

Detection of *Cucumber mosaic virus* on *Clematis paniculata* in lowland forest in New Zealand

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Received: 27 February 2011 / Accepted: 19 April 2011 / Published online: 15 May 2011
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Abstract *Cucumber mosaic virus* (subgroup II) was associated with the decline of *Clematis paniculata* in lowland forest near Dunedin, New Zealand. CMV's role as an invader of native ecosystems is briefly discussed.

Keywords CMV infection · Biological invasions · Native flora

Clematis paniculata is a large woody vine found at the margins of lowland and subalpine forest throughout New Zealand. Following the discovery of two declining *C. paniculata* with leaf mottle symptoms (Fig. 1) at two separate sites a total of 50 plants were sampled from tree tops near Dunedin and tested for virus infection using mechanical inoculation and ELISA.

Leaflets and petals were ground in 15–100 mM phosphate buffers and inoculated to *Chenopodium* spp and *Nicotiana* spp and subsets of the other species listed in Guy et al. (1984). ELISA tests run according to the manufacturer's instructions (Agdia Inc) of leaves, petals and symptomatic indicator plants were negative for *Alfalfa mosaic virus*, *Cucumber mosaic virus* (CMV) subgroup I, *Impatiens necrotic spot virus*, *Potyvirus* group and *Tomato spotted wilt virus*. The two original *C. paniculata* plants (incidence 4%) and *C. murale*, *C. quinoa*, *N. clevelandii* and *N. glutinosa* which developed local lesions 10–15 days after inoculation were positive for CMV subgroup II by ELISA. CMV was only reliably transmitted to the indicator hosts from petals ground in 100 mM phosphate buffer (pH7.2) containing 20 mM sodium diethylcarbamate. No other viruses were detected in the indicator hosts. The

incidences of CMV infection at four sites were: Grahams Bush (0/2), Leith Saddle (1/24), Pigeon Flat (0/22) and Waitati (1/2).

Although CMV incidence was low (4%) virus infection was associated with a dramatic decline of individual *C. paniculata*. Such a low incidence would be of little consequence in an annual crop however *C. paniculata* are usually of a similar age to the trees supporting them. Vines and supporting trees both establish after ecosystem disturbance. The fibrous stems of *C. paniculata* are not suitable for tree ring analysis, however tree ring analysis of supporting *Kunzea ericoides* trees at one site put the stand at 80 years old. Therefore CMV may be contributing to the decline of a long-lived perennial. Initially *K. ericoides* leaves were also tested for virus infection however infectivity assays using *Red clover necrotic mosaic virus* diluted in *K. ericoides* sap showed ten-fold to complete inhibition (data not shown) of virus transmission. ELISA tests using *K. ericoides* sap produced absorbances near the positive/negative threshold for most of the viruses listed above. Attempts to detect viruses in *K. ericoides* were therefore abandoned.

No other species at the four sites displayed virus symptoms. *Solanum laciniatum*, a common native species and known host of CMV (Pearson et al. 2006), was not present at these sites. CMV is most likely transmitted between *C. paniculata* via aphids; the fibrous bark of the vine and the papery bark of its host would preclude mechanical transmission. Although there are no records of aphids colonizing *C. paniculata* (or *K. ericoides*) this may reflect difficulties in sampling in tree canopies rather than insect activity. The low incidence of infection suggests that aphid visits may be infrequent.

CMV is most likely a biological invader in New Zealand as all of its aphid vectors are introduced species from the

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Fig. 1 One healthy (left) and three leaflets from *Cucumber mosaic virus* infected *Clematis paniculata*

northern hemisphere and New Zealand has a depauperate native aphid fauna (Cottier 1953). CMV is reported to infect *Sicyos australis*, New Zealand's only native cucurbit, where along with *Zucchini yellow mosaic virus* it is contributing to its decline (Delmiglio and Pearson 2006). CMV is often reported to form mixed infections with other aphid transmitted viruses and the presence of CMV in some mixtures increases disease severity (Palukaitis and Garcia-

Arenal 2003), Because of its wide host range and its successful spread around the world CMV has the potential to invade many ecosystems.

Acknowledgements Thanks to the University of Otago for financial support and to Erin Zydervelt for help in the laboratory and in the field.

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