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Short communication

First report of Colombian datura potyvirus in tomato

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Abstract

Colombian datura potyvirus (CDV) was detected in about 300 plants of tomato 'Cabrion' in one greenhouse in the Netherlands. Virus identification was based on host range and symptomatology, aphid transmission, electron microscopy and serology. Evidence was obtained that the tomato plants were infected by viruliferous *Myzus persicae* that acquired the virus from a CDV-infected *Brugmansia* plant present in the same greenhouse.

In 1995 unknown virus symptoms were observed in about 300 plants of tomato (*Lycopersicum esculentum* 'Cabrion') in a greenhouse in the Netherlands. The infected plants showed growth reduction, mosaic of the young leaves, and fruit discolouration (Figure 1).

Mechanical inoculation to herbaceous test plants and analysis by electron microscopy revealed the presence of filamentous virus particles resembling those of a potyvirus. In DAS-ELISA (Clark and Adams, 1977) this virus appeared to be different from potato virus Y (PVY), the only potyvirus known to occur in tomato in the Netherlands (Roenhorst and Verhoeven, 1994). Therefore, further studies were made to identify the isolated virus.

Symptomatic leaves of tomato were mechanically inoculated to the plant species of Table 1. Inoculum preparation and greenhouse conditions were as described before (Verhoeven et al., 1995). Symptoms were recorded up to four weeks after inoculation. In addition, the virus was tested with antisera to potato virus A (PVA) and wild potato mosaic virus (WPMV) in DAS-ELISA. Both inoculation (Table 1) and serological tests indicated that the isolated virus was different from the other potyviruses reported for tomato so far, i.e. Peru tomato virus (Fribourg, 1979), tobacco etch virus (Debrot, 1976), tomato mild mottle virus (Walkey et al., 1994) and WPMV (Adam et al., 1995). None of these viruses is indigenous to Europe. Besides, the virus appeared to be different from PVA, which occurs in potato in Europe.

Observations in the greenhouse indicated that the source of the unknown virus in tomato could have been a large *Brugmansia* plant placed in the same greenhouse for wintering. Leaves of this plant showed mosaic. In addition, the plant was colonized by *M. persicae*. These aphids were also observed in the tomato plants. Mechanical transmission experiments and examination by electron microscopy disclosed that the virus infecting tomato was also present in *Brugmansia*.

The tomato virus was compared with five potyviruses reported from the genus *Datura*, including *Brugmansia*, i.e. CDV (Kahn and Bartels, 1968), datura distortion mosaic virus (Mali et al., 1985), datura mosaic virus (Qureshi and Mahmood, 1978), datura necrosis virus (Badami and Kassanis, 1959) and datura virus 437 (Damsteegt, 1974). Comparison was on the basis of the symptomatology described in literature, as the virus isolates were no longer available. The reactions on test plants, especially those on *D. metel*, *D. stramonium* and *Nicotiana tabacum* 'Samsun', indicated that the virus might be an isolate of CDV.

Electron microscopy of crude extracts of plant tissue infected with virus isolates from tomato

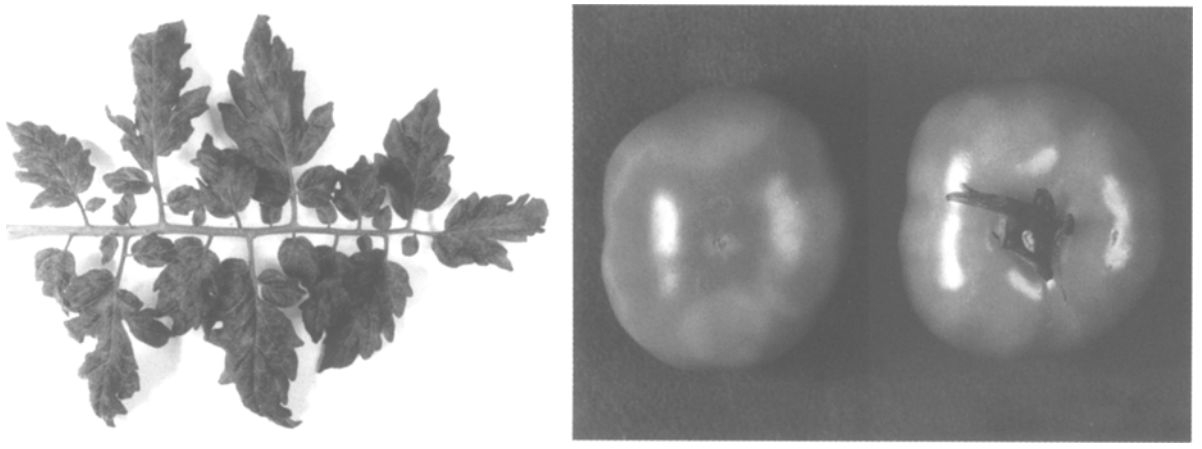

Figure 1. Tomato leaf showing mosaic (left) and fruits showing discolouration (right), caused by Colombian datura virus.

Table 1. Symptomatology of Colombian datura potyvirus isolates from tomato and *Brugmansia*

Plant species	Local symptoms	Systemic symptoms
Ammi majus	C[1]	Ms
Capsicum annuum 'Mazurka'	–*	–
C. frutescens 'Tabasco'	–*	–
Chenopodium amaranticolor	N	–*
C. quinoa	N	–*
Datura metel	N	V,W
D. stramonium	–*	–
Lycopersicum esculentum 'Money-maker'	–*	Ms
Nicotiana glutinosa	N	M
N. tabacum 'Samsun'	N	Vn
N. tabacum 'White Burley'	N	V,Vn,M
N. tabacum 'Xanthii'-nc	N	V,Vn,M
Physalis floridana	W	W
Petunia hybrida 'Polo Pink'	N	Vc,M,F
Solanum melongena 'Black Beauty'	–*	–
S. nigrum	N	Ms
S. tuberosum 'Nicola'	–*	–
Vicia faba 'Witkiem major'	–*	–

[1] C = chlorotic lesions; F = flower-breaking; M = mottle; Ms = mosaic; N = necrotic lesions; V = vein chlorosis; Vc = vein clearing; Vn = vein necrosis; W = wilting; – = no infection, confirmed by testing for symptomless infection; –* = no symptoms.

and *Brugmansia* revealed filamentous particles with normal lengths of 791 and 827 nm, respectively, and a diameter of c. 12 nm. For one normal length determination 100 particles were measured. Measurements were done at 36000-fold magnification in a Zeiss EM 906 electron microscope on uranyl acetate-stained preparations from fresh leaf samples, using a carbon grating replica as size standard and a SIS image analysing system. According to Kahn and Bartels (1968) the particle length of CDV is 721 nm. However, the mean value of the new normal length determinations with ten isolates (including the above mentioned values of 791 and 827 nm) from the Netherlands and Germany was 812 nm (Lesemann et al., 1996). The difference between the old and new measurements is most probably due to methodological differences and, therefore, was not considered significant. In tests by immunoelectron microscopy, the isolates from tomato and *Brugmansia* were strongly decorated by an antiserum to CDV (Kahn and Bartels, 1968) diluted 1:50 (Figure 2). Decoration titres with this antiserum were at 1:1600 and 1:3200, respectively. Additional decoration tests with 56 antisera to other potyviruses from the stock of the institute at Braunschweig revealed either no (46 antisera) or weak reactions. The weak heterologous reactions were obtained with antisera to bean common mosaic, carnation vein mottle, chilli veinal mottle, endive necrotic mosaic, groundnut eyespot, pepper mottle, plum pox, sweet potato latent, tobacco vein mottling and zucchini yellow mosaic viruses. They all differed from the respective homologous reactions by at least five twofold dilution steps (Lesemann et al., 1996) and, therefore, demonstrate a clear distinction of CDV.

Ultrathin sections of leaf material infected with the tomato and the *Brugmansia* isolates were made from glutaraldehyde- and OsO_4-fixed tissues embedded in Epon (Koenig and Lesemann, 1985). In these preparations only cylindrical inclusions of type IV (Edward-

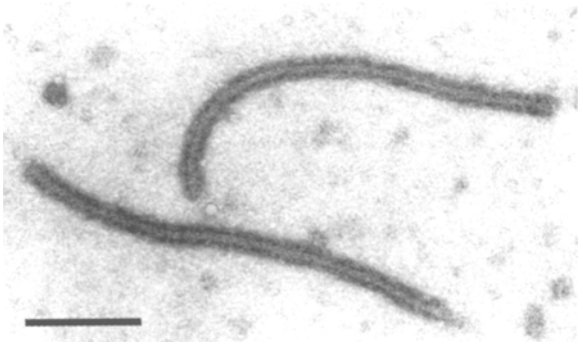

Figure 2. Filamentous virus particles of the tomato isolate of Colombian datura virus (CDV) from *Nicotiana tabacum* 'White Burley' strongly decorated by 1:50 diluted antiserum to CDV. Bar equals 200 nm.

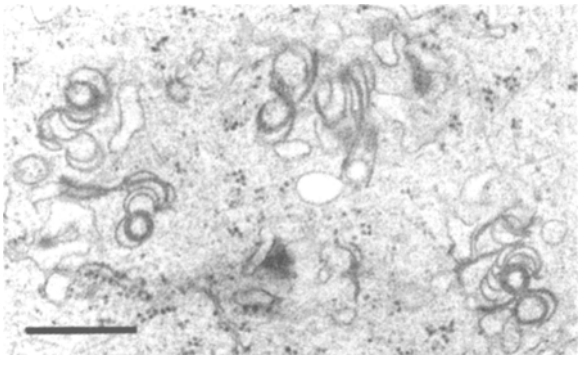

Figure 3. Cylindrical cytoplasmic inclusions of type IV in a cell of *Nicotiana tabacum* 'White Burley' systemically infected by the tomato isolate of Colombian datura virus, embedded in Epon. Bar equals 500 nm.

son et al., 1984) (Figure 3) were observed. Since three additional isolates from *Brugmansia* revealed identical inclusions (Lesemann et al., 1996), the close similarity of the CDV isolates from tomato and *Brugmansia* was verified cytopathologically.

Evidence that CDV was transmitted from *Brugmansia* to tomato by *M. persicae*, was obtained by transmission experiments. Aphids were reared on *Capsicum annuum* 'Mazurka', which is not a host for CDV. They were starved for 2 h and subsequently placed for 5 min on an infected *N. tabacum* 'White Burley' plant in order to acquire the virus isolated from tomato. For the next 24 h they were placed on two healthy plants of *N. tabacum* 'White Burley' and *L. esculentum* 'Money-maker', respectively. After this inoculation access period the aphids were killed by application of pirimicarb. About two weeks after inoculation, all inoculated plants showed symptoms. Similar results were obtained with the *Brugmansia* isolate from the tomato greenhouse. This confirms the non-persistent transmission of CDV by *M. persicae*, as reported by Kahn and Bartels (1968). The fact that all affected tomato plants were located in the vicinity of the CDV-infected *Brugmansia* plant, provides further evidence that this plant functioned as inoculum source.

Until recently, only one interception of CDV in *Brugmansia* was reported for plants that originated in Colombia (Kahn and Bartels, 1968). During the last few years, however, CDV has been isolated from *Brugmansia* plants at several locations. In addition, the virus was found in *Juanulloa aurantiaca* and *Petunia hybrida*. (Lesemann et al., 1996). It is supposed that CDV is already widespread in *Brugmansia* plants in Europe. Infected plants often do not show symptoms, which favours unnoticed spread by cuttings, the major way of propagation. In addition, the virus is easily spread by *M. persicae*. It is expected that the number of infected *Brugmansia* plants will still increase, as this ornamental is very popular at the moment. Therefore, tomato and other solanaceous crops are at increased risk to become infected by CDV. Evidence was obtained that besides CDV also other foreign pathogens that were introduced via the importation of exotic plants, disseminated to other crops. In tomato both WPMV (Adam et al., 1995) and potato spindle tuber viroid (Verhoeven and Roenhorst, 1995) were identified, which appeared to be introduced via imported pepino plants (*Solanum muricatum*). In pepino also the Andean strain of potato virus S was detected in plants imported in the past (Verhoeven and Roenhorst, 1995). These findings clearly demonstrate the risks accompanying the importation of exotic plants.

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