Chlorotic Ringspot and Decline of Ornamental Shamrock (*Oxalis regnellii*)

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ABSTRACT

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Chlorotic ringspot and decline of shamrock, a new, presumably viral disease, caused serious losses in 1977-1978 in a Washington nursery. The causal agent was not mechanically transmissible to any of 24 plant hosts but was transmitted by root contact in 116 of 120 pairs (97%) of infected and healthy plants. Symptomatological evidence of transmission developed after 100 or more days of plant contact, in the absence of nematode or insect vectors of plant viruses. Judicious roguing of infected plants is a suggested control measure.

Shamrock plants (*Oxalis regnellii* Miq.) were received from a nursery near Seattle, WA, in April 1977 for diagnosis. The symptoms were unfamiliar to the grower, who had cultivated this crop at the same location for 30 yr without serious problems. Diseased shamrock developed chlorotic ringspot (Fig. 1A) typical of certain viral diseases. However, only two virus diseases have been reported among the Oxalidaceae (1,3,4), and neither causes foliar ringspots on the host. No viral diseases are known to occur in *O. regnellii*. Costa and Bennett (1) transmitted Euphorbia mosaic virus to *Oxalis* sp. using white flies (*Bemisia tabaci* Genn.) as vectors. Starrett (4) infected *O. stricta* L. with sugar beet curly top virus by the leafhopper *Circulifer tenellus* (Baker), and Severin (3) extended the host range of this virus to include *O. corniculata* L. and *O. corniculata* var. *atropurpurea* (Planch.), which were also inoculated by *C. tenellus*. The symptoms described on these hosts differ markedly from those observed on *O. regnellii*. The purpose of this paper is to describe a new disease of ornamental shamrock and to suggest a control measure.

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MATERIALS AND METHODS

Mechanical transmission. Symptomatic leaf tissue of shamrock was homogenized in 2.5% nicotine buffer to which a small quantity of Celite had been added. Inoculum was applied to upper leaf surfaces of *Chenopodium amaranticolor* Coste et Reyn., *C. quinoa* Willd., *Cucumis sativus* L., *Lycopersicon esculentum* Mill., *Medicago sativa* L., *Nicotiana glutinosa* L., and *O. regnellii* Miq. In addition, 23 host plants (2) were inoculated during routine testing for possible legume viruses by rubbing Carborundum-dusted leaves with homogenate of symptomatic leaves of *O. regnellii* in 0.02 M phosphate buffer (R. Hampton, *personal communication*).

Transmission by plant contact. Propagules (scaly rhizomes) from diseased and healthy shamrock were planted together in fiber pots (10×10×10 cm) containing a mixture of equal parts of sand, soil, peat, and Perlite that had been pasteurized (75 C, 30 min) before planting. Plants were positioned on greenhouse benches (18 C at night, 24 C in daytime) in a randomized block design and rerandomized at intervals throughout the test.

In one test, soil from pots that had contained diseased plants was used as a potting medium for healthy plants. A sample of this soil was examined for nematodes.

Electron microscopy. Leaf dip preparations were made by dipping a freshly cut edge of an infected leaf in a solution of 2% phosphotungstic acid on a collodion-carbon coated grid. Photographs were taken in a Philips EM 300 electron microscope on Kodak Electron Image plates at a magnification of ×42,000. Viruslike particles were measured from ×2.5 enlargements of the negatives.

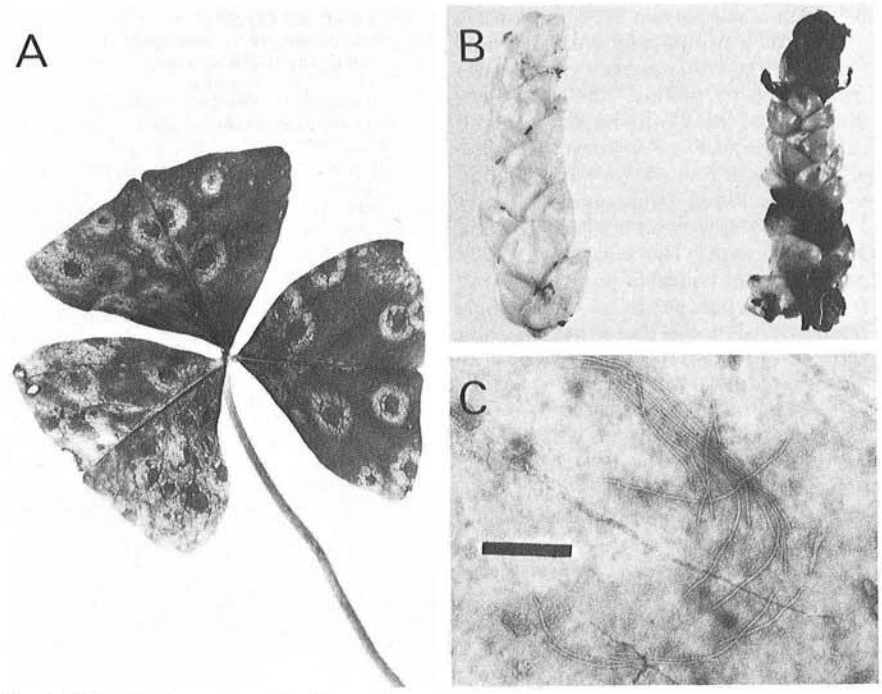

Fig. 1. Chlorotic ringspot and decline on shamrock (*Oxalis regnellii*): **(A)** Symptoms on infected leaf. **(B)** Comparison of healthy (left) and infected (right) scaly rhizomes. **(C)** Flexuous rod-shaped viruslike particles from symptomatic leaves; scale bar = 500 nm.

RESULTS AND DISCUSSION

The causal agent was not mechanically transmissible to plants comprising 20 species, 17 genera, and 7 families. In two tests with 10 pots each containing propagules of diseased and healthy shamrock, all healthy plants developed symptoms in approximately 100 days. In a third test involving 40 pots, 90% of the healthy plants became infected.

Symptoms appeared as chlorotic rings surrounding islands of green tissue (Fig. 1A), which gradually advanced to indiscriminant chlorotic streaks and blotches. Infected plants produced scaly rhizomes that became progressively darker as the disease developed (Fig. 1B). Gradual plant decline continued and frequently death occurred within 1–2 yr after infection. Plants grown from healthy propagules planted in soil previously cropped to infected plants remained healthy for more than a year after planting. No nematodes were found in soil samples collected from pots in which infected plants were grown, which suggests that transmission resulted from direct contact between infected and healthy plants.

Some healthy plants developed ringspot when only healthy propagules were planted together (18.75% total of all tests). This occurred only when healthy plants were grown near infected plants, and in every instance, the lily aphid (*Neomyzus circumflexus* Buckton) infested the plants during the test period. Mites (*Tetranychus urticae* Koch) were the only other pest observed on the plants during the 3-yr study. Healthy plants grown in an isolated area remained symptomless.

Leaf dip preparations from symptomatic leaves contained long flexuous rod-shaped particles, most of which approximated 800–900 × 18 nm. Some accompanying particles were approximately twice the modal length, suggesting end-to-end dimerism. No viruslike particles were detected in symptomless leaves.

Chlorotic ringspot and decline is a new disease of nursery-propagated shamrock plants. Symptomatology, electron microscopy, and mode of transmission suggest a viral etiology. The disease is readily transmitted when roots of healthy and infected plants are grown in close proximity. Because the lily aphid is a suspected vector, transmission of the causal agent by this insect is the subject of a separate study.

Chlorotic ringspot presents a potential problem for shamrock growers but judicious roguing of infected plants appears to provide effective control.

LITERATURE CITED

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