

Natural Infection of Coriander Plants by a Strain of Clover Yellow Vein Virus

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Clover yellow vein virus (CYVV) from white clover (*Trifolium repens* L.) has been described from England (1) and Canada (2). Here we report the isolation of CYVV from a new naturally infected host, coriander (*Coriandrum sativum* L.).

Young coriander plants growing in a garden near Fredericton, New Brunswick, Can., showed symptoms of vein clearing which resulted in yellow-net appearance (Fig. 1). In addition, leaves were severely malformed with cupping, and diseased plants were severely stunted. Visible symptoms were produced in coriander plants in the greenhouse within 5-7 days after being rubbed with sap prepared in 1% K_2HPO_4 solution from infected plants. Inoculated plants were held in the greenhouse with temp and light conditions as described earlier (3).

In host-range studies, the virus produced necrotic local lesions in *Chenopodium amaranticolor* Coste & Reyn., slight chlorosis and stunting in *Nicotiana clelandii* Gray, vein yellowing and stunting of *T. hybridum* L. (Alsike clover) plants, and diffuse mosaic mottling of leaves in *T. repens* L. (Ladino clover), similar to those described earlier by Hollings & Nariani (1). In addition, *Pisum sativum* L. 'Lincoln' (pea) became infected with the coriander isolate and developed symptoms of vein clearing, mosaic, and eventual wilting of plants. Another leguminous plant, *Trigonella foenugreek* L. (fenugreek) was inoculated with the coriander isolate, and yellow vein mosaic and wilting were the predominant symptoms. The following 21 plant species did not develop symptoms, and when sap from inoculated plants was subsequently inoculated to coriander seedlings, none became infected: *Anthem graveolens* L. (dill); *Apium graveolens* L. (celery); *Borago officinalis* L. (Borage); *Datura metel* L.; *Daucus carota* L. var. *sativa* DC. (carrot); *Foeniculum vulgare* Mill. (fennel); *Gomphrena globosa* L. (globe amaranth); *Majorana hortensis* Moench. (marjoram); *Nicotiana tabacum* L. 'Samsun' and 'White Burley' (tobacco); *N. glutinosa* L.; *Ocimum basilicum* L. (basil); *Pastinaca sativa* L. (parsnip); *Petroselinum crispum* (Mill.) Nyman. (parsley); *Phaseolus vulgaris* L. 'Pencil Pod' and 'Soldier' (bean); *Pimpinella anisum* L. (anise); *Rosmarinus officinalis* L. (rosemary); *Salvia officinalis* L. (sage); *Satureja hortensis* L. (savory); *Solanum tuberosum* L. 'Saco' (potato); *Thymus vulgaris* L. (thyme); and *Vicia faba* L. (broad bean).

Three species of aphids: the foxglove aphid, *Aulacorthum solani* (Kltb.); red and green clones of the

potato aphid, *Macrosiphum euphorbiae* (Thomas); and the green peach aphid, *Myzus persicae* (Sulzer); acquired the virus in a single 30- to 45-sec probe on infected leaves and transmitted it to healthy coriander plants after a 2- to 3-hr feeding period. In six separate tests with *M. persicae*, a total of 277 plants were infested with single aphids, of which 183 plants became infected (66% transmission). Stylet-borne nature of transmission was shown in another test, where 61 aphids (*M. persicae*) were allowed to feed for 5 min on each of five healthy plants individually after making single probes on infected plants. The transmission level was 57% in the first 5 min, and declined to 9% by 15 min; no transmission occurred after that.

The coriander isolate in coriander sap remained infective at 25 C for 28 but not 48 hr, its thermal inactivation point (10 min) was between 48-50 C, and its dilution end point was between 1:1000 to 1:10,000.

The virus was partially purified by differential centrifugation, using coriander sap extracted in 0.5 M K_2HPO_4 buffer, pH 9.4. Electron-microscopic observation of partially purified virus solution (stained with 2% phosphotungstic acid solution, pH 6.5) showed the presence of filamentous particles (Fig. 3). Sixty-five particles were measured, and ranged from 590-650 m μ in length. This is slightly smaller than the length reported by Hollings & Nariani (1) for CYVV, but since few particles were measured, this difference may not be real.

In cytological studies, leaves from infected and healthy coriander plants were fixed in 6% glutaraldehyde and 2% osmium tetroxide, embedded in Durcupan, and stained with uranyl acetate and lead citrate. Sections were cut on an LKB ultramicrotome, and were examined in a Phillips E.M. 200 electron microscope. The predominant inclusions observed in sections from infected coriander were pinwheel and bundle types (Fig. 4) similar to those observed by Pratt (2) in plants infected by CYVV. We also observed a few very dense rhomboidal crystals surrounded by ribosomes (Fig. 2).

To investigate serological relationships, the following virus antisera were obtained: bean yellow mosaic (BYMV), and white clover mosaic (WCMV) from R. Bercks (Institute für Viroserologie, Braunschweig, Germany); CYVV from O. M. Stone (Glasshouse Crops Research Institute, Littlehampton, England); and western celery mosaic virus (WCeMV) from R. G. Grogan (University of California, Davis). Other virus antisera were produced in this laboratory. An antiserum prepared against coriander isolate had an homologous titer of 1/512 by the tube precipitin test. The specificity of coriander isolate antiserum was checked with several virus antigens. No reaction was observed with coriander isolate serum against potato virus S, potato virus X, potato virus Y, tobacco mosaic virus, and turnip mosaic virus. The reciprocal tests involving virus antisera of BYMV, CYVV, WCMV, WCeMV, and potato virus M, X, and Y were performed with infected and healthy sap of coriander

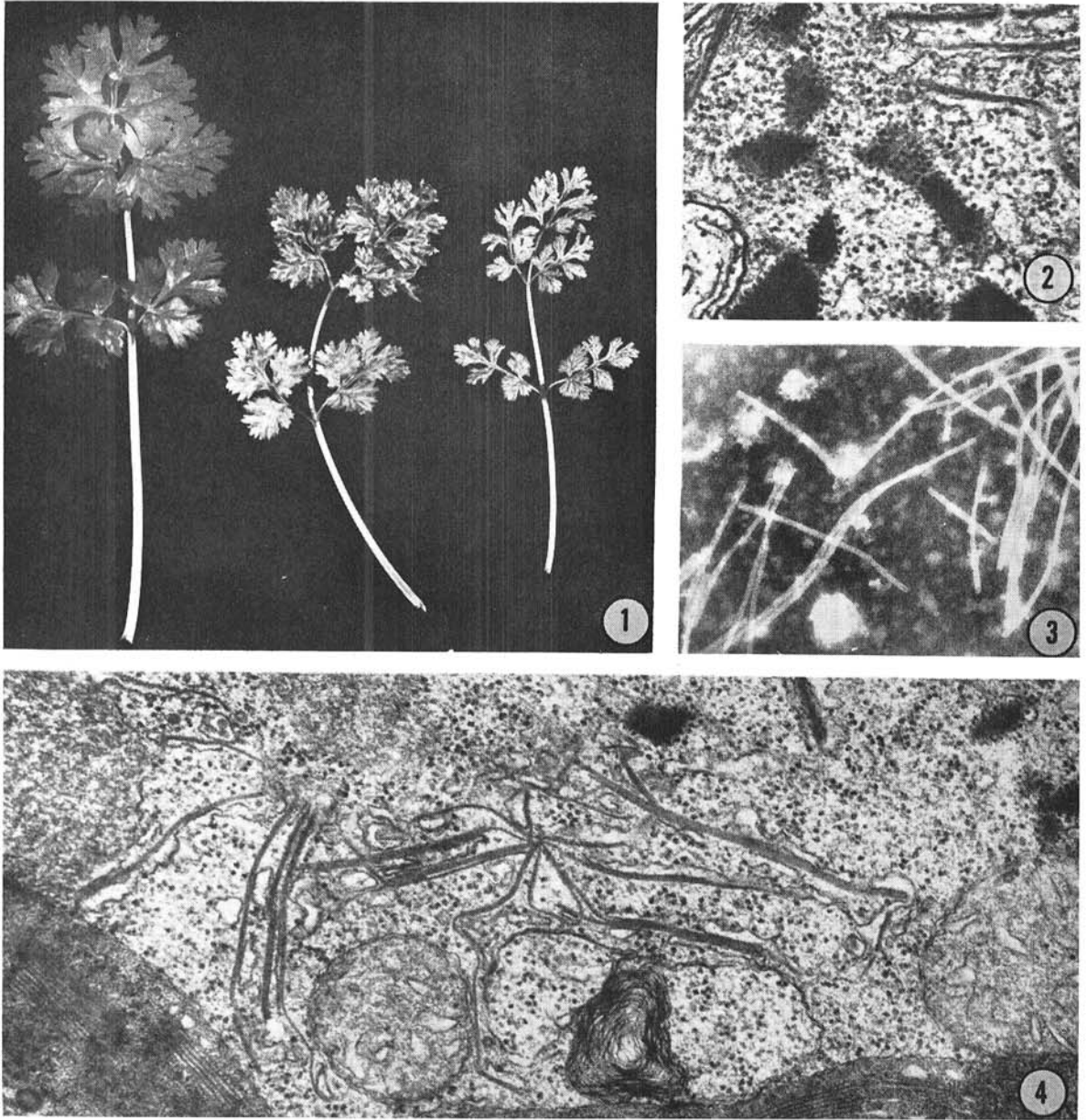


Fig. 1-4. Symptoms, particles, and inclusion bodies of clover yellow vein virus in coriander plants. **1)** Left, healthy coriander leaf; right, two leaves showing yellow-net symptoms. **2)** Rhomboidal crystals surrounded by ribosomes ($\times 49,000$). **3)** Negatively stained virus particles from partially purified preparation ($\times 97,000$). **4)** Bundle and pinwheel structures ($\times 43,000$).

over a range of antiserum dilutions from 1/4 to 1/2048. No serological reactions were obtained between infected coriander sap and any of the antisera listed above except CYVV antiserum. The heterologous titer of CYVV antiserum against infected coriander sap equalled its stated homologous titer of 1/2048.

On the basis of host range, inclusion bodies, particle shape, and serological reaction, the coriander isolate closely resembles CYVV. But it is less stable in vitro,

and has lower thermal inactivation and dilution end points than those reported for CYVV from clover (1).

LITERATURE CITED

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