NAME OF THE ORGANISM: Candidatus Liberibacter solanacearum (Liberibacter solanacearum) (LIBEPS)

GENERAL INFORMATION ON THE PEST

Name as submitted in the project specification (if different to the preferred name):
 
  
Pest category:
 
Bacteria **1- Identity of the pest/Level of taxonomic listing:**  
Is the organism clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?
 
Yes  
Is the pest defined at the species level or lower?:
 
Yes  
Can listing of the pest at a taxonomic level higher than species be supported by scientific reasons or can species be identified within the taxonomic rank which are the (main) pests of concern?

* Not relevant: Seed potato sector, Vegetable seed sector

Is it justified that the pest is listed at a taxonomic rank below species level?
 
Yes  
Conclusion:

* Candidate: Seed potato sector, Vegetable seed sector

Justification (if necessary):
 
Haplotypes A and B are not present in the EPPO region. If haplotypes A and B are regulated as quarantine pests, a listing of haplotypes C, D and E could be justified based on geographical distribution. **2 – Status in the EU:**
   
Is this pest already a quarantine pest for the whole EU?
 
No  
Presence in the EU:
 
Yes  
List of countries (EPPO Global Database):
 
Finland (2017); Germany (2015); Spain (2017); Spain/Islas Canárias (2017); Sweden (2016)  
Conclusion:
 
candidate  
Justification (if necessary):
 
Data of the presence of this pest on the EU territory are available in EPPO Global Database (<https://gd.eppo.int/>). Only haplotypes C, D and E are present in the EPPO region (European haplotypes, Apiaceae haplotypes).

HOST PLANT N°1: Daucus carota (DAUCA) for the Vegetable seed sector.

Origin of the listing:
 
EPPO Panel on phytosanitary measures for potato  
Plants for planting:
 
Seeds **3 - Is the pest already listed in a PM4 standard on the concerned host plant?**
 
No 
Conclusion:
 
Evaluation continues **4 - Are the listed plants for planting the main\* pathway for the "pest/host/intended use" combination? (\*: significant compared to others):**
 
? 
Conclusion:
 
  
 
Justification:
 
The transmission of the bacterium from the seeds to the plants is reported by Bertolini et al. (2015): they demonstrated a ratio of transmission up to 42%. However these results are discutable in regards to the study recently published by Loiseau et al. (2017), in which “results indicate that transmission of ‘Ca. L. solanacearum’ by carrot seed is rare and difficult to reproduce'. Psyllids can spread the disease. In addition, the pest has a wide natural host range in Apiaceae family (Hajri, 2017). Treatments with insecticide against the psyllid vectors are available.  
Whether reduction of inoculum of haploptypes present in the EPPO region can be achieved by RNQP status depends on the significance of seed transmission compared to other pathways and reservoirs of the pathogen. Published research has not confirmed the results of Bertolini et al. (2015) which showed high transmission rates. More data is needed before a decision can be taken on this point, and is being generated in current EU projects. **5 - Economic impact:**  
Are there documented reports of any economic impact on the host?
 
Yes  
Justification:
 
In several European farms, ‘Candidatus Liberibacter solanacearum’ was found associated to severe disorders in carrot, making the productions unmarketable (Finland, Munyaneza et al., 2010; Norway, Munyaneza et al., 2012; Sweden, Munyaneza et al., 2012; Spain Mainland, Alfaro-Fernández et al., 2012a; Spain Canary Islands, Alfaro-Fernández et al., 2012b; France, Loiseau et al., 2014; Morocco, Tahzima et al., 2014; Germany, Munyaneza et al., 2015; Austria, EUPHRESCO meeting 2017; Greece, Holeva et al., 2017). Affected plants show leaf curling, yellow and purple discolouration of leaves, stunting of roots and shoots, and proliferation of secondary roots (EPPO, 2009). In Norway, infection rate of 'Ca. L. solanacearum' in carrot, ranged from 10 to 100% in 70 to 80% of commercial fields and experimental plots in southeastern Norway from late July to mid-September of 2011. In Greece, in July 2016, 35-40% of plants were found symptomatic in a 10 ha commercial field (Munyaneza et al., 2012; Holeva et al., 2017).  
What is the likely economic impact of the pest irrespective of its infestation source in the absence of phytosanitary measures? (= official measures)
 
Major  
Is the economic impact due to the presence of the pest on the named host plant for planting, acceptable to the propagation and end user sectors concerned?
 
No  
Conclusion:
 
Candidate  
Justification:
 
Medium to Major on the basis of the previous cited literature. Lack of official economic data. **6 - Are there feasible and effective measures available to prevent the presence of the pest on the plants for planting at an incidence above a certain threshold (including zero) to avoid an unacceptable economic impact as regards the relevant host plants?**
 
Yes
 
Conclusion:
 
candidate  
Justification:
 
Inclusion of ‘Ca L. solanacearum’ in the certification scheme would prevent the presence of the pest on the plants for planting. Measures taken now will help to reduce the economic impact if an efficient vector establishes in the future. **7- Is the quality of the data sufficient to recommend the pest to be listed as a RNQP?**
 
 
Conclusion:
 
  
Justification:
 
 **CONCLUSION ON THE STATUS:**
 
Not conclusive. Experts recommended waiting for additional data before a decision can be taken on this point. Such data are being generated in current EU projects. **8 - Tolerance level:**  
Is there a need to change the Tolerance level:
 
  
Proposed Tolerance levels:
 
 **9 - Risk management measures:**  
Is there a need to change the Risk management measure:
 
  
Proposed Risk management measure:
 
 **REFERENCES:**

* Alfaro-Fernández A, Cebrián MC, Villaescusa FJ, de Mendoza AH, Ferrándiz JC, Sanjuán S & Font MI (2012a) First report of ‘Candidatus Liberibacter solanacearum’in carrot in mainland Spain. Plant Disease 96, 582-582;
* Alfaro-Fernández A, Siverio F, Cebrián MC, Villaescusa FJ & Font MI (2012b) ‘Candidatus Liberibacter solanacearum’associated with Bactericera trigonica-affected carrots in the Canary Islands. Plant Disease 96, 581-581;
* Bertolini E, Teresani GR, Loiseau M, Tanaka FAO, Barbé S, Martínez C, Gentit P, López MM, Cambra M (2015) Transmission of ‘Candidatus Liberibacter solanacearum’ in carrot seeds. Plant Pathology 64, 276-285;
* Euphresco (2017) PHYLIB meeting Bologna, 27-28 April 2017;
* EPPO (European Plant Protection Organization) (2009) 'Candidatus Liberibacter solanacearum'. <https://www.eppo.int/QUARANTINE/Alert_List/bacteria/Liberibacter_psyllaurous.htm>;
* IPPC Emergency actions (2015) Notification of phytosanitary measures to reduce the risk of introduction of 'Candidatus Liberibacter solanacearum' through the importation of carrot (seed and seedling) and celery (seedling) - Emergency Actions. FAO, Roma. <https://www.ippc.int/en/countries/japan/eventreporting/2015/05/emergency-measures-to-reduce-the-risk-of-introduction-of-candidatus-liberibacter-solanacearum-through-the-importation-of-carrot-seed-and-seedling-and-celery-seedling/>;
* IPPC Emergency Action (2016) Proposed revision of List of the plants subject to Specific Phytosanitary Measures to be carried out in Exporting Countries (Annexed Table 2-2 of the Ordinance for Enforcement of the Plant Protection Act). FAO, Roma.
* <http://www.maff.go.jp/j/syouan/keneki/kikaku/pdf/04_at2_2_specific_measures.pdf>;
* Hajri A, Loiseau M, Cousseau-Suhard P, Renaudin I & Gentit P (2017) Genetic Characterization of ‘Candidatus Liberibacter solanacearum’Haplotypes Associated with Apiaceous Crops in France. Plant Disease, Posted online on 15 May 2017. <https://doi.org/10.1094/PDIS-11-16-1686-RE>;
* Holeva MC, Glynos PE & Karafla CD (2017) First report of ‘Candidatus Liberibacter solanacearum’on carrot in Greece. Plant Disease, Accepted for publication. <https://doi.org/10.1094/PDIS-03-17-0419-PDN>;
* IPPC (2017) ISPM 27. Diagnostic protocols for regulated pests DP 21: ‘Candidatus Liberibacter solanacearum’ Adopted 2017 – Taxonomic Information p.3
* Loiseau M, Garnier S, Boirin V, Merieau M, Leguay A, Renaudin I, Renvoisé J-P & Gentit P (2014) First Report of ‘Candidatus Liberibacter solanacearum’ in Carrot in France. Plant Disease 6, 839, available at: <https://doi.org/10.1094/PDIS-08-13-0900-PDN>;
* Loiseau M, Renaudin I, Cousseau-Suhard P, Lucas PM, Forveille A, Gentit P (2017) Lack of evidence of vertical transmission of ‘Candidatus Liberibacter solanacearum’ by carrot seeds suggests that seed is not a major transmission pathway. Plant Disease. Available at <https://doi.org/10.1094/PDIS-04-17-0531-RE>;
* Munyaneza JE, Fisher TW, Sengoda VG, Garczynski SF, Nissinen A & Lemmetty A (2010) First Report of 'Candidatus Liberibacter solanacearum' associated with Psyllid-Affected Carrots in Europe. Plant Disease 94, 639;
* Munyaneza JE, Sengoda VG, Stegmark R, Arvidsson AK, Anderbrant O, Yuvaraj JK, Ramert B & Nissinen A (2012) First report of 'Candidatus Liberibacter solanacearum' associated with psyllid-affected carrots in Sweden. Plant Disease 96, 453;
* Munyaneza JE, Sengoda VG, Sundheim L & Meadow R (2012) First report of “Candidatus Liberibacter solanacearum” associated with psyllid-affected carrots in Norway. Plant Disease 96, 454-454;
* Munyaneza JE, Swisher KD, Hommes M, Willhauck A, Buck H & Meadow R (2015) First report of ‘Candidatus Liberibacter solanacearum’associated with psyllid-infested carrots in Germany. Plant Disease 99, 1269;
* Tahzima R, Maes M, Achbani EH, Swisher KD, Munyaneza JE & De Jonghe K (2014) First report of ‘Candidatus Liberibacter solanacearum’on carrot in Africa. Plant Disease 98, 1426-1426;

HOST PLANT N°2: Solanum tuberosum (SOLTU) for the Seed potato sector.

Origin of the listing:
 
EPPO Panel on phytosanitary measures for potato  
Plants for planting:
 
Plants intended for planting, other than [true] seeds **3 - Is the pest already listed in a PM4 standard on the concerned host plant?**
 
No 
Conclusion:
 
Evaluation continues **4 - Are the listed plants for planting the main\* pathway for the "pest/host/intended use" combination? (\*: significant compared to others):**
 
Yes 
Conclusion:
 
Candidate  
 
Justification:
 
’Ca. L. solanacearum' is associated with the zebra chip disease of potato (usually haplotypes A and B). The recent discovery of volunteer potato plants in Finland infected with haplotype C and in Spain infected with haplotype E would suggest that all haplotypes can infect potato. Lso is transmitted by psyllids, however no efficient vector other than Bactericera cockerelli is currently known for transmission of Lso between solanaceous plants. This psyllid species does not occur in the EPPO Region. Psyllids in the PRA area could act as inefficient vectors from carrot to potato but it appears not within or between solanaceous crops. Seed potato tubers are considered as an important source of inoculum (EPPO, 2012) particularly in New Zealand where tubers mostly sprout and infected plants may be asymptomatic. Importance of the plants for planting pathway compared to natural dispersal will vary according to the pest and vector prevalence in the area. In area where the pest is present, and in the absence of efficient vectors, plants for planting are considered to be the main pathway for the pest/host/intended use combination. **5 - Economic impact:**  
Are there documented reports of any economic impact on the host?
 
Yes  
Justification:
 
’Ca. L. solanacearum’ causes severe damage in potato in its current area of distribution. Yield and quality are affected: It caused millions of dollars in losses in the USA and New-Zealand. Yields were impacted by more than 20% (USA) to approximately 60% (New-Zealand). Yield impacts have been as high as 100% in some fields in Central America. Quality is affected in relation to internal discoloration, modification of the sugar and mineral content, reduction of the dry matter, and appearing of phenolic compounds. In the Americas potato tubers affected by zebra chip usually do not sprout or produce week sprouts and cannot be used as seed (EPPO, 2012), however in New Zealand tubers mostly sprout and infected plants may be asymptomatic. This data is for haplotypes A and/ or B. The five haplotypes A, B, C, D and E are not yet known to elicit biological differences, although recently haplotype B was said to be more pathogenic than haplotype A. Haplotypes C and E have been detected recently in the EPPO region in volunteer potato or potato crops, and may have the same economic impact if an efficient vector for transmission was introduced.  
What is the likely economic impact of the pest irrespective of its infestation source in the absence of phytosanitary measures? (= official measures)
 
Major  
Is the economic impact due to the presence of the pest on the named host plant for planting, acceptable to the propagation and end user sectors concerned?
 
No  
Conclusion:
 
Candidate  
Justification:
 
 **6 - Are there feasible and effective measures available to prevent the presence of the pest on the plants for planting at an incidence above a certain threshold (including zero) to avoid an unacceptable economic impact as regards the relevant host plants?**
 
Yes
 
Conclusion:
 
candidate  
Justification:
 
Inclusion of ‘Ca L. solanacearum’ in the certification scheme would prevent the presence of the pest on the plants for planting. Measures taken now will help to reduce the economic impact if an efficient vector establishes in the future. **7- Is the quality of the data sufficient to recommend the pest to be listed as a RNQP?**
 
Yes
 
Conclusion:
 
Candidate  
Justification:
 
 **CONCLUSION ON THE STATUS:**
 
Recommended for listing as an RNQP - based on Data. If haplotypes A and B are regulated as quarantine pests in a country, the RNQP Status should then be restricted to European haplotypes C, D and E. This regulation will help in preventing introduction of Lso into the potato production system, and help in suppressing Lso in potato production systems where it is present. Reducing reservoirs of inoculum would help in reducing then economic impact of haplotypes C, D and E if an efficient vector might establish or arise. **8 - Tolerance level:**  
Is there a need to change the Tolerance level:
 
Yes  
Proposed Tolerance levels:
 
Zero tolerance, based on symptoms, or inspection and testing (see Risk management measures). **9 - Risk management measures:**  
Is there a need to change the Risk management measure:
 
Yes  
Proposed Risk management measure:
 
(a) Plants produced in areas known to be free from Liberibacter solanacearum. The pest free area status should take into account the carrot pathway and whether vectors are present;  
or  
(b) No symptoms of 'Candidatus Liberibacter solanacearum' have been seen during official crop or tuber inspections of seed potatoes at the place of production since the start of the last complete cycle of vegetation;  
or  
(c) Inspection of each lot (cut a representative sample of tubers) and testing of symptomatic tubers to confirm the absence of 'Candidatus Liberibacter solanacearum'.  
  
Reports of the new incidences of 'Candidatus Liberibacter solanacearum' should continue to be reported to EPPO so that the effect can be monitored. **REFERENCES:**

* EPPO (2012) Final pest risk analysis for Candidatus Liberibacter solanacearum in Solanaceae. EPPO, Paris.