



First report of *Shallot virus X* infecting shallot in Italy

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Shallot (*Allium ascalonicum*) is an annual vegetable cultivated for its edible bulb. In Italy, cultivars of regional origin are mainly grown for local markets. During a survey on viruses infecting garlic in the Latium region (central Italy), shallot plants showing virus-like symptoms were noted in one of the farms surveyed (Fig. 1). Samples of three local cultivars ('Bianco', 'Violetto romagnolo' and 'Allungato violetto della Romagna') were screened for the most common viruses affecting *Allium* species. Using DAS-ELISA, *Onion yellow dwarf virus* (OYDV) was found in all samples. The presence of allexiviruses was assessed by a modified one-step RT-PCR amplification procedure using degenerate oligonucleotide primers (Chen *et al.*, 2004). Symptomatic samples of the three cultivars generated amplicons of c. 750 bp which were purified and bi-directionally sequenced. All nucleotide sequences were assembled and BLAST searches identified the presence of *Shallot virus X* (ShVX). The identification was confirmed by RT-PCR amplification using ShVX-specific primers (Chodorska *et al.*, 2014) which amplified a fragment of c. 800 bp from all samples. The nucleotide sequences of the two amplified genome regions from one of the Italian ShVX isolates contained partial sequences of the replicase, and the coat protein and nucleic acid binding protein (CP-NABP) genes and were deposited in GenBank with accession numbers KT898125 and KT898126 respectively. These sequences shared 98% and 96% nucleotide identity respectively with a Russian ShVX isolate (JX310755).

The CP-NABP region of the Italian isolate was compared with nine other ShVX sequences and related species of the genus *Allexivirus* available in GenBank: *Garlic virus A* (GarV-A), *Garlic virus B* (GarV-B), *Garlic virus C* (GarV-C), *Garlic virus D* (GarV-D), *Garlic virus E* (GarV-E) and *Garlic virus X* (GarV-X). A phylogenetic tree was generated (Fig. 2) and the Italian ShVX isolate was closely related to Shallot mite-borne latent virus from the Netherlands, which is a synonym of ShVX (Perez-Egusquiza *et al.*, 2009), and to a group of Russian ShVX isolates. The comparable GarV-A, GarV-D and GarV-E sequences were more similar to our amplicon sequence than to the GarV-B, GarV-C and GarV-X sequences, but this was

not unexpected since the latter group contains an intergenic sequence between the coding CP and NABP regions, which is absent in ShVX, GarV-A, GarV-D and GarV-E.

Allexiviruses cause asymptomatic infection on *Allium* spp. (Katis *et al.*, 2012). The severe symptoms observed on shallot plants in this investigation were due to mixed infections with ShVX and OYDV, the latter being widely found in nearby onion and garlic crops. In Italy, allexiviruses have been reported in garlic (Dovas & Vovlas, 2003; Lanzoni *et al.*, 2006) but this is the first report of ShVX on shallot in Italy and a wider distribution of allexiviruses is feared by farmers in the country.

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Figure 1

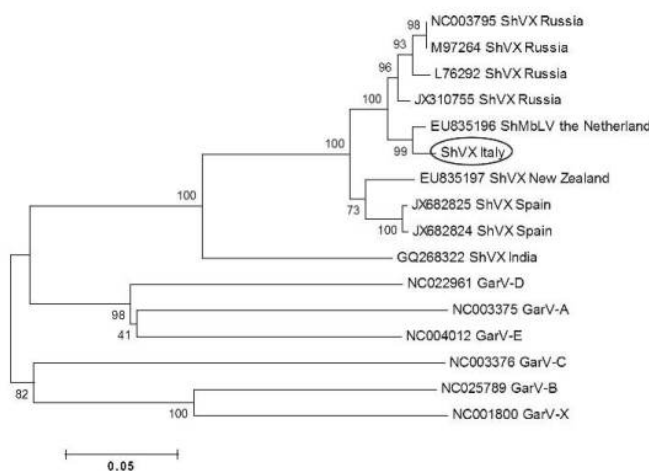


Figure 2

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