UPDATE ON WESTERN FLOWER THRIPS AND TOMATO SPOTTED WILT VIRUS

by James R. Baker and Ronald K. Jones

Although we have written various articles on the western flower thrips and tomato spotted wilt virus over the past months (NC Flower Growers Bulletins 29 (1), 29(4), 30(3), 30(4), 31(5)), because of the widespread occurrence of western flower thrips and the small but growing number of cases of tomato spotted wilt virus in greenhouses across North Carolina, it seems appropriate to call more attention to this grave threat to the flower growing industry. At one time the western flower thrips was restricted in its range to the western United States and Canada, but because of its extraordinary pesticide resistance (Robb et al., 1988) it now breeds successfully in greenhouses all year long. The western flower thrips is easily spread through industry channels on flowering crops. This thrips has become entrenched in commercial greenhouses throughout the United States and numerous countries around the world. Flower growers often have an extremely difficult time eradicating this thrips. Although the western flower thrips is a very damaging pest in its own right, its potential for harm is greater as a vector of the tomato spotted wilt virus.

Tomato spotted wilt virus has become established in the propagation stock of some large firms so that the likelihood of any one greenhouse of receiving thrips from one source and tomato spotted wilt infected plants from another source is too high. Bitter experience has shown that once tomato spotted wilt virus becomes established in a commercial greenhouse, the process of eradicating the disease and its vector is difficult, costly and time consuming.

One major problem with detecting the presence of tomato spotted wilt virus is that all virus infected plants do not react to the commercial ELISA serological assay kit that is on the market now. Thus sole reliance on this valuable but only partially effective tool may lead to the distribution of infected plant material by honest and well-meaning plant propagators.

Tomato spotted wilt virus has historically been a problem in South and Central America, Mexico and southwestern and western parts of the United States and Hawaii on several vegetable crops including tomato, potato, etc. During the past several years, tomato spotted wilt virus has caused severe damage to tomato, tobacco and peanut crops along the gulf coast states from Texas to the panhandle of Florida and north into Tennessee and Kentucky. Greenhouse flower growers in southeastern Texas and several other western states are in the area of natural infestation and have battled this problem for several years. In North Carolina, one commercial flower grower has had problems with western flower thrips and tomato spotted wilt virus with a loss of 100% of 10,000 gloxinia pots in 1986 during a heavy thrips infestation and 5% loss of Reiger begonia production during a light thrips infestation in the spring of 1987. Another North Carolina grower has been forced to discard 12,000 New Guinea impatiens baskets in the spring of 1988 as well as thousands of other types of ornamentals. Still other growers have discarded hundreds of gloxinias, exacum, begonia, and impatiens (African and New Guinea) because of the tomato spotted wilt virus.

Thus far, tomato spotted wilt virus has not been found outdoors in North Carolina. However, the presence of tomato spotted wilt virus infected plants in greenhouses which also grow tomato, pepper, dahlia,

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and other bedding plants represents a real threat to the trellis tomato, burley tobacco, flue cured tobacco, and peanut industries as well as home gardens. Tomato spotted wilt virus was introduced into Rhodesia in infected dahlia tubers. Once the problem was diagnosed, regulatory actions were taken in which all of the original plants were destroyed. However, the virus had already been spread to other plants by that time and the virus has been a problem on tobacco crops there ever since (Lewis, 1973).

Western flower thrips have been spread nationwide in the greenhouse floral industry in the past few years. Tomato spotted wilt virus seems to be following a similar pattern. Tomato spotted wilt virus can move only in viruliferous thrips (thrips infected with the virus) or in infected plants. Because of the great amount of living plant material moved daily throughout the floral industry, there is a real catastrophe looming in the industry unless these problems can be eliminated soon.

The greenhouse floral industry is based on a national, even international, distribution system of live plant or plant parts. There are numerous small to very large companies that asexually propagate plants such as mums, geraniums, carnations, etc. for sale to other growers to finish the product. Historically, this segment of the ornamental plant industry has greatly reduced several very damaging diseases which were common on asexually propagated crops. Culture indexing, viral indexing, and more recently, meristem culture and tissue culture have been used to produce "disease-free" cuttings and rooted cuttings. However, tomato spotted wilt virus has become established in a few of the large propagators who are now unwitting "Typhoid Marys" shipping infected plants to unwary growers.

A major problem is that tomato spotted wilt virus has a very extensive host range (166 species in 34 plant families) of cultivated plants plus numerous weeds. There are many strains of the virus that produce different symptoms or infect different plants. Also, within any species of plant, all cultivars are not susceptible.

Symptoms of Tomato Spotted Wilt Virus

CHRYSANTHEMUMS- In several western states, chrysanthemums have been reportedly infected by tomato spotted wilt virus exhibiting severe necrosis on the stem and petioles. The cultivar 'Polaris' has been most severely damaged. Recently the cultivar 'Iridon' has been shown to be susceptible to the virus.

CYCLAMEN- Finely etched necrotic and chlorotic ring spots have been observed in cyclamen leaves, but we have not confirmed the disease in this plant. Damage to cyclamen appears to be minimal.

EXACUM- Plants wilt and die branch by branch. Irregular gray to tan, slightly sunken lesions appear on dying stems. Tan leaf spots have also been observed.

GARDEN IMPATIENS- Infected plants are stunted with necrotic spots and ring patterns in the leaves.

NEW GUINEA IMPATIENS- Infected plants are stunted with small twisted leaves with or without mosaic. Some terminal dieback and

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necrotic leaf spot is common. Rooted cuttings do not grow. Darker cultivars are more frequently infected.

GLOXINIA- Symptoms on gloxinia include necrotic line patterns and ring spots on leaves, terminal bud necrosis, malformed leaves, stunted plants, white ring and line patterns on colored flowers, flower distortion, and delayed flowering. The necrotic lines and ring patterns persist as long as the affected leaves live, but other symptoms may disappear. Symptom expression is most severe within 7 to 10 days after infection on young plants. If the plants survive this shock phase of the disease, they often become symptomless, but remain infected. Symptoms vary widely from plant to plant.

REIGER BEGONIA- On Reiger begonia symptoms include severe necrotic leaf veins, finely etched necrotic ring spots, chlorotic mottling and blotching. White rings (color break) may show up in red and pink flower petals. Frequently, only 1 or 2 leaves show these symptoms on individual plants. Plants may not appear to be severely damaged. Tomato spotted wilt virus has been observed in the cultivars 'Whisper O'Pink', 'Renaissance', 'Schwabenland Red', and 'Improved Schwabenland Orange'. This virus has also been diagnosed in 'Non Stop' begonias.

Control of the Western Flower Thrips

Western flower thrips reproduce by inserting eggs into succulent host plant tissue. From the eggs hatch tiny first stage larvae that soon molt into second stage larvae. Second stage larvae soon become whitish and then molt into a prepupal stage that sometimes crawls to the soil (Robb et al., 1988) . Prepupae do not feed although they can crawl about. In a few days, the prepupae molt into the pupal stage and within a few more days, new adults emerge from the pupal stage. Western flower thrips may develop from egg to adult in as little as 7.5 days (Robb and Parrella, 1987). Larvae of the western flower thrips can become infected with the tomato spotted wilt virus by feeding on an infected plant for at least 30 minutes. After a latent period of 3 to 18 days, these thrips can then infect new plants after feeding only 5 to 15 minutes. Only larvae can become infected by the tomato spotted wilt virus but both larvae and adults can transmit this disease. However, larvae cannot fly or even jump, so they are not likely to move readily from one plant to another.

Western flower thrips are often attracted to the flowers of ornamental plants although they breed readily on the foliage of chrysanthemum, gloxinia, tomato, vegetables and grasses. In flowers, thrips feed on pollen and on the petals. Symptoms on African violets include showering of the pollen onto the petals before the thrips actually feed on the petals. Feeding on the petals causes pale spots and necrotic patches so that infested blossoms appear to age prematurely. Feeding on the foliage by this pest results in two types of injury depending on the age of the plant tissue under attack. Feeding on very young tissue results in distorted growth as the leaf tissue expands. Damaged leaves may be puckered and twisted. Feeding on expanded tissue results in spider mitelike injury. Damaged areas have pale spots formed when the thrips slash the surface of the leaf and suck out the contents of the cells beneath.

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Robb and Parrella (1988) reported that Dibrom as a fumigant and Dursban, Carzol, and Lannate sprays gave good control whereas diazinon, Orthene and Thiodan sprays gave fair control. Some flower growers report that Avid as a spray gives good control of western flower thrips. Treatments should be scheduled twice a week or no further apart than five days. When treating for thrips, it is better to use normal rate and treat more often than to use heavy rates and treat less often. In order to impede the onset of resistance to insecticides, it is recommended that growers use a variety of insecticides rather than using only one pesticide time after time. Unfortunately, control of the western flower thrips is likely to be difficult and costly in the near future.

Control of Tomato Spotted Wilt Virus

Virus diseases can be very difficult to control when there is a source of the virus, numerous susceptible hosts and abundant vectors. Once a plant becomes infected it remains infected as long as it lives. Even if the symptoms disappear, an infected plant remains a source of the virus.

Insecticides alone are often not enough to control a virus disease in the greenhouse if thrips infected with the virus can migrate from untreated plants or if infected thrips emerge from pupal stages in the potting mix or soil on the greenhouse floor between applications. This is because such thrips can infect the plant before the pesticide residue has time to kill the thrips. Control of a virus disease in the greenhouse is based on eliminating all sources of the virus. Thus, all infected plants must be destroyed and all infected plants or infected thrips must be excluded from the greenhouse.

Summary

In summary, the real challenge to the greenhouse floral industry is total elimination of the thrips and tomato spotted wilt virus from all plant material. Only one virus infected plant (or thrips) in many hundreds or thousands of healthy plants may be enough to start an epidemic. Since the virus can exist in symptomless plants, it may be necessary to index all stock plants of susceptible species. This will be a complex and expensive process, but if western flower thrips and tomato spotted wilt virus are not controlled now, losses and cost of control will be much greater in the future.

References

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