



First report of a phytoplasma associated with bell pepper big bud disease in Iran

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Bell pepper, also known as sweet pepper (*Capsicum annuum*), is an important economic vegetable in Iran. In February 2015, typical symptoms of phytoplasma disease, including yellowing, big bud, little leaf and virescence were observed in bell pepper plants in different areas of Hormozgan province, Iran (Fig. 1). Total DNA was extracted separately from five symptom-bearing and two symptomless plants using the CTAB method. Samples were analysed for detection of phytoplasma DNA by PCR using the phytoplasma universal primer pair P1/P7 (Deng & Hiruki, 1991; Schneider *et al.*, 1995). Amplicons of c. 1.8 kb were obtained from all symptom-bearing but not from symptomless plants. PCR products obtained from two infected plants were directly sequenced and the sequences were deposited in GenBank. The two 16S rDNA sequences shared 100% sequence identity. Sequence comparison by BLAST analysis revealed that the two phytoplasma isolates associated with bell pepper big bud (BPBB), BPBB1 (KR706443) and BPBB2 (KR706444) had the highest identity (100%) with seven phytoplasma sequences, all belonging to isolates in the 16SrII group (peanut witches' broom group). These seven phytoplasma sequences had an Asian/Australasian origin and were identified in association with phytoplasma diseases in eggplant (JX441321, from Iran), faba bean (KP869129, from Iran), tomato (JQ868448, from Australia), papaya (Y10096 and Y10097, from Australia), beach naupaka (AB257291, from Oman) and parthenium weed (LN879442, from India). Phylogenetic analysis using the neighbour-joining method (MEGA 5 software) based on the 16S rRNA gene sequences of the phytoplasma isolated from bell pepper and other phytoplasmas demonstrated that the BPBB phytoplasma is a member of the 16SrII phytoplasma clade (Fig. 2).

Phytoplasmas associated with *C. annuum* diseases have been reported worldwide, including pepper little leaf (16SrI), chilli pepper big bud (16SrVI), and pepper witches' broom (16SrI) (Randall *et al.*, 2009; Santos-Cervantes *et al.*, 2008; Zheng-Nan *et al.*, 2013). Moreover, Arocha *et al.* (2010) detected a 16SrIII phytoplasma associated with leaf size reduction and shortening of internodes in bell pepper in Bolivia. This report illustrates the potential of 16SrII-related phytoplasmas to damage the production of

bell pepper. To our knowledge, this is the first report of a 16SrII phytoplasma associated with bell pepper big bud in Iran and most probably in the world.

References

- Arocha Y, Plata G, Franco J, Maín G, Veramendi S, Lazcano F, Crespo JL, Lino V, Calderón C, Llerena R, Andrew R, Antezana O, Gutiérrez A, Coca M, Boa E. 2010. First report of a 16SrIII phytoplasma (X-disease group) affecting bell pepper, strawberry (frutilla), *Schinus molle* and *Arracacia xanthorrhiza* in Cochabamba, Bolivia. *Plant Pathology* **59**, 395. <http://dx.doi.org/10.1111/j.1365-3059.2009.02235.x>
- Deng S, Hiruki C, 1991. Amplification of 16 S rRNA genes from culturable and non-culturable mollicutes. *Journal of Microbiological Methods* **14**, 53–61. [http://dx.doi.org/10.1016/0167-7012\(91\)90007-D](http://dx.doi.org/10.1016/0167-7012(91)90007-D)
- Randall JJ, Bosland PW, Hanson SF, 2009. Broto grande, a new phytoplasma associated disease of chile peppers. *Plant Disease* **93**, 968. <http://dx.doi.org/10.1094/PDIS-93-9-0968C>
- Santos-Cervantes ME, Chávez-Medina JA, Méndez-Lozano J, Leyva-López NE, 2008. Detection and molecular characterization of two little leaf phytoplasma strains associated with pepper and tomato diseases in Guanajuato and Sinaloa, Mexico. *Plant Disease* **92**, 1007-1011. <http://dx.doi.org/10.1094/PDIS-92-7-1007>
- Schneider B., Seemüller E, Smart CD, Kirkpatrick BC, 1995. Phylogenetic classification of plant pathogenic mycoplasma-like organisms or phytoplasmas. In: Razin S, Tully JG, eds. *Molecular and Diagnostic Procedures in Mycoplasmaology*. New York, USA: Academic Press, Vol. 2, 369-80. <http://dx.doi.org/10.1016/B978-012583805-4/50040-6>
- Zheng-Nan L, Zhang L, Song J-G, Wu, Y-F, 2013. Molecular detection and identification of phytoplasma associated with pepper witches' broom in China. *Phytoparasitica* **41**, 429-434. <http://dx.doi.org/10.1007/s12600-013-0304-2>



Figure 1

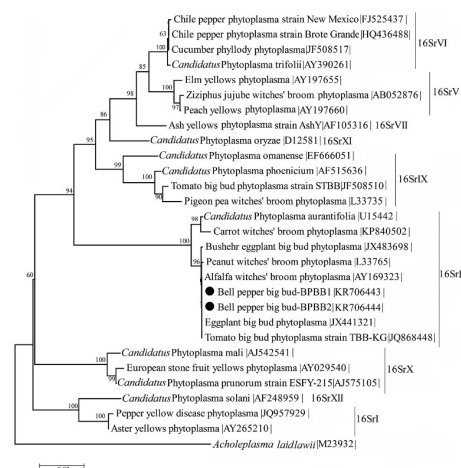


Figure 2

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