NAME OF THE ORGANISM: Verticillium dahliae (VERTDA)

GENERAL INFORMATION ON THE PEST

Name as submitted in the project specification (if different to the preferred name):
 
  
Pest category:
 
Fungi **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: Vegetable propagating and planting material (other than seeds) sector, Fruits (including hops) sector

Is it justified that the pest is listed at a taxonomic rank below species level?
 
Not relevant  
Conclusion:

* Candidate: Vegetable propagating and planting material (other than seeds) sector, Fruits (including hops) sector

**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):
 
Austria (2014); Belgium (2015); Bulgaria (1986); Cyprus (2011); Czech Republic (2011); Denmark (1986); France (1986); Germany (2012); Greece (2013); Greece/Kriti (2013); Hungary (1986); Italy (2007); Malta (2007); Netherlands (2015); Portugal (1986); Slovakia (2012); Spain (2014); United Kingdom (2014); United Kingdom/England (1986); United Kingdom/Scotland (1986); United Kingdom/Channel Islands (1986)  
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/>). V. dahliae is present in most EU MSs, with the exception of Ireland (absent, no pest records) and Poland (absent/uncertain). The current status of V. dahliae in the MSs where the pathogen is known to occur ranges from “restricted distribution” to “widespread” (EFSA, 2014).

HOST PLANT N°1: Capsicum annuum (CPSAN) for the Vegetable propagating and planting material (other than seeds) sector.

Origin of the listing:
 
2 - Vegetable seedling sector: Commission Directive 93/61/EC  
Plants for planting:
 
Plants intended for planting **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):**
 
No 
Conclusion:
 
Not candidate  
 
Justification:
 
Verticillium albo-atrum and V. dahliae cause wilting and sometimes death of plants. Verticillium wilt is a cool-weather disease and has a wide host range in natural areas. The two Verticillium spp. survive in soil, as long lived resting mycelium or microsclerotia, respectively, or in debris from infected plants (included weeds (EFSA, 2014)). Control is by use of healthy planting material, resistant cultivars, prevention of movement of infected plants and infested soil, removal of diseased plants and plant debris, avoiding high nitrogen concentrations and soil disinfestation. Crop rotation can reduce losses, but not eliminate the pathogens because of the wide host range of Verticillium spp. (EPPO, 2004). Bell pepper was found resistant to all V. dahliae isolates except those from pepper or eggplant in one paper, but in two other papers found little host specificity existed in isolates of V. dahliae and V. alboatrum, so crop rotation would not assist in control. Because C. annuum is grown from seeds (short production time), and because of the wide host range and longevity of inoculum sources in the environment, planting material (transplants) are not considered to be the main pathway. Once, established, V. dahliae can be spread by infected asymptomatic weed seeds and weed seeds, by water and by human-assisted means. **CONCLUSION ON THE STATUS:**
 
Disqualified: plants for planting are not the main pathway. Remark: the full methodology was applied on this pest to insure consistency with entries submitted by the IIA2 AWG for this pest. Indeed this pest/host combination was not identified by any EU MS in the RNQP Questionnaire as requiring a revision of current thresholds and or a revision of current management measures. This pest/host combination was not identified by the experts of the vegetable SEWG as being a candidate for the RNQP Status with specific tolerance levels and/or specific risk management measures. Experts recommended that this pest/host combination should be covered in the future by the 'substantially free from' requirement that will stay in the Vegetable propagating and planting (excluding seeds) EU Marketing Directives. **8 - Tolerance level:**  
Is there a need to change the Tolerance level:
 
No  
Proposed Tolerance levels:
 
Delisting. **9 - Risk management measures:**  
Is there a need to change the Risk management measure:
 
No  
Proposed Risk management measure:
 
Delisting. **REFERENCES:**

* Çürük S, Dasgan Y H, Mansuroglu S, Kurt S, Mazmanoglu M, Antaklı O & Tarla G (2009) Grafted eggplant yield, quality and growth in infested soil with Verticillium dahliae and Meloidogyne incognita. Pesquisa agropecuaria brasileira 12, 1673-1681. <http://dx.doi.org/10.1590/S0100-204X2009001200017>;
* EFSA Panel on Plant Health (PLH) (2014) Scientific Opinion on the pest categorisation of Verticillium dahliae Kleb. EFSA Journal 2014;12(12):3928, 54 pp. doi:10.2903/j.efsa.2014.3928. <http://www.efsa.europa.eu/en/efsajournal/doc/3928.pdf>;
* EPPO (2004) Good plant protection practice PP 2/30 (1) Outdoor solanaceous crops Bulletin OEPP/EPPO Bulletin 34, 79-90;
* EU COM (2016) Recommendation of the Working Group on the Annexes of the Council Directive 2000/29/EC – Section II – Listing of Harmful Organisms as regards the future listing of Verticillium dahlia Kleb.;
* Rudolph B A and Snyder W C (1937) Verticillum wilt of pepper. Plant Disease 21, 204;

HOST PLANT N°2: Corylus avellana (CYLAV) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°3: Cydonia oblonga (CYDOB) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°4: Cynara cardunculus (CYUCA) for the Vegetable propagating and planting material (other than seeds) sector.

Origin of the listing:
 
2 - Vegetable seedling sector: Commission Directive 93/61/EC  
Plants for planting:
 
Plants intended for planting **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):**
 
No 
Conclusion:
 
Not candidate  
 
Justification:
 
Verticillium albo-atrum and V. dahliae cause wilting and sometimes death of plants. Verticillium wilt is a cool-weather disease and has a wide host range in natural areas. The two Verticillium spp. survive in soil, as long lived resting mycelium or microsclerotia, respectively, or in debris from infected plants. Control is by use of healthy planting material, resistant cultivars, prevention of movement of infected plants and infested soil, removal of diseased plants and plant debris, avoiding high nitrogen concentrations and soil disinfestation. Crop rotation can reduce losses, but not eliminate the pathogens because of the wide host range of Verticillium spp. (EPPO, 2004). Bell pepper was found resistant to all V. dahliae isolates except those from pepper or eggplant in one paper, but in two other papers found little host specificity existed in isolates of V. dahliae and V. alboatrum, so crop rotation would not assist in control.  
Because cardon is grown from seeds, and because of the wide host range and longevity of inoculum sources in the environment, planting material (transplants) are not considered to be the main pathway. Once, established, V. dahliae can be spread by infected asymptomatic weed seeds and weed seeds, by water and by human-assisted means. **CONCLUSION ON THE STATUS:**
 
Disqualified: plants for planting are not the main pathway. Remark: the full methodology was applied on this pest to insure consistency with entries submitted by the IIA2 AWG for this pest. Indeed this pest/host combination was not identified by any EU MS in the RNQP Questionnaire as requiring a revision of current thresholds and or a revision of current management measures. This pest/host combination was not identified by the experts of the vegetable SEWG as being a candidate for the RNQP Status with specific tolerance levels and/or specific risk management measures. Experts recommended that this pest/host combination should be covered in the future by the 'substantially free from' requirement that will stay in the Vegetable propagating and planting (excluding seeds) EU Marketing Directives. **8 - Tolerance level:**  
Is there a need to change the Tolerance level:
 
No  
Proposed Tolerance levels:
 
Delisting. **9 - Risk management measures:**  
Is there a need to change the Risk management measure:
 
No  
Proposed Risk management measure:
 
Delisting. **REFERENCES:**

* EFSA Panel on Plant Health (PLH) (2014) Scientific Opinion on the pest categorisation of Verticillium dahliae Kleb. EFSA Journal 2014;12(12):3928, 54 pp. doi:10.2903/j.efsa.2014.3928. <http://www.efsa.europa.eu/en/efsajournal/doc/3928.pdf>;
* EPPO (2004) Good plant protection practice PP 2/30 (1) Outdoor solanaceous crops Bulletin OEPP/EPPO Bulletin 34, 79-90;
* EU COM (2016) Recommendation of the Working Group on the Annexes of the Council Directive 2000/29/EC – Section II – Listing of Harmful Organisms as regards the future listing of Verticillium dahlia Kleb.;
* Giménez-Jaime A, Beltrán R, Vicent A, Armengol J & García-Jiménez J 2004 Differential infection of artichoke propagating material grown in Verticillium dahliae infested and noninfested soil. Acta Horticulturae No.660, pp 501-505;
* Ortega A & Pérez S 2007 Aggressiveness of Verticillium dahliae isolates from potato to artichoke. Acta Horticulturae No.730, pp 407-411;
* Temperini A, Ercolani F, Temperini O, Colla G & Saccardo F 2010 Grafting of artichoke (Cynara cardunculus var. scolymus L.). Italus Hortus 17, No.2, pp 72-73;

HOST PLANT N°5: Cynara scolymus (CYUSC) for the Vegetable propagating and planting material (other than seeds) sector.

Origin of the listing:
 
2 - Vegetable seedling sector: Commission Directive 93/61/EC  
Plants for planting:
 
Plants intended for planting **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:
 
V. dahliae microsclerotia in infested soil or mycelia in the vascular rings of symptomless planting material (off-shoots or stumps) are the only inocula giving rise to disease in artichokes. Verticillium wilt is a monocyclic disease, i.e., it has only one cycle of pathogenesis per cropping season and the resulting inoculum does not give rise to new infection and disease within the same season. The epidemiology of Verticillium wilt diseases is driven mainly by inoculum density in soil. In addition, the ability of V. dahliae to infect many weed species may play an important role in the epidemiology of Verticillium wilts. Weeds may serve as alternative hosts contributing to maintenance or even increase of V. dahliae inoculum in soil (Cirulli et al., 2010).  
Verticillium albo-atrum and V. dahliae cause wilting and sometimes death of plants. Verticillium wilt is a cool-weather disease and has a wide host range in natural areas. The two Verticillium spp. survive in soil, as long lived resting mycelium or microsclerotia, respectively, or in debris from infected plants. Control is by use of healthy planting material, partial resistant cultivars (for artichoke), prevention of movement of infected plants and infested soil, removal of diseased plants and plant debris, avoiding high nitrogen concentrations and soil disinfestation. Crop rotation can reduce losses, but not eliminate the pathogens because of the wide host range of Verticillium spp. (EPPO, 2004). Bell pepper was found resistant to all V. dahliae isolates except those from pepper or eggplant in one paper, but in two other papers found little host specificity existed in isolates of V. dahliae and V. alboatrum, so crop rotation would not assist in control. In general, natural populations of V. dahliae are conceived as host adapted rather than host specific, i.e., they display cross pathogenicity but are more virulent to the host from which they were isolated. Pathogenicity of artichoke isolated was investigated and, in some cases, preferential hosts were found (cardoon, eggplant, melon, watermelon). Pepper, tomato, cucumber were not always affected by artichoke isolates (Cirulli et al., 2010).  
Regarding the wide host range and longevity of inoculum sources in the environment, planting material (transplants) are not considered to be the main pathway for introduction. However because artichoke is not produced using seeds (using vegetative propagation from mother plants, grown in open fields), and because rotation is available for this crop, experts agreed that plant for planting could be considered as a significant pathway compared to other pathways. **5 - Economic impact:**  
Are there documented reports of any economic impact on the host?
 
Yes  
Justification:
 
Severe wilt problems caused by Verticillium dahliae Kleb. are frequently observed in artichoke (Cynara cardunculus var. scolymus) grown in South Italy, Spain, and Chile, where diseased plants do not produce at all or give only few small and deformed heads (Temperini et al., 2010). In Eastern Spain, Verticillium wilt caused by V. dahliae is now recognized as one of the major problems limiting yield in artichoke crops (Cynara cardunculus var. scolymus [C. scolymus] (Ortega & Perez, 2007). Armengol et al. reported over 80% disease prevalence in Spanish fields of stump- and seed-propagated artichokes sampled during 1999 to 2002, with an average wilt incidence of 53.8%.  
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:
 
Overall, Verticillium wilt caused by V. dahliae is difficult to manage, and no single disease control measure is efficient enough if applied individually. The application of integrated management strategies that combine selection of planting site, disease risk assessment (e.g. assessment of the available inoculum in the soil, determination of pathotypes/races/VCGs present in the site, cropping history of the field, etc.), cultural practices, such as crop rotation and manipulation of fertility and irrigation, use of healthy planting material, including seeds, use of available resistant cultivars and sometimes pre-plant soil treatments, such as solarisation, that reduce the viability of microsclerotia in soil (El-Zik, 1985; Shen, 1985; Bell, 1992; Jeger et al., 1996; Klosterman et al., 2009; Jiménez-Díaz et al., 2012) may reduce disease incidence and severity, but they do not eliminate the pathogen (EFSA, 2014).  
In artichoke, the use of stump-propagated planting material should be reinforced by the establishment of fields of V. dahliae–free mother plants and the implementation of certification schemes. An alternative approach to reduce the risk of introducing the pathogen in non-infested soil would be the use of seed-propagated planting material (Cirulli et al., 2010). **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. Artichoke is produced using vegetative propagation from mother plants, grown in open fields, with rotation available. In these conditions experts agreed that plant for planting could be considered as a significant pathway compared to other pathways. Remark: the full methodology was applied on this pest to insure consistency with entries submitted by the IIA2 AWG for this pest. Indeed this pest/host combination was not identified by any EU MS in the RNQP Questionnaire as requiring a revision of current thresholds and or a revision of current management measures. This pest/host combination was not identified by the experts of the vegetable SEWG as being a candidate for the RNQP Status with specific tolerance levels and/or specific risk management measures. **8 - Tolerance level:**  
Is there a need to change the Tolerance level:
 
Yes  
Proposed Tolerance levels:
 
Zero tolerance approach, based on visual examination, recording of the cropping history and testing of material from which it derived. **9 - Risk management measures:**  
Is there a need to change the Risk management measure:
 
Yes  
Proposed Risk management measure:
 
(a) Mother plants have been derived from pathogen tested material;  
and  
(b) The plants have been grown in a site of production of which the cropping history is known, with no records of the occurrence of Verticillium dahliae;  
and  
(c) Plants have been inspected at appropriate times since the beginning of the last complete cycle of vegetation and found free from symptoms of Verticillium dahliae; **REFERENCES:**

* Armengol J, Berbegal M, Giménez-Jaime A, Romero S, Beltrán R, Vicent A, Ortega A & García-Jiménez J (2005) Incidence of Verticillium wilt of artichoke in eastern Spain and role of inoculum sources on crop infection. Phytoparasitica 33, 397-405;
* Cirulli M, Bubici G, Amenduni M, Armengol J, Berbegal M, Jiménez-Gasco M & Jiménez-Díaz M (2010) Verticillium Wilt: A Threat to Artichoke Production. Plant Disease 94, 1176-1187;
* EFSA Panel on Plant Health (PLH) (2014) Scientific Opinion on the pest categorisation of Verticillium dahliae Kleb. EFSA Journal 2014;12(12):3928, 54 pp. doi:10.2903/j.efsa.2014.3928. <http://www.efsa.europa.eu/en/efsajournal/doc/3928.pdf>;
* EPPO (2004) Good plant protection practice PP 2/30 (1) Outdoor solanaceous crops Bulletin OEPP/EPPO Bulletin 34, 79-90;
* EU COM (2016) Recommendation of the Working Group on the Annexes of the Council Directive 2000/29/EC – Section II – Listing of Harmful Organisms as regards the future listing of Verticillium dahlia Kleb.;
* Giménez-Jaime A, Beltrán R, Vicent A, Armengol J & García-Jiménez J 2004 Differential infection of artichoke propagating material grown in Verticillium dahliae infested and noninfested soil. Acta Horticulturae No.660, pp 501-505;
* Ortega A & Pérez S 2007 Aggressiveness of Verticillium dahliae isolates from potato to artichoke. Acta Horticulturae No.730, pp 407-411;
* Temperini A, Ercolani F, Temperini O, Colla G & Saccardo F 2010 Grafting of artichoke (Cynara cardunculus var. scolymus L.). Italus Hortus 17, No.2, pp 72-73;

HOST PLANT N°6: Fragaria (1FRAG) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°7: Humulus lupulus (HUMLU) for the Fruits (including hops) sector.

Origin of the listing:
 
IIA2AWG  
Plants for planting:
 
Plants intended for planting, other than seeds **3 - Is the pest already listed in a PM4 standard on the concerned host plant?**
 
Yes 
Conclusion:
 
Qualified **CONCLUSION ON THE STATUS:**
 
Recommended for listing as an RNQP - based on EPPO PM 4 Standard. **8 - Tolerance level:**  
Is there a need to change the Tolerance level:
 
No  
Proposed Tolerance levels:
 
Zero tolerance of symptomatic plants in the marketed material. **9 - Risk management measures:**  
Is there a need to change the Risk management measure:
 
Yes  
Proposed Risk management measure:
 
Non-certified material:  
(A) Derived from mother plants which have been inspected and found free from symptoms of Verticillium dahliae.  
AND  
(B) (a) Plants produced in areas known to be free from Verticillium dahliae;  
or  
(b) (aa) Isolation from production crops of Humulus lupulus, and  
(bb) Site of production found free from Verticillium dahliae over the last complete growing season at appropriate times by visual inspection of the foliage, and  
(cc) Recording of cropping and soil borne disease history of fields with a rest period from host plants of at least four years between findings of Verticillium dahliae and next planting.  
  
- Pre-basic, Basic, Certified material (Remark: no certification scheme on Hops at EU level):  
Additional measures to be considered:  
• Recording of cropping and soil borne disease history of fields;  
• Testing of pre-basic mother plants;  
• Pre-basic, basic: no symptoms seen at two inspections at appropriate times during the last growing season. **REFERENCES:**

* EFSA Panel on Plant Health (PLH) (2014) Scientific Opinion on the pest categorisation of Verticillium dahliae Kleb. EFSA Journal 2014;12(12):3928, 54 pp. doi:10.2903/j.efsa.2014.3928. <http://www.efsa.europa.eu/en/efsajournal/doc/3928.pdf>;
* EU COM (2016) Recommendation of the Working Group on the Annexes of the Council Directive 2000/29/EC – Section II – Listing of Harmful Organisms as regards the future listing of Verticillium dahlia Kleb.;

HOST PLANT N°8: Malus (1MABG) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°9: Olea europaea (OLVEU) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°10: Pistacia vera (PIAVE) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°11: Prunus armeniaca (PRNAR) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°12: Prunus domestica (PRNDO) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°13: Prunus dulcis (Prunus amygdalus) (PRNDU) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°14: Prunus persica (PRNPS) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°15: Prunus salicina (PRNSC) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)

HOST PLANT N°16: Pyrus (1PYUG) for the Fruits (including hops) sector.

**CONCLUSION ON THE STATUS:**
 
Not evaluated: from the fruit Marketing Directive (see Terms of reference)