Express PRA for *Fusarium oxysporum* f.sp. *conglutinans* – Research and Breeding –

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Initiation: Application for an Express-PRA by the Federal State Lower Saxony resulting from the request for the movement and use of the organism (here: an isolate from Canada highly pathogenic for rape) for research and breeding purposes.

Express Pest risk Analysis	***Fusarium oxysporum* f.sp. *conglutinans* W.C. Snyder & H.N. Hansen**		
Phytosanitary risk for Germany	**high** ☒	**medium** ☐	**low** ☐
Phytosanitary risk for EU-Member States	**high** ☒	**medium** ☐	**low** ☐
Certainty of assessment	**high** ☐	**medium** ☒	**low** ☐
Conclusion	The fungus *Fusarium oxysporum* f.sp. *conglutinans* (*Foc*) is native to the USA and was found locally in Germany only once in 1973. In the EU, there were reports from France, the Netherlands, Lithuania, Italy, Sardinia and Hungary. So far, *Foc* is listed neither in the Annexes of the Regulation (EU) 2019/2072 nor by EPPO. *Foc* infects Brassicaceae. Enormous damage is known in particular from China because of the infection with *Foc* race 2 on brassica vegetable. In recent times, there has been considerable damage on rape through race 1 in Russia and Canada. Due to appropriate climatic conditions, it is assumed that *Foc* can establish outdoors in Germany. The establishment in South European Member States is possible, too. Due to its high damage potential for Brassicaceae, like rape and cabbage, as well as the lack of chemical control *Foc*, in particular non-European isolates, pose a considerable phytosanitary risk to Germany and other EU-Member States. Based on this risk analysis, it is assumed that the pest can establish in Germany or another Member State and cause considerable damage. Thus, measures on the prevention of the release of this potential quarantine pest should be taken according to Article 29 of the Regulation (EU) 2016/2031.		
Preconditions for an Express-PRA fulfilled?	Could be a pest; is not listed. So far, it is not established in the area covered by the notifying plant protection service.		

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Taxonomy, common name, synonyms	Kingdom: fungi; Phylum: Ascomycota; Order: Hypocreales; Family: Nectriaceae, Species: *Fusarium oxysporum* f.sp. *conglutinans* W.C. Snyder & H.N. Hansen; Synonyms: *Fusarium conglutinans*, *Fusarium orthoceras* var. *conglutinans*, *Fusarium oxysporum* f. *conglutinans* (Wollenw.) W.C. Snyder & H.N. Hansen 1940, *Fusarium oxysporum* var. *orthoceras* (Appel & Wol.) Bilay; Common name: Cabbage Fusarium Wilt, Crucifers Fusarium Wilt
EPPO Code	FUSACO
Does a relevant earlier PRA exist?	No
Distribution and biology	Originally, *Foc* comes from the USA (LI et al. 2015). In the meanwhile, the fungus is present on all continents (CABI, 1986). In Europe, *Foc* is considered as widely distributed in France, Hungary and the Netherlands. The presence is known from Sardinia, Italy, Lithuania and locally in Ukraine, too (CABI, 2018). In Germany, Foc was found on radish (*Raphanus* sp.) outdoors near Frankfurt on Main once in 1973 (GERLACH, 1975). In Northern China, there have been severe outbreaks of *Foc* on cabbage since 2001 (LI et al., 2015). Currently, two races of *Foc* with different host plant preferences are known (LI et al., 2015). *Foc* can infect plants in all development stages. The fungus is a soil organism and with its chlamydospores (asexual fungus spores that serve for persistence), it may survive for many years in the soil and stay infectious. The infection occurs via the root system of the host plant. The fungus grows within the phloem and leads to blockage, wilting, leaf yellowing, dwarfing or dieback of the plant. Above ground, the disease shows as slow wilting. The soil temperature is the limiting factor of the disease, and at temperatures below 20°C the infection usually does not develop. *Foc* infections in warm temperatures are faster and more serious (KOIKE et al., 2006).
Presence of host plants in the PRA-area? If so, which?	*Foc* infects Brassicaceae. In the PRA-area, cauliflower (*Brassica oleracea* var. *botrytis*), cabbage (*B. oleracea* var.

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	capitata), broccoli (*B. oleracea* var. *italica*), turnip (*Brassica rapa* subsp. *oleifera*), black mustard (*Eruca vesicaria*) (CABI, 2018), rape (*Brassica napus*) (GAETÁN, 2005), and radish (*Raphanus* sp.) are economically relevant (GERLACH, 1975). In 2017, app. 1.3 million ha rape were cultivated in Germany and cabbage and other crucifers were cultivated on app. 14.000 ha (FAOSTAT, 2019). Throughout the EU, app. 6.7 million ha rape were cultivated and 165.000 ha of other crucifers (FAOSTAT, 2019).
Is a vector/ further plant for host alternation needed? Which? Distribution?	No. The infection occurs via the seeds, the seedling or infested soil.
Climate in the distribution area comparable to PRA area?	*Foc* is present nearly worldwide. The fungus is present in tropical and temperate regions (KOIKE et al., 2006). Currently, a limitation of the species due to climatic conditions is not assumed in Germany or Europe. However, suitable soil temperatures of 22 to 28°C are decisive for impacts caused by *Foc* (LIU, 2017).
If no, are host plants present in protected cultivation?	----
Damage to be expected in the PRA-area?	Infected plants have a reduced crop yield, minor quality, or there are total losses due to the dieback of the host plant. In 1973, severe losses caused by *Foc* were found on radish cultivated outdoors in Frankfurt am Main in Germany (GERLACH, 1975). According to Gerlach (1975), race 1 is found in Europe. Race 1 causes increasing damage in rape cultivation (Fusarium wilt on canola). Significant damage was reported from Russia (1996), Canada (1999) and Argentina (since 2002). Since 2001, the occurrence of *Foc* Race 2 increased in North China. This led to significant crop losses of cabbage (*Brassica oleracea* var. *capitata*) (LI et al., 2015). *Foc* may persist in soil for up to 10 years and can hardly be controlled by chemical or physical means (LIU, 2017). In the case of an infected area, only the cultivation of resistant species may help.

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	In recent times, damage caused by the fungus is not known in Europe. It is not clear whether this is the result of a high resistance of cultivated crop plants, of the absence of the pest or of a low pathogenicity of possibly latently occurring *Foc*-populations. Severe damage from pathogenic, non-European isolates (here: Canadian isolates on rape) can be expected.
Remarks	The damage caused by *Foc* increased considerably in several regions on earth. It is not clear whether the increased damage caused by *Foc* is the result of a decreased resistance of the cultivated species, the climate change or new isolates of the fungus. Thus, the establishment of isolates from third countries has to be prevented. Data on the distribution of *Foc* in Europe are very fragmentary. The latent distribution of populations with low pathogenicity seems possible. The prevention of the release of the organism must be ensured during transport and use.
Literature	CABI, 1986: *Fusarium oxysporum* f.sp. *conglutinans*. [Distribution map]. Distribution Maps of Plant Diseases 1986 March (Edtion 5) Map 54, CAB International, Wallingford, UK. CABI, 2018: Datasheet *Fusarium oxysporum* f.sp. *conglutinans* (cabbage *fusarium* wilt). Invasive Species Compendium, https://www.cabi.org/cpc/datasheet/24632 (Revision: 28-03-2018; accessed on: 28-02-2019) FAOSTAT, 2019: Crops. Food and Agriculture Organization of the United Nations. http://www.fao.org/faostat/en/#data/QC (accessed on: 28-02-2019) Gaetán, S. A., 2005: Occurrence of *Fusarium* Wilt on Canola Caused by *Fusarium oxysporum* f.sp. *conglutinans* in Argentina. Plant Disease 89(4), 432. GERLACH, W., 1975: Der erste Fall von *Fusarium*-Welke an Levkojen (unter Glas) in Germany. The first observation of *Fusarium* wilt on garden stock (*Matthiola incana*) in Germany. Nachrichtenbl. Deu. Pflanzenschutzd. (Braunschweig) 27, 17-20. KOIKE, S. T., P. GLADDERS, A. O. PAULUS, 2006: Vegetable Diseases: A Color Handbook. Gulf Professional Publishing, 448 S.

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