is quite likely that up to the present many trees that were actually infected have not been recognized.

The first table above shows the insects used in transmission tests on the definite cases of quick decline that have appeared to date. Sixteen of the 18 trees listed in the second table above had the melon aphid, *Aphis gossypii* Glover placed on them, either alone or in combination with treehoppers. Two had treehoppers—*Membracids*—only. *Spissistilus*—(*Stictocephala*)—*festinus* Say is the three-cornered alfalfa hopper. The three undescribed species of *Stictocephala* belong to the *Stictocephala*—(*Ceresa*)—*albidosparsa*—Stål—group. Treehoppers in California do not breed on citrus. The most common species is the three-cornered alfalfa hopper which breeds in large numbers on alfalfa in southern California.

During the spring aphid season of 1950—a relatively light aphid year—a survey of the citrus aphid populations was conducted throughout the southern and central California citrus districts, other years may not give the same picture. Orchards were sampled by counting the number of each aphid species found on 10 twigs on each of 10 trees.

The coastal area includes San Diego County, San Juan Capistrano, Orange County southwest of Santa Ana and Garden Grove, the corresponding part of Los Angeles County, and Ventura County west of Saticoy.

The intermediate area includes Orange County north and east of Santa Ana and Buena Park; La Habra, Whittier and Pico, an area including that part of Los Angeles County east of the metropolitan area; and the Ontario-Upland part of San Bernardino County; the San Fernando Valley; and Ventura County east of Saticoy.

The interior area includes the citrus districts between Ontario and San Gorgonio Pass, Corona, and Elsinore.

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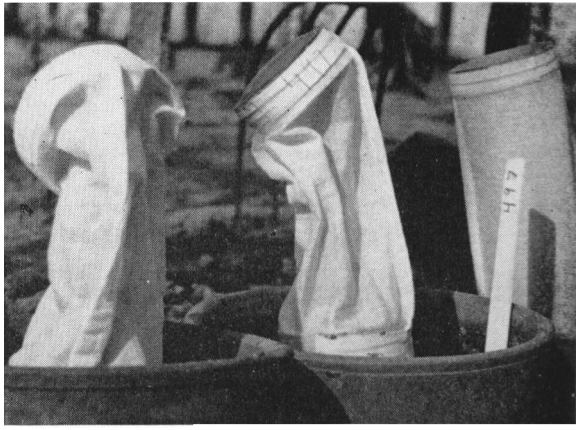
Insects and Mites Used in Transmission Tests to Find the Vectors of Citrus Quick Decline.

Insect group	Number		
	Tests	Species	Insects
Aphids	654	42	363,092
Leafhoppers	958	170	20,021
Treehoppers	361	16	8,263
Fulgorids	65	29	670
Psyllids	36	18	1,766
Spittlebugs	12	4	125
Whiteflies	3	2	48
Scale insects	16	4	10,091
Lygaeid bugs	11	2	449
Plant bugs	11	5	141
Thrips	35	6	5,474
Red spider mites	6	2	510
Others	19	12	1,285
Totals	2,185	312	411,435

Insects Used on Test Trees that Have Shown Definite Quick Decline Symptoms.

Insects used in these trees		No. of trees showing symptoms
No.	Species	
11,206	*Aphis gossypii* Glover	13
2,200 10	*Aphis gossypii* Glover *Spissistilus franciscanus* (Stål) *nigricans* (Van Duzee)	1
1,500 25	*Aphis gossypii* Glover *Spissistilus festinus* (Say)	1
700 15 12	*Aphis gossypii* Glover *Spissistilus franciscanus* (Stål) *nigricans* (Van Duzee) *Spissistilus festinus* (Say)	1
16 4	*Spissistilus franciscanus* (Stål) *nigricans* (Van Duzee) *Spissistilus festinus* (Say)	1
26	Three undescribed species of *Stictocephala*	1



Sleeve cages containing insects under test as vectors of the quick decline virus.

Sleeve cage transmission trials tested 312 suspected species of insects and mites.

VIRUS

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The aphid populations differed markedly among the different localities. The cowpea aphid, *Aphis medicaginis* Koch was the most common aphid in the desert and San Joaquin Valley areas, and became progressively less common as the coast was approached. The green citrus aphid, *Aphis spiraecola* Patch, which made up the bulk of the citrus aphid populations in most of southern California, was not found on the desert and in the San Joaquin Valley. The black citrus aphid, *Toxoptera aurantii*—Fonsc—was primarily a coastal species.

The melon aphid was found most abundantly in the intermediate area this year. This area includes the localities in which quick decline has spread most rapidly. It also includes the Ventura County area in which the quick decline disease has appeared recently.

The interior area showed much lower melon aphid populations. If this aphid is the only vector of quick decline virus, and if citrus aphid populations in other years show the same distribution, the quick decline should spread slowly in the interior districts. It should spread even more slowly in the desert and in the San Joaquin Valley.

Estimates of Aphid Populations on Citrus Trees in Various California Citrus Areas in the Spring of 1950

Aphid species	Per cent of populations				
	Coastal	Inter-mediate	Interior	Desert	San Joaquin Valley
Melon aphid	6.3	13.6	3.5	0	0.5
Green citrus aphid	58.3	78.4	80.7	0	0
Cowpea aphid	0.1	0.8	2.3	70.7	94.7
Green peach aphid	4.3	2.6	11.7	29.3	1.2
Potato aphid	0	0.2	1.7	0	3.4
Foxglove aphid	0	0.04	0.1	0	0.1
Black citrus aphid	28.0	4.4	0.02	0	0
Sunflower aphid	3.1	0	0	0	0
Total aphids per tree	7,085	61,110	11,570	11,960	6,890
Melon aphids per tree	442	8,287	409	0	39

It appears improbable that the control of aphid populations by insecticides in individual citrus groves will slow the spread of quick decline enough to make it practical.

The spread is by winged melon aphids that fly from infected orange or other citrus trees to healthy orange trees. The infection of a healthy orange tree very probably takes place within the first few minutes that the aphid feeds on it. Killing her—all melon aphids are females—after she has infected the tree is futile.

To effectively reduce the spread of the virus it would be necessary to keep aphids carrying the virus from landing on and feeding on healthy trees. An effective aphid repellent would be the obvious answer, but none is known. Another method would be to keep the melon aphids from breeding upon infected trees since these are the aphids that are most likely to carry the virus. But it would not be enough to keep the aphids killed off the trees showing quick decline symptoms.

Transmission may take place from infected trees on sweet orange root that will never show symptoms or from infected trees on sour orange root that have not yet shown any sign of the disease. It would be necessary to keep the melon aphid populations very low on all citrus trees for some—not known—distance around the orchard to be protected. On rare occasions aphids can be carried long distances by wind, but it is probable that they ordinarily move not more than five miles and that flights of less than a mile are the usual rule. Most commonly they fly only short distances, sometimes from one tree to the next.

Perfect aphid control in an orange orchard should reduce the spread of quick decline slightly, but most orange orchards are too small units to expect aphid control to give practical protection from the spread of citrus quick decline.

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CHRYSANTHEMUM

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and an approved respirator—as well as protective clothing and care in handling—is necessary during mixing and application.

The main advantage in the use of OMPA for control of the two-spotted spider mite on chrysanthemums is in the ease of application. One hundred per cent control was obtained in all cases, when the top coverage of the plants was thorough. When coverage on the lower, older leaves was spotty, control of the mites was found to be incomplete.

In small plots consisting each of several hundred plants—as well as in a small cloth-house containing about 4,000 plants—it was five weeks following treatment with OMPA before a reinfestation of spider mites was found. The OMPA formulation was applied at a rate of two or three pints per 100 gallons of water, and the lighter infestations of mites were treated with the lighter dosage in these tests.

OMPA is excellent for aphid control. Several species of aphids feed on chrysanthemums—the leaf-curl plum aphid, the green peach aphid, the chrysanthemum aphid, and the cotton or melon aphid are found most commonly. The leaf-curl plum aphid is the most difficult to control, because it penetrates the buds so deeply.

Experimental results indicate that all of these aphids may be controlled with applications of two pints of the OMPA formulation per 100 gallons of water at a minimum of three weeks apart.

No adverse affects to chrysanthemums were noted in experimental work with OMPA. Applications were made to immature plants as well as to flowers coming into bloom, and observations continued until cutting.

In addition to a number of plots—several hundred plants each—about 6,000 plants were treated with dosages of one pound of OMPA per 100 gallons of water. Varieties included were: Lemon Yellow, Buckingham, Kashima Red, Bright Rose, Spiders—pink, yellow, and white—Rayonant, Fuji—white, pink, yellow, bronze—Indianapolis, J. W. Prince, Good News, Detroit News, Armistice Day, Wait's—bronze and yellows—Albatross—notorious for aphid infestation—and Turner's—yellow and white.

Another 4,000 plants—representing Masterpiece and Mefo varieties—received 1½ pounds OMPA per 100 gallons of water and again no plant injury was evident. No spider mites were present on these plants when cut one month later, whereas the checks were unmarketable.

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