



Potyriviruses and tobnaviruses infecting ornamental *Allium* species in the United Kingdom

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In autumn 2013, a range of bulbs of ornamental *Allium* species was planted in the Royal Horticultural Society's garden at Wisley to assess their vigour and aesthetic qualities. The trial included 179 accessions of plant material, representing 32 species or hybrids, from six nurseries in the United Kingdom or The Netherlands. Yellow flecking and striping with occasional reddening on the leaf surfaces and leaf curling was observed on many of the plants during April 2015 (Figs. 1-4). Leaf samples were collected from symptom-bearing plants of 20 accessions. RNA was extracted using an RNeasy Plant Mini Kit (Qiagen, Manchester, UK) and tested by RT-PCR using broad-spectrum primers for carlaviruses and tospoviruses (Agdia, Elkhart, USA), potyriviruses (Marie-Jeanne *et al.*, 2000) and tobnaviruses (Jones *et al.*, 2008). No samples tested positive for tospoviruses but all tested positive using at least one of the three other primer sets. *A. jesdianum* 'Pendjikent', *A. nigrum* and *A. sicutum* (syn. *Nectaroscordum sicutum*) tested positive using the carlavirus primers but it was not possible to sequence the product. The remaining amplicons of the expected size were directly sequenced in both directions and were identified by BLAST analysis; representative sequences were deposited in GenBank (Table 1). GenBank Accession Nos. KT223098, KT223099, KT223100, KT223101, KT223102 and KT223103 had 98, 98, 99, 92, 99 and 85 % nucleotide sequence identity with *Leek yellow stripe virus* (AB194628), *Onion yellow dwarf virus* (KR025485), *Ornamental onion stripe mosaic virus* (OrOSMV; EU042750) *Pea early browning virus* (PEBV; X14006) *Tobacco rattle virus* (JX144383), and *Turnip mosaic virus* (TuMV; AB701697), respectively. The limited sequence identity of the *Allium* TuMV isolate with other isolates of the species may suggest that the isolate belongs to a distinct strain. This is the first report of PEBV infecting *Allium* and does not accord with Brunt *et al.* (1996) who reported that *A. cepa* was not experimentally susceptible to the virus. The remaining viruses have been reported previously from *Allium* spp. However, with few exceptions such as Noda *et al.* (1989), the specific identity of ornamental hosts has not been reported and therefore this is the first report of many of these virus-host associations. This is also the first report of OrOSMV in the UK. Since the early 1800's ornamental *Allium* species have been grown widely in UK gardens as herbaceous perennials. They are prized for their

architectural qualities and large, colourful umbels that attract pollinating insects. They are generally hardy and well suited to most UK soil types (Block, 2010). The increasing importance of ornamental *Allium* (including *Nectaroscordum*) is illustrated by the 8% rise in production area over the last 4 years (to 228 ha in 2014/15) in The Netherlands (Bloembollenkeuringsdienst, 2015).

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Figure 1

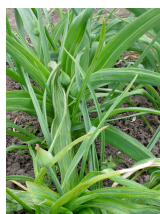


Figure 2



Figure 3



Figure 4

Host genus	Host species	Host species	GenBank Accession No.
Poaceae	<i>Lolium perenne</i>	<i>A. elongatum</i>	KJ223098
	<i>Lolium perenne</i>	<i>A. setense var. subintercedens</i>	
	<i>Lolium perenne</i>	<i>A. setense</i>	
	<i>Lolium perenne</i>	<i>A. elongatum</i>	KJ223099
	<i>Lolium perenne</i>	<i>A. setense</i>	
Onion yellow dwarf virus	<i>A. sicutum</i>	<i>A. sicutum</i>	KJ223100
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	
Ornamental onion stripe mosaic virus	<i>A. sicutum</i>	<i>A. sicutum</i>	KJ223101
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	
Turnip mosaic virus	<i>A. sicutum</i>	<i>A. sicutum</i>	KJ223102
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	
Pea early browning virus	<i>A. sicutum</i>	<i>A. sicutum</i>	KJ223103
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	
	<i>A. sicutum</i>	<i>A. sicutum</i>	

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