A healthy fuchsia, such as the one at left, is one of the most attractive and popular of flowering plants among California home gardeners and hobbyists. The recently discovered fuchsia gall mite disfigures plants, causing twisted and distorted leaves and swelling and reddening of tissues.

Fuchsia gall mite management

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Pruning plus chemical sprays are needed to keep susceptible plants healthy

In 1981, an eriophyid mite new to North America was discovered disfiguring fuchsias in San Francisco County. Identified by T. Kona, California Department of Food and Agriculture, as *Aculops fuchsiae* Keifer, this gall mite is believed to be native to Brazil. Over the next several years, the fuchsia gall mite spread quickly and is now reported from Mendocino to San Diego County.

This mite infests the growing points, young leaves, and blossoms of fuchsia. As a result of hormonal-like substances that the mites inject into plant tissue as they feed, infested growth becomes twisted and stunted, grotesquely swollen and blistered, and often reddened.

Biology

Attempts to rear the fuchsia gall mite under greenhouse conditions were mostly unsuccessful, suggesting that it responds preferentially to cool temperatures. This has been confirmed by the ease of inoculating plants with gall mites outdoors. The rapid spread of the mite coastally and lesser spread into the warmer inland areas further suggest that this is a cool-weather species.

Like some other eriophyids that have been studied in greater detail, the gall mite probably is spread locally by wind, as well as by bees and hummingbirds that visit flowers. Movement of infested plants or cuttings also helps spread the mite. The popularity of fuchsias among home gardeners and hobbyists and the ease of their vegetative propagation virtually ensure widespread dissemination of foliar disorders of these plants.

The mites live and reproduce within the folds of galled tissue and among the plant hairs. As the plants grow, some mites leave the galls and move upward to attack new growth and blossoms, and in time can stop all new growth.

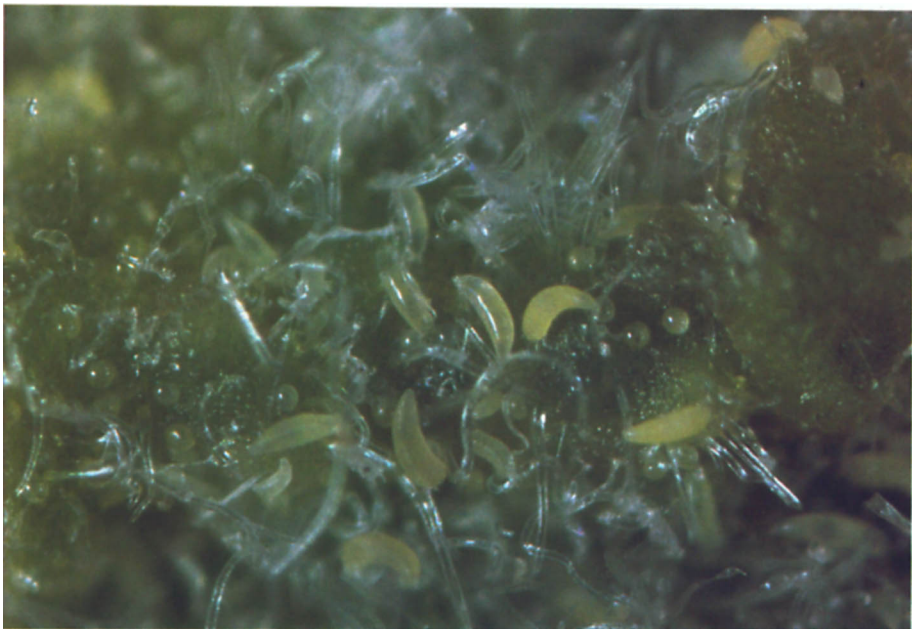
A predaceous mite, *Amblysieus californicus* (McGregor), has increasingly been found in association with the fuchsia gall mite. The future role of this native predator is uncertain. As with many newly introduced pests, however, it appears that fuchsia gall mite populations already are being dampened by this and other predators taking advantage of a new food source.

Chemical control experiments

In a lathhouse at the Deciduous Fruit Field Station, San Jose, we conducted a series of five experiments to evaluate pesticides for fuchsia gall mite control. All experiments used the fuchsia cultivar Display, grown in 1-gallon nursery containers, in a randomized complete block design with single-plant plots, and all treatments were replicated four times.

Fuchsias were inoculated with mite-galled tissue placed on the plants. Several weeks later, after new galls began to form, the plants were sprayed to the point of complete coverage with a hand compression sprayer. Periodically thereafter, samples of galled tissue were pinched from each plant and the gall mites counted under magnification. When the mite count for any one gall sample reached 100, further counting of that sample was discontinued.

Although many of the common insecticides such as diazinon and malathion sup-



Jack Kelly Clark

The microscopic fuchsia gall mites live and reproduce in the folds of galled tissue and among the plant hairs. The round bodies in the photo are mite eggs.

pressed the fuchsia gall mite, the degree of suppression was not sufficient for lasting control because of rapid mite reproduction after treatment (table 1). The same held true for the more common miticides such as dicofol, propargite, and fenbutatin-oxide. Carbaryl and endosulfan, however, have kept plants free of mites for many weeks in repeated tests. Since these tests were conducted with treated and untreated plants closely intermixed, it is believed that carbaryl and endosulfan are sufficiently effective to give long-lasting control.

Spraying and pruning trials

Carbaryl was used in an experiment evaluating various combinations of spraying and pruning schedules for gall mite control. At the Deciduous Fruit Field Station in 1983, seven cultivars (Christmas, Display, Joni, Little Ronnie, Louise Emershaw, Peppermint Stick, and Susan) were planted outdoors. The entire planting of 42 fuchsias was covered with a shade tent. The experiment, from July 21 to October 31, included sprays every two weeks (seven applications) or four weeks (four applications). Pruning consisted of removing all galled tissue.

All spraying schedules, with or without pruning, greatly improved the appearance of plants, compared with those in the unpruned, unsprayed control or the pruning-only treatment (table 2). On several of the less mite-susceptible cultivars, such as Joni and Louise Emershaw, however, pruning alone was modestly effective in keeping the plants attractive. There was no benefit from spraying every two weeks compared with every four, as long as galled growth was pruned off before spraying started.

Carbaryl was not phytotoxic to any of the seven fuchsia cultivars, although its repeated use caused a problem with the twospotted spider mite, *Tetranychus urticae* Koch.

Resistant fuchsias

At Blake Garden in Kensington, Contra Costa County, we evaluated a number of fuchsia species and cultivars in 1984 to determine their susceptibility to the fuchsia gall mite. Inoculation with the mite was by means of several mite-infested galls placed on each plant grown outdoors in 1-gallon containers. After six to eight weeks, each plant was examined and given a numerical score indicating the degree of injury caused by the fuchsia gall mite.

Nine fuchsia species or cultivars were highly resistant to the gall mite (table 3). Although these were given a rating of 1.0, indicating that no injury symptoms were seen, more than half in fact did support low numbers of mites. After the first test in which these nine were evaluated, they were again challenged with mites, with the same results as earlier. Other fuchsia species or cultivars were found moderately resistant, but most were moderately to highly susceptible to gall mite injury.

Heat treatment

The earlier observation, that fuchsia gall mite seemed to prefer relatively cool temperatures, encouraged consideration of heat treatment of mite-infested plants as a means of disinfesting them. Accordingly, two severely galled plants of each of four cultivars were placed in an incubator for 3½ hours at 45°C (113°F). Three days later, samples of galled growth taken from these plants were examined under magnification.

The presence of living mites foreclosed heat treatment as a means of disinfesting fuchsias, at least as performed in this test. Normal foliage of the plants held up well, but blossoms and some of the gall-mite-blistered foliage soon became necrotic as a result of the heat treatment.

Conclusions

Most fuchsias grown within the area infested by the gall mite will require some form of management to keep plants

TABLE 1. Effectiveness of various pesticides for control of the fuchsia gall mite. San Jose, California, 1982-84

Material	Rate*	Mite count on days after first spray†		
Test 1 (sprayed 10/5/82)		**8 days**	**14 days**	**23 days**
Carbaryl	1.0	0 a	0 a	2 a
Diazinon	0.5	3 ab	22 ab	70 a
Malathion	1.0	17 ab	10 ab	54 a
Lime-sulfur (Orthorix)	2.0 qt	29 bc	14 ab	40 a
Acephate + dicofol (Isotox)	0.77 + 0.29	56 cd	1 a	64 a
Soap (Safers)	9.4 qt	61 cd	51 b	76 a
Dicofol	0.4	75 cd	9 ab	30 a
Untreated	—	100 d	75 b	73 a
Test 2 (sprayed 3/30 & 4/20/83)		**14 days‡**	**35 days**	**42 days**
Endosulfan	0.5	0 a	0 a	0 a
Carbaryl	1.0	1 a	0 a	0 a
Dicofol	0.4	25 a	3 a	8 a
Malathion	1.0	75 b	84 b	77 b
Untreated	—	90 b	100 b	100 b
Test 3 (sprayed 11/8/83)		**21 days**	**35 days**	**57 days**
Endosulfan	0.5	0 a	0 a	0 a
Carbaryl	1.0	0 a	0 a	37 abc
Propargite	0.3	0 a	9 a	37 abc
Ethion + oil	0.3 + 1.1 qt	0 a	26 a	4 ab
Fenbutatin-oxide	0.5	9 a	25 a	92 c
Dicofol	0.4	8 a	42 a	50 abc
Untreated	—	62 b	64 a	65 bc

* Rates: pounds active ingredient per 100 gallons water, unless otherwise indicated.
† Means followed by the same letter in a column are not significantly different according to Duncan's Multiple Range Test (DMRT) (5% level).
‡ Second spray applied after the 14-day count.

TABLE 2. Evaluation of various pruning and carbaryl spraying schedules for control of fuchsia gall mite, San Jose, California, 1983

Treatment		Average injury rating†
Pruning	Spraying intervals*	
	weeks	
All galls at start	2	1.0 a‡
All galls at start	4	1.4 ab
None	2	1.1 ab
None	4	1.6 b
Every 2 weeks	None	2.7 c
None (control)	None	3.4 d

* Carbaryl applied at 1 pound active ingredient per 100 gallons water.
† Rating of injury on October 31 on a scale of 1 to 4: 1 = no symptoms of gall mite injury; 4 = severe gall mite injury.
‡ Means followed by the same letter are not significantly different according to DMRT (5% level).

TABLE 3. Ratings of gall mite injury on fuchsia species and cultivars evaluated for resistance, Kensington, California, 1984

Fuchsia	No. plants tested	Avg. injury rating*
Plants inoculated March 8, evaluated May 7		
Baby Chang	2	1.0
Chance Encounter	2	1.0
Cinnabarina	1	1.0
F. minutiflora	3	1.0
F. thymifolia	2	1.0
Isis	2	1.0
Mendocino Mini	3	1.0
Miniature Jewels	3	1.0
Ocean Mist	1	1.0
Golden West	3	1.7
Englander	4	1.8
F. arborescens	3	2.0
Dollar Princess	4	2.3
F. procumbens	4	2.3
Lena	4	2.3
Raspberry	4	2.8
Capri	4	3.0
Louise Emershaw	4	3.0
F. magellanica	4	3.5
China Doll	4	3.8
Christy	4	3.8
Display	4	3.8
Plants inoculated May 11, evaluated June 22		
Voodoo	4	1.5
Dollar Princess	3	2.0
Pink Marshmallow	4	2.3
Psychedelic	4	2.3
Golden Anne	4	2.5
Kaleidoscope	4	2.8
Tinker Bell	4	2.8
Troubadour	4	2.8
Angel's Flight	3	3.0
Bicentennial	4	3.0
Dark Eyes	4	3.0
First Love	4	3.0
Lisa	3	3.0
Novella	4	3.0
Swingtime	4	3.0
Vienna Waltz	4	3.0
Kathy Louise	4	3.3
Marinka	3	3.3
Papoose	4	3.3
Jingle Bells	4	3.5
South Gate	4	3.5
F. magellanica	4	3.8
Display	4	4.0

* 1 = no symptoms; 2 = trace of injury; 3 = moderate injury; 4 = severe injury.

Foliar discoloration on carbaryl-treated fuchsia plants was attributed to spider mite feeding (plant in center of row) and not to chemical injury.

attractive. The intensity of management required depends on how susceptible a given fuchsia is to the gall mite. Pruning off mite-galled tissue whenever it is seen will keep plants of low to moderate susceptibility (to about 2.5, table 3) in an acceptable condition. Plants of higher susceptibility require pruning first to remove all galled growth, then thorough spraying with carbaryl or endosulfan; this process should be repeated two to three weeks later. If carbaryl is used, a miticide such as dicofol probably should be added to the spray tank to prevent spider mite outbreaks, but this may not be necessary if only two applications of carbaryl are made. After two applications of either carbaryl or endosulfan, several months of mite-damage-free fuchsia growth can be expected.

Practical chemical control depends on thorough spray coverage. The most opportune time is in the spring, after all the old galls and excess foliage have been removed. Adding a wetting agent to the sprays at a rate of 2 ounces per 100 gallons of water will help wet the new growth and galls. Carbaryl is a more appropriate insecticide for the home gardener because of its much lower toxicity, but endosulfan would be a useful tool for the commercial fuchsia grower.

Growing fuchsias highly resistant to *A. fuchsiae* is another means of managing the mite. Nine such fuchsias have been identified in this research, and their use would completely negate the need for spraying. Most of these highly resistant fuchsias are not the large-flowered cultivars most often seen in the marketplace, but have tiny leaves and flowers. It is hoped, however, that fuchsia hybridizers will use them to develop new cultivars having both good horticultural qualities and high resistance to the fuchsia gall mite.

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