



First report of a '*Candidatus Phytoplasma asteris*'-related strain (16SrI-B) associated with *Sonchus oleraceus* (common sowthistle) phyllody disease in Iran

M. Salehi^{1*}, S.A. Esmailzadeh Hosseini² and E. Salehi¹

¹ Plant Protection Research Department, Fars Agricultural and Natural Resources Research and Education Center, AREEO, Zarghan, Iran; ² Plant Protection Research Department, Yazd Agricultural and Natural Resources Research and Education Center, AREEO, Yazd, Iran

*E-mail: salehi_abarkoochi@yahoo.com

Received: 05 Jan 2018. Published: 02 Feb 2018. Keywords: aster yellows

Common sowthistle (*Sonchus oleraceus*) is a major weed problem in Iran and is also used for medicinal purposes. During 2012-2015 surveys of Fars and Yazd provinces (Iran) for phytoplasma diseases, a phyllody disease was observed in *S. oleraceus* plants growing as weeds within and/or in the surroundings of fields and orchards. The main symptoms of the disease were yellowing and reddening of leaves, shortened internodes, flower virescence, phyllody, proliferation and witches' broom (Fig. 1).

Total DNA was extracted from 0.2 g of leaf midribs of eight symptomatic (four plants per province) and four symptomless (collected in Fars province) *S. oleraceus* plants using the CTAB method of Zhang *et al.* (1998). DNA samples were tested for phytoplasma presence by a nested PCR assay primed by primer pairs P1/P7 followed by R16F2n/R16R2 (Lee *et al.*, 1998). Amplicons of ~1.25 kb were obtained in the nested round from all eight diseased plants but not from the four symptomless plants. Eight nested amplicons were separately cloned and sequenced. The obtained sequences were identical and a consensus sequence corresponding to the Abarkooch (Yazd Province, Iran) *S. oleraceus* phyllody phytoplasma was deposited in GenBank (Accession No. MG652627). The *S. oleraceus* phyllody phytoplasma strain had 99.78% sequence identity with the '*Ca. P. asteris*' reference strain (M30790). A BLAST search showed that this sequence had maximum identity (99-100%) with members of the 16SrI subgroup B. Phylogenetic analysis using the neighbour-joining method (MEGA7) (Fig. 2) showed that the Abarkooch *S. oleraceus* phyllody phytoplasma was clustered within the 16SrI group closest to onion yellows phytoplasma (NC_005303), representative of subgroup 16SrI-B.

A 16SrI-A phytoplasma has been previously reported in *S. oleraceus* in Canada (Khadhair *et al.*, 2008), however to our knowledge this is the first report of a 16SrI-B phytoplasma associated with *S. oleraceus* phyllody disease. The occurrence of 16SrI-B phytoplasma strains were previously reported in Iran on *Brassica napus* (Salehi *et al.*, 2011), *Eruca sativa*

(Esmailzadeh Hosseini *et al.*, 2017) and *Eucalyptus camaldulensis* (Salehi *et al.*, 2016); *S. oleraceus* may act as a reservoir host.

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Figure 1

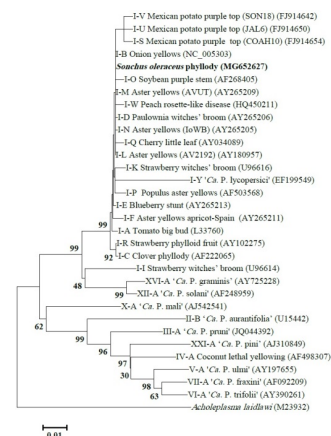


Figure 2

To cite this report: Salehi M, Esmailzadeh Hosseini SA, Salehi E, 2018. First report of a '*Candidatus Phytoplasma asteris*'-related strain (16SrI-B) associated with *Sonchus oleraceus* (common sowthistle) phyllody disease in Iran. *New Disease Reports* **37**, 6. <http://dx.doi.org/10.5197/j.2044-0588.2018.037.006>

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