

Mini data sheet on *Fusarium oxysporum* f.sp. *lactucae*

Added in 2009 - Deleted in 2013

Reasons for deletion:

Fusarium oxysporum f.sp. *lactucae* has been included in EPPO Alert List for more than 3 years and during this period no particular international action was requested by the EPPO member countries. In 2013, it was therefore considered that sufficient alert has been given and the pest was deleted from the Alert List.

Fusarium oxysporum f.sp. *lactucae*, a fusarium wilt of lettuce

Why	A wilt disease of lettuce caused by <i>Fusarium oxysporum</i> f.sp. <i>lactucae</i> was first described in Japan in 1955. This disease was then detected in other Asian countries, in the USA (California and later in Arizona, which are the main lettuce-growing areas of the country) and finally in Europe (Italy and Portugal). Because this fusarium wilt of lettuce is apparently spreading across different continents and causing significant economic losses, especially in the highly profitable sector of pre-processed lettuce, the Panel on Phytosanitary Measures suggested its addition to the EPPO Alert List.
Where	EPPO region: Italy (first found in 2002 in Lombardia, and then in Piemonte, Veneto and Emilia Romagna), Portugal (found in 2004 in Entre Douro e Minho). Asia: Iran (1995), Japan (1955; Hokkaido, Honshu, Kyushu), Korea Republic (Gyeonggi Province in 2006), Taiwan (1998). North America: USA (Arizona in 2001, California in 1990).
On which plants	<i>Lactuca sativa</i> and <i>Valerianella locusta</i> (lamb's lettuce). Most cultivar groups of lettuce, such as butterhead, iceberg, oak leaf, romaine, Batavia, are susceptible to the disease. In Northern Italy, outbreaks mainly occurred on spring and summer leaf lettuce, particularly on cultivars belonging to the Batavia type and grown for the production of pre-processed lettuce.
Damage	Affected plants show leaf yellowing and wilting. Crown tissues and upper roots usually show a reddish brown necrosis followed by decaying. Vascular necrosis can often be seen on leaf veins. Infected plants are stunted and often die, resulting in significant losses for the growers. In Northern Italy, <i>F. oxysporum</i> f.sp. <i>lactucae</i> is considered as one of the limiting factors for commercial production of lettuce during the summer season, particularly when lettuce is grown as a monoculture (e.g. in the production of pre-processed lettuce). In Italy, up to 70% losses in contaminated lettuce fields have been observed. Under favourable climatic conditions (the optimum soil temperature is between 24-28°C), infection may lead to total destruction of the crop. In many cases, growers have been obliged to stop growing lettuce on infested plots.
Transmission	<i>F. oxysporum</i> f.sp. <i>lactucae</i> is a soil-borne disease. It is thought that the fungus penetrates the plants via natural apertures or wounds on the roots, and that its chlamydospores can remain viable in the soil or on plant debris for a long time. In addition, studies carried out in Italy have showed that this fusarium wilt was also transmitted through seeds. Over long distance, it is considered that the most important mode of transmission is through infected seeds, and it is hypothesized that the disease was introduced in this way into Europe. Over smaller distances (i.e. within a country or region) infected transplants can rapidly spread the disease, and on a smaller scale (from field to field) the disease is probably spread by soil attached to machinery, agricultural tools, water, and plant debris.
Pathway	Plants for planting and seeds of <i>Lactuca sativa</i> and <i>Valerianella locusta</i> , soil attached to plants or machinery. The risk of spreading the disease via infected vegetables seems very low but cannot be totally excluded (in particular, more information would be needed to assess the risk of spreading the disease while processing lettuce for the final consumers and whether infected plant debris or soil might be released into the environment).

Possible risks	Lettuce is an important vegetable crop in the EPPO region (the main producers are Spain, Italy, France and the United Kingdom) and its commercial production is increasing. In most areas where <i>F. oxysporum</i> f.sp. <i>lactucae</i> has emerged, economic losses have been observed. Although data is lacking on its potential of establishment in other European countries, its presence in Italy and Portugal strongly suggests that the fungus has the potential to establish in many lettuce-growing areas. In general, control of soilborne diseases is difficult. In the case of <i>F. oxysporum</i> f.sp. <i>lactucae</i> , research is being carried out on the effects of crop rotation (probably 5 years without lettuce crops would be necessary), crop management (e.g. planting dates), soil disinfection (e.g. solarization, chloropicrin), use of tolerant/resistant cultivars, and of biological control measures (e.g. <i>Streptomyces griseoviridis</i> , <i>Trichoderma harzianum</i> and hypovirulent strains of <i>Fusarium</i>). The fact that the fungus is seed-transmitted adds to the risk of spreading the disease across continents. It is thought that the use of healthy planting material (seeds, transplants) produced in the framework of certification schemes would probably be an essential tool to prevent further spread of the disease through trade.
Source(s)	<p>Antoniacci L, Montuschi C, Gengotti S, Censi D (2006) [Solutions for the fusarium wilt of lettuce]. <i>L'informatore Agrario</i> no. 43, 39-41 (in Italian).</p> <p>Bignami C, Sidero F, Roma F (2009) Cloropicrina: necessaria su rucola per scampare a funghi e infestanti. <i>Terra et Vita</i> no. 31-32, 69-71 (in Italian).</p> <p>Etebarian HR, Milani MJ, Alizadeh A (2001) Reaction of lettuce cultivars to Fusarium wilt (<i>Fusarium oxysporum</i> f.sp. <i>lactucum</i>). <i>Seed and Plant</i> 17(3), 275-285 (abst.).</p> <p>Garibaldi A, Gilardi G, Gullino ML, Omodei M (2002) [Severe attacks of Fusarium wilt on lettuce near Bergamo (Northern Italy)]. <i>Informatore Fitopatologico</i> no. 7-8, 53-55 (in Italian).</p> <p>Garibaldi A, Gilardi G, Gullino ML (2004) First report of <i>Fusarium oxysporum</i> causing vascular wilt of lamb's lettuce (<i>Valerianella olitoria</i>) in Italy. <i>Plant Disease</i> 88(1) p 83.</p> <p>Garibaldi A, Gilardi G, Gullino ML (2004) Seed transmission of <i>Fusarium oxysporum</i> f.sp. <i>lactucae</i>. <i>Phytoparasitica</i> 32(1), 61-65.</p> <p>Gilardi G, Gullino ML, Garibaldi A (2006) [New diseases on processed salads]. <i>Informatore Fitopatologico</i> no. 12, 15-19.</p> <p>Hong C F, Chang PFL, Huang JL, Wan YL, Huang JW (2008) Identification for physiological races of <i>Fusarium oxysporum</i> f.sp. <i>lactucae</i> and screening of lettuce cultivars resistant to Fusarium wilt. <i>Plant Pathology Bulletin</i> 17(3), 233-242.</p> <p>Kim JY, Hong SS, Lee JG, Lee HJ, Lim JW, Kim JW, Kim HG (2008) [Occurrence of fusarium wilt caused by <i>Fusarium oxysporum</i> f.sp. <i>lactucae</i> and cultivar susceptibility on lettuce]. <i>Research in Plant Disease</i> 14(2), 79-84 (abst.) (in Korean).</p> <p>Marques Ramalheite M de L, Gonçalves Bastos C, Matias Furtado AJ (2006) [New diseases of lettuce in the region of Entre Douro e Minho]. O Minho, a Terra e o Homem, Ministério da Agricultura, do Desenvolvimento Rural e das Pescas, pp 61-65 (in Portuguese). http://www.drapn.min-agricultura.pt/draedm/centrodocumentacao/revista_pdf/13.M.Ramalheite.pdf</p> <p>Matheron ME, Koike ST (2003) First report of fusarium wilt of lettuce caused by <i>Fusarium oxysporum</i> f.sp. <i>lactucae</i> in Arizona. <i>Plant Disease</i> 87(10) p 1265</p> <p>Matheron ME, McCreight JD, Tickes BR, Porchas M (2005) Effect of planting date, cultivar, and stage of plant development on incidence of <i>Fusarium</i> wilt of lettuce in desert production fields. <i>Plant Disease</i> 89(6), 565-570.</p> <p>Mbofung GY, Hong SG, Pryor BM (2007) Phylogeny of <i>Fusarium oxysporum</i> f.sp. <i>lactucae</i> inferred from mitochondrial small subunit, elongation factor 1-α, and nuclear ribosomal intergenic spacer sequence data. <i>Phytopathology</i> 97(1), 87-98.</p> <p>McCreight JD, Matheron ME, Tickes BR, Platts B (2005) Fusarium wilt race 1 on lettuce. <i>HortScience</i> 40(3), 529-531.</p> <p>Millani MJ, Erebarian HR, Alizadeh A (1999) Occurrence of Fusarium wilt of lettuce in Shahr-Ray, Varamin and Karaj areas. <i>Iranian Journal of Plant Pathology</i> 35(1/4), p 121 (abst.).</p> <p>Montuschi C, Antoniacci L (2006) [Fusarium wilt a new disease of lettuce]. <i>Agricoltura</i>, May 2006, 94-95 (in Italian). http://www.ermesagricoltura.it/wcm/ermesagricoltura/rivista/2006/maggio/ra0605094s.pdf</p> <p>Pasquali M, Dematheis F, Gullino ML, Garibaldi A (2007) Identification of race 1 of <i>Fusarium oxysporum</i> f.sp. <i>lactucae</i> on lettuce by inter-retrotransposon sequence-characterized amplified region technique. <i>Phytopathology</i> 97(8), 987-996.</p> <p>Scott JC, Kirkpatrick SC, Gordon TR (2010) Variation in susceptibility of lettuce cultivars to fusarium wilt caused by <i>Fusarium oxysporum</i> f.sp. <i>lactucae</i>. <i>Plant Pathology</i> 59(1), 139-146.</p> <p>Scott JC, Gordon TR, Shaw DV, Koike ST (2010) Effect of temperature on severity of Fusarium wilt of lettuce caused by <i>Fusarium oxysporum</i> f.sp. <i>lactucae</i>. <i>Plant Disease</i> 94(1), 13-17.</p> <p>Yamauchi N, Shimazu J, Satou M, Horiuchi S, Shirakawa T (2004) Physiological races and vegetative compatibility groups of butterhead lettuce isolates of <i>Fusarium oxysporum</i> f.sp. <i>lactucae</i> in Japan. <i>Journal of General Plant Pathology</i> 70(6), 308-313 (abst.).</p>

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