Express PRA[1] for caraway yellows virus – Occurrence –

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Initiation: Occurrence on caraway *(Carum carvi)* in an outdoor area in the Federal State Hesse

Express Pest Risk Analysis	**Caraway yellows virus**		
Phytosanitary risk for Germany	**high** ☐	**medium** ☐	**low** ☒
Phytosanitary risk for EU MS	**high** ☐	**medium** ☐	**low** ☒
Certainty of assessment	**high** ☐	**medium** ☐	**low** ☒
Conclusion	For the first time the caraway yellows virus (CawYV) was found in an outdoor crop of caraway in Hesse in 2016. So far, it is neither listed in the Annexes of Directive 2000/29/EC nor by EPPO. CawYV infests caraway (*Carum carvi*). Currently, no other natural host plants are known. The virus established in outdoor areas in Germany. The establishment in other EU Member States with caraway cultivation of cannot be ruled out. Currently, the damage potential of CawYV is estimated as low. In Germany and the other EU Member States, the cultivation of caraway is of minor economic importance. Furthermore, a long crop free interval is common in the cultivation of plants of the family Apiaceae. Thus, a significant virus presence in the field is unlikely. The greatest part of the observed damage in the concerned field could be traced to an infestation with root aphids (Aphidoidea). Based on previous knowledge, CawYV presents no phytosanitary risk for Germany and the other EU-Member States. Thus, CawYV is not classified as a quarantine pest and § 4a of the Plant Inspection Order does not apply.		
Taxonomy[2]	Viruses; Family: *Secoviridae*; Subfamily: *Comovirinae*; Genus: *Nepovirus* subgroup C; Species: Caraway yellows virus (CawYV)		
Trivial name	Caraway yellows virus		
Synonyms	----		
Does a relevant earlier PRA exist?	no		

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Biology	In herbaceous plants, the recovering from symptoms of a nepovirus-infection can be typical. Normally, symptoms develop in the directly infected leaves and via a systemic (within the plant) distribution in younger leaves. Further new produced leaves show no symptoms, due to defence mechanisms of the plant. Mostly, nepoviruses have a broad host range. Depending on the host plant, the occurring symptoms may considerably differ.
Is the pest a vector?[3]	no
Is a vector needed?[4]	So far, it is not clear how the virus is transmitted. Mostly, nepoviruses are transmitted to the host plants via root nematodes. Within the nematodes, there is no propagation of the virus. The nematodes are virus-free again after moulting. Thus, the virus can distribute only in the case of a permanent new colonization of the vector. However, nematodes can survive in the soil without nutrition for several years and transmit nepoviruses. Most nepoviruses can also be transmitted via seeds or pollen (FUCHS *et al.*, 2017). In contrast, the blackcurrant reversion virus (BRV) can be transmitted via mites (*Cecidophyopsis ribis*) (SAFAÇON, 2008). In the only occurrence of CawYV, nematodes of the *Rotylenchus*- /*Helicotylenchus*-species complex as well as root aphids (Aphidoidea) were detected in the soil. It is not clear whether these were the cause for the CawYV transmission.
Host plants	So far, caraway (*Carum carvi*) is the only known natural host plant. In laboratory, there was a mechanical transmission to *Nicotiana benthamiana* (GAAFAR *et al.*, 2019).
Symptoms[5]	Firstly, red colourings appear on the caraway plants. Later, the plants turn yellow. Currently, it cannot be assessed whether the observed dieback of the plants was partly caused by the virus or exclusively by the infestation with root aphids. The infestation distributes circularly to neighbouring plants.
Presence of the host plants- in Germany[6]	In Germany, caraway is widely present as a wild plant on waysides or in grassland. The commercial cultivation in Germany mainly is limited to the biannual winter form (SARG, 2009). In 2011, caraway was cultivated on 283 ha in Germany (FNR, 2014).

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Presence of the host plants in the MS[7]	The biannual form of caraway is present in all of Central and North Europe (SARG, 2009). The annual spring form of caraway is native to the Eastern Mediterranean area. Important producers of caraway in Europe are Finland (CARLSON-NILSSON, 2017), the Netherlands, Poland and Hungary (CABI CPC, 2018).
Known infested areas[8]	The only currently known occurrence was in a field with caraway in 2016 in Hesse. In 2019, the virus was described for the first time (GAAFAR *et al.*, 2019).
Pathways[9]	Some nepoviruses can be transmitted through pollen or seeds (FUCHS *et al.*, 2017). Additionally, virus-carrying vectors could also be moved.
Natural spread[10]	Normally, nepoviruses are distributed through vectors with a small-scale distribution capability.
Expected establishment and spread in Germany[11]	It is assumed that the virus is capable to establish outdoors in caraway cultivation. In Germany, caraway is present wildly on waysides or in grassland.
Expected establishment and spread in the MS[12]	No information on eventual climatic requirements of the virus is known. It is assumed that the potential area for the establishment corresponds to the distribution area of the host plants. The wild form of caraway is distributed in all of Central and North Europe (SARG, 2009). The annual spring form of the caraways is native to the Mediterranean region. Important producers of caraway in Europe are Finland (CARLSON-NILSSON, 2017), the Netherlands, Poland and Hungary (CABI CPC, 2018).
Known damage in infested areas[13]	App. 30 % of the plant crop died during the only known occurrence in 2016. However, the main damage was caused by a severe infestation with root aphids.
Limitation of the endangered area in Germany	In outdoor areas, where caraway is cultivated.
Expected damage in endangered area in Germany[14]	Caraway is a special crop with very long crop-free periods. It is unlikely that the virus may reach economical relevant densities in a healthy crop. Despite a high contribution margin in the cultivation of spice plants caraway is of minor economic importance because of the small cultivation area. Furthermore, the small cultivation area and the spatial

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	separation of single lots will limit the distribution of local infections with CawYV. It is not easy to estimate the actual damage caused by CawYV because the observed losses of app. 30% in the affected field mainly were caused by a massive infestation with root aphids (Aphidoidea). The finding in 2016 was a single local event, no further occurrence of and damage caused by CawYV is known. In 2017 and 2018, no further symptoms on caraway were found in the company. Based on the current information, no severe damage by CawYV must be expected.
Expected damage in endangered area in MS[15]	In literature, only few clues can be found on the importance of the cultivation of caraway in other Member States. Obviously, Finland, the Netherlands, Poland and Hungary belong to the most important producers. In common data banks, no concrete data on the cultivation or marketing of caraway in the MS were found. In total, the economic importance of the caraway cultivation in the Member States is estimated as low.
Control feasibility and measures[16]	Direct control possibilities against the virus are not available. Thus, it is not known yet how long the virus remains infectious without host plant material. Nepoviruses may survive for several years in nematodes, but are not able to reproduce (FUCHS *et al.*, 2017). Nevertheless, it must be assumed that the recommended crop-free period of 7-10 years between all umbellifers (SARG, 2009) results in a strong reduction of the virus. Certified virus-free seeds should be used because some nepoviruses may be distributed via seeds. It is not clear whether CawYV is transmittable via seeds.
Detection and diagnosis[17]	In the case of the occurrence of red and yellow leaf colouring on caraway, a molecular-biological examination of the plant material is necessary to detect the virus (GAFAAR et al., 2019).
Remarks	In 2019, the virus was described for the first time. Thus, available information is limited. Currently there is no knowledge on the distribution mechanisms of the virus as well as on its survival ability. This risk analysis will be updated as soon as new relevant information is available.
Literature	CABI CPC, 2018: Datasheet *Carum carvi* (caraway). Cabi Crop Protection compendium.

https://www.cabi.org/cpc/datasheet/16319 (accessed on: 20-03-2019; last update: 15-07-2018)

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SAFAÇON, H., 2008: Nepoviruses. In: Mahy, B.W.J., van Regenmortel, M. H. (Eds.), Encyclopedia of Virology. 3rd edition. Elsevier, Oxford, pp. 405-413.

SARG, A., 2009: Ein Rundgang durch die nicht alltäglichen Kulturen. Fachtagung Biologischer Ackerbau 2009, 13 S. ISBN: 978-3-902559-38-8

Explanation

1 Compilation of the most important directly available information allowing a first preliminary estimation of the phytosanitary risk. This short assessment is necessary for the decision on a notification to EU and EPPO as well as the preparation of a complete risk analysis, for the information of the countries and as a basis for the possible initiation of eradication measures. Regarding the phytosanitary risk especially the possibility of the introduction into and spread in Germany and the Member States as well as possible damage are taken into account.

2 Taxonomic classification - also subspecies - as the case may be; in the case that the taxonomic classification is uncertain the JKI-scientist initiates the taxonomic classification as far as possible.

3 If so, which organism (organisms) is (are) transmitted and does it (do they) occur in Germany/the MS?

4 If so, which organism serves as a vector and does it occur in Germany/ the MS?

5 Description of the pattern of damage and the strength of the symptoms/damage on the different host plants.

6 Appearance of the host plants in protected cultivation, open field, public gardens, forest,....; where, in which regions do the host plants appear and to which extent?
How important are the host plants (economic, ecological, ...)?

7 Appearance of the host plants in protected cultivation, open field, public gardens, forest,....; Where, in which regions do the host plants appear and to which extent?
How important are the host plants (economic, ecological, ...)?, possible origin.

8 f. e. acc. to CABI, EPPO, PQR, EPPO Datasheets.

9 Which ways of introduction and pathways are known for the pest and how important are they for the probability of introduction. Primarily the transport of the pest over long distances is meant, normally with infested traded plants, plants products or other contaminated articles. This does not comprise the natural spread resulting from introduction.

10 Which pathways are known for the pest and of which relevance are they in respect of the probability of the spread? In this case the natural spread resulting from introduction is meant.

11 Under the given/prevalent environmental conditions.

12 Under the given /prevalent environmental conditions (domestic areas and areas of introduction).

13 Description of the economic, ecological /environmental relevant and social damage in the area of origin resp. areas of occurrence up to now

14 Description of the economic, ecological /environmental relevant and social damage to be expected in Germany, as far as possible and required, differentiated between regions.

15 Description of economic, ecological/ environmental relevant and social damage to be expected in the EU / other Member States, as far as possible and required, differentiated between regions.

16 Can the pest be controlled? Which possibilities of control are given? Are plant health measures conducted in respect to this pest (in the areas of its appearance at present resp. by third countries)?

17 Description of possibilities and methods of detection. Detection by visual inspections? Latency? Uneven distribution in the plant (sampling)?