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Tobacco rattle virus in lilies

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In the Netherlands, virus diseases in *Lilium* spp. are associated with lily symptomless virus (LSV), tulip breaking virus (TBV), cucumber mosaic virus (CMV), and *Arabis* mosaic virus (AMV) (Asjes et al., 1973), but the literature makes no mention of tobacco rattle virus (TRV; R/1:2.3 + 0.6 to 1.3/5:E/E:S/Ne, Harrison, 1970; tobravirus group) in this connection. However, TRV has been reported to occur in other Liliaceae (Anonymous, 1971), and in the USA TRV was occasionally found in *Lilium longiflorum* (McWhorter and Allen, 1964).

In 1972 a virus was isolated in the Netherlands from *Lilium hollandicum* 'Preludium' (Derks, 1973). The infected plants showed veinal chlorosis, curling of the leaves, and usually small necrotic spots on the leaves (Fig. 1). The virus was isolated by inoculation of *Nicotiana tabacum* 'White Burley', *Chenopodium quinoa* and *Gomphrena globosa* with sap from leaves of the diseased lilies.

The virus was purified from sap of locally infected leaves of 'White Burley' plants with a mixture of diethyl ether and carbon tetrachloride according to Huttinga (1972). The purified virus suspensions reacted in microprecipitin tests (Van Slogteren, 1955) with antiserum prepared against TRV from *Gladiolus* and propagated in 'White Burley' plants (Cremer and Schenk, 1967).

The length of the virus particles was measured in preparations of locally infected leaves of 'White Burley' plants negatively stained with 2% phosphotungstic acid (pH 7.2). Tobacco mosaic virus was inserted as an internal standard (Bos, 1970). The length distribution showed peaks between 60 and 80 nm and between 180 and 200 nm. Leaf preparations of diseased 'Preludium' lilies contained many elongated virus particles of LSV and only a few TRV-like particles.

The symptoms observed on the 'Preludium' lilies closely resembled those generally referred to as being caused by CMV. The symptoms on the test plants inoculated with sap of the diseased lilies indicated the presence of TRV instead of CMV. However, CMV symptoms on the test plants might have been suppressed by TRV. To investigate this possibility, *Myzus persicae* aphids were transferred to 'White Burley' plants (20–25 per plant) after a 5 sec to 3 min acquisition time on leaves of the diseased 'Preludium' lilies. No symptoms were observed on these plants within 6 weeks after inoculation, which indicates the absence of CMV.

A similar experiment was carried out with *L. formosanum* seedlings as test plants. No symptoms were observed within 9 months after inoculation, indicating the absence of TBV in the diseased 'Preludium' lilies (Derks, 1973), but serological tests demonstrated the presence of LSV in these plants. *C. quinoa* inoculated with sap of the diseased lilies did not show a systemic reaction, thus indicating the absence of AMV.

Fig. 1. *Lilium hollandicum* 'Preludium'. Left: moderately affected; right: severely affected.

Fig. 1. Lilium hollandicum 'Preludium'. Links: matig aangetast; rechts: ernstig aangetast.

These observations justify the conclusion that the described symptoms were caused by TRV, either alone or in combination with LSV. Further investigations are concentrated on the crucial test, i.e. to show that the virus can infect healthy *Lilium* plants and can then be isolated again.

The progeny plants (49) grown from stem bulblets of the diseased 'Preludium' plants, showed leaf symptoms resembling those of the mother plants. Electron-microscopically, all plants contained TRV-like particles. After inoculation of the test plants with sap of these progeny lilies TRV-like symptoms developed.

In 1973 and 1974 TRV was isolated from *L. hollandicum* 'Brandywine' showing the same symptoms as 'Preludium' and from *L. speciosum rubrum* showing a veinal chlorosis. The virus was also isolated from bulb scales of *L. regale* 'Mabel Violet' and *L.* Mid-century hybrid 'Enchantment'.

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Samenvatting

Tabaksratelvirus in lelies

Uit planten van *Lilium hollandicum* 'Preludium' met krullende bladeren, die nerfchlorose en meestal kleine necrotische vlekjes vertoonden (Fig. 1), werd een virus geïsoleerd, dat als tabaksratelvirus (TRV) werd geïdentificeerd op grond van symptomen op een drietal toetsplanten en serologische en elektronenmicroscopische waarnemingen. Daarnaast kon, behalve het symptoomloos lelievirus, geen van de virussen, waarvan bekend is dat zij in lelie kunnen voorkomen, in deze planten worden aangetoond. TRV ging op alle stengelbolletjes (49) van de zieke 'Preludium'-lelies over. Ook uit andere leliesoorten werd TRV geïsoleerd. Zo was in de Verenigde Staten TRV incidenteel aangetroffen in *Lilium longiflorum*.

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