Express PRA[1] for Syndrome "basses richesses" – Occurrence –

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Initiation: Occurrence in the Federal State Baden-Württemberg

Initiation for the revision: *Application for the revision of the risk analysis by the plant protection service of the Federal State Bavaria*

Express-PRA	**Syndrome „basses richesses“ (SBR)**		
Phytosanitary risk	*Categorization no longer applicable, due to the considerable distribution of SBR in Germany the characteristics of a potential quarantine pest are no longer fulfilled; in addition, vector and host plants are widespread in the EU.*		
Certainty of the assessment	**high** ☒	**medium** ☐	**low** ☐
Conclusion	In 1991, the Syndrome „basses richesses“ (SBR) was detected in Burgundy in France for the first time. In 2008, first infested sugar beets were found in Germany. In 2010, there was no evidence of an infestation but there were *further* outbreaks in autumn 2011 *and in 2013. Since then, there has been both local spread in the known infestation area and further infestation in the federal territory*. The γ-3-Proteobacterium *Candidatus Arsenophonus phytopathogenicus* is the main cause of the syndrome that was detected in France *and Germany*. *Mainly,* the bacterium is transmitted by the plant hopper *Pentastiridius leporinus* that is widespread in the European Union. So far, the pest is not listed in the Annexes of the Regulation (EU) 2019/2072. *After the first occurrence in Germany, the disease was included in the EPPO-alert list in 2012 (deleted in 2016, because warning has been given).* The further transmission *and natural spread* of *Candidatus* Arsenophonus phytopathogenicus within Germany and possibly to further Member States is most likely because the vector *P. leporinus* is widespread. *Candidatus* Arsenophonus phytopathogenicus *caused already significant damage to sugar beets locally in Germany* and may as well cause significant damage in other EU-Member States where sugar beets are cultivated. *Due to the establishment of the pest and its vector in great parts of Germany as well as limited efficacy of control and containment strategies, phytosanitary measures against the movement and spread seem no longer useful. Thus, Article 29 of the Regulation (EU) 2016/2031does not apply any longer.*		

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Taxonomy[2)]	The Syndrome „basses richesses“ is associated with the plant pathogenic bacterium "*Candidatus* Arsenophonus phytopathogenicus“ (γ-3 Proteobacterium; Enterobacteriaceae) (BRESSAN, 2011). *The phytoplasm Candidatus Phytoplasma solani can cause SBR in sugar beets, too. However, currently the phytoplasm is not important in Germany and France.* The vector of the bacterium, *Pentastiridius leporinus*, belongs to the family of the Cixiidae (Hemiptera). *Currently, further possible vectors like* Cixius wagneri, Empoasca pteridis, Empoasca affinis *and* Hyalesthes obsoletus *are of no or only of minor importance in Germany in respect to the outbreaks of SBR (PFITZNER et al., 2019).*
Common name	-
Synonyms	-
Does already a relevant earlier PRA exist?	No
Biology	*Candidatus* Arsenophonus phytopathogenicus: the bacterium forms long rods within its vector *P. leporinus.* It is often thread-shaped and infests the cytoplasm of cells that produce reproductive organs, salivary glands, intestine and fatty tissue (BRESSAN, 2012). *Most of the year, the bacterium remains in the vector. The females transmit the bacterium to the next generation (vertical transmission). With 30% infected offspring, this transmission is relatively inefficient and would not guarantee a long-term survival of the bacterium in the population of the vectors. A new loading of the vector happens through the suction on infected plants (horizontal transmission) (BRESSAN, 2014).* Vector *Pentastiridius leporinus*: the nymphs feed below ground on the roots of sugar beets. After overwintering, the nymphs finish their development in the following spring by feeding on the roots of winter wheat. Thus, they are exceptionally well adapted to the crop rotation winter wheat – sugar beet (Bressan *et al.*, 2009). The adults feed above ground and are the main source for further spread. *In the past,* P. leporinus *developed one generation per year in Germany. In 2018, the occurrence of a second generation for* P. leporinus *could be detected in Baden-Württemberg for the first time (PFITZNER at al., 2019).* The cicada transmits the bacterium via sucking on host plants.

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Is the pest a vector?[3)]	No
Is a vector needed?[4)]	Yes, a cixiid plant hopper (Cixiidae), *Pentastiridius leporinus* that is widespread in Europe. *In Germany and Europe further potential vectors are present, whose role so far can be neglected (PFITZNER et al., 2019).*
Host plants	Bacterium: sugar beets (*Beta vulgaris*); strawberries (*Fragaria*; BRESSAN, 2012. Vector: also other plants, e.g. reed (*Phragmites australis*) and winter wheat (*Triticum aestivum*) (only little and unclear information available).
Symptoms[5)]	Yellowing and distortion of old leaves and new growing of central leaves which are chlorotic, lanceolar and asymmetric. The beets have lower sugar content than non-infested plants (Gatineau *et al.*, 2002). In case of the infestation in Germany, also reduced growth and a necrotic vascular system in the beet were detected.
Presence of host plants in Germany[6)]	Sugar beets *(in 2018, cultivation of 413,009 ha)* and winter wheat are widespread throughout Germany *(EUROSTAT, 2019)*.
Presence of host plants in the Member States[7)]	Sugar beets *(cultivation in EU28: 1.73 Mio. ha in 2018)* and winter wheat are cultivated throughout the Member States (sugar beets especially in France, followed by Germany, Poland, Great Britain; *EUROSTAT, 2019*).
Known infested areas[8)]	France (first detection in Burgundy in 1991, GATINEAU *et al.*, 2002), Italy (*in plants of strawberry; Terlizzi et al. 2014*), Japan (?) (BRESSAN *et al.*, 2012), Germany *(so far, occurrence known in the Federal States Baden Württemberg, Bavaria, Brandenburg, Saxony, Saxony-Anhalt, Rhineland-Palatinate, Hesse, North Rhine-Westphalia)*, *Switzerland (first evidence in 2016; 2018 already 15% of the cultivation area of sugar beets are infested), Hungary (no pathogen detection) (PFITZNER et al., 2019).*
Pathways[9)]	Presumably, the bacterium came to Germany by natural spread via the vector from France where an infestation near the German border exists. The pathway to France is not known.
Natural spread[10)]	Via the vector, by flight and anemochory.
Establishment and spread to be expected in Germany[11)]	Since the bacterium is moved with the vector and the vector and the host plants are widespread, further establishment and spread have to be expected.

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Establishment and spread to be expected in the Member States[12)]	Since the bacterium is moved with the vector and the vector and the host plants are widespread, further establishment and spread have to be expected, mainly in the main cultivation areas of sugar beets and winter wheat in France, Germany and Poland, but also in Great Britain, the Netherlands, Belgium etc. (*EUROSTAT, 2019*).
Known damage in infested areas[13)]	Massive losses in the sugar production industry may be caused by the reduction of the sugar content in sugar beets. E.g. in France, losses up to 50% were registered in this sector in 1992 (GATINEAU *et al.*, 2002). *In 2018, approx. 16,400 ha in Germany were significantly infested with SBR (PFITZNER et al., 2019)*
Delimitation of the endangered area in Germany	Sugar beet cultivation areas rotating with winter wheat (*EUROSTAT, 2019*); possibly, also strawberry cultivation areas but there is only little information available on this.
Damage to be expected in endangered area in Germany[14)]	Since the sugar beet cultivation is an important sector and the vector is widespread, damage comparable to that in France has to be expected. *In case of extraordinary high temperatures in summer, like in 2018, a second vector generation must be expected. Due to a longer stay in the crop, higher population densities and an increasing loading of the vector with the pathogen, increasing damage has to be expected in future.*
Damage to be expected in endangered area in the Member States[15)]	Damage has to be expected wherever sugar beets (possibly also strawberries) are cultivated.
Control feasibility and measures[16)]	The control is done via the containment of the cicada populations. The infestation may be reduced resp. contained via crop rotation since the vector is reliant to sugar beets and winter wheat. Thus, it was established through experiments that by replacing of winter wheat with barley a reduction of approx. 80 % of the nymphs and adults of *P. leporinus* could be achieved. Reduced tillage may also contribute to a reduction of the nymph populations. Furthermore, the invasion of adults into the sugar beet fields may be reduced by the use of insecticides, but only with limited success – while combining of all three methods probably leads to a successful control (Bressan, 2009). *Currently, no insecticides are approved for the effective control of* P. leporinus*. Variety differences in the susceptibility of sugar beets to the disease have been observed. The breeding and the cultivation of species that are tolerant or resistant against the pathogen seems possible (PFITZNER et al., 2019).*
Detection and diagnosis[17)]	Examination of the infested plants and the vector *Pentastiridius leporinus* on *Ca*. A. phytopathogenicus by means of PCR (Bressan *et al*., 2011). In 2012, Bressan *et al*. used also

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	fluorescence *in situ* hybridization procedures for the detection of the bacterium in plants and in the vector.
Remarks	*There is still a significant need for research on effective control strategies against the pest and its vector.* In respect to the relevance for strawberries, a high uncertainty remains.
Literature	BRESSAN, A., 2009: Agronomic practices as potential sustainable options for the management of *Pentastiridius leporinus* (Hemiptera: Cixiidae) in sugar beet crops. Journal of Applied Entomology 133, 760–766 BRESSAN, A., W. E. HOLZINGER, B. NUSILLARD, O. SÉMÉTEY, F. GATINEAU, M. SIMONATO, E. BOUDON-PADIEU, 2009: Identification and biological traits of a planthopper from the genus *Pentastiridius* (Hemiptera: Cixiidae) adapted to an annual cropping rotation. European Journal of Entomology 106, 405-413. BRESSAN, A., F.-J. MORAL GARCÍA, E. BOUDON-PADIEU, 2011: The Prevalence of ‘*Candidatus* Arsenophonus phytopathogenicus’ Infecting the Planthopper *Pentastiridius leporinus* (Hemiptera: Cixiidae) Increase Nonlinearly With the Population Abundance in Sugar Beet Fields. Environmental Entomology 40 (6), 1345-1352. BRESSAN, A., F. TERLIZZI, R. CREDI, 2012: Independent origins of vectored plant pathogenic bacteria from arthropod-associated *Arsenophonus* endosymbionts. Microbial Ecology 63, 628-638. *BRESSAN, A., 2014: Emergence and evolution of* Arsenophonus *bacteria as insect-vectored plant pathogens. Infection, Genetics and Evolution 22, 81–90.* *EUROSTAT, 2019: https://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tag00103&language=de (Website accessed on 03-12-2019).* GATINEAU, F., N. JACOB, S. VAUTRIN, J. LARRUE, J. LHERMINIER, M. RICHARD-MOLARD, E. BOUDON-PADIEU, 2002: Association with the Syndrome “Basses Richesses” of sugar beet of a phytoplasma and a bacterium-like organism transmitted by a Pentastiridius sp. Phytopathology 92: 384-392. *PFITZER, R., K. SCHRAMEYER, R.T. VOEGELE, J. MAIER, C. LANG, M. VARRELMANN, 2019: Ursachen und Auswirkungen des Auftretens von "Syndrome basses richesses" in deutschen*

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	Zuckerrübenanbaugebieten. Sonderheft 14. Göttinger Zuckerrübentagung, Sugar Industry 144, 70-80. *Terlizzi, F., R. Beber, A. Pisi, G. Filippini, C. Poggi Pollini, C. Ratti, 2014: Characterization of two plant pathogenic Arsenophonus bacteria responsible for strawberry marginal chlorosis disease in Italy. Journal of Plant Pathology 96, 64. (Abstract)* https://cris.unibo.it/handle/11585/548375?mode=full.1559#.XeUjYtVCeg0

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 – in the case that the taxonomical classification is uncertain the JKI-scientist initiates the taxonomic classification as far as possible.

[3)] If so, which organism (which 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 severity of the symptoms/damage on the different host plants

[6)] Presence of host plants in protected cultivation, open field, amenity plantings, forest…….;
where, in which regions are the host plants present and to which extent?
How important are the host plants (economical, ecological, …)?

[7)] Presence of the host plants in protected cultivation, open field, amenity plantings, forest ....;
where, in which regions are the host plants present and to which extent?
How important are the host plants (economical, ecological, ...)?, possible origin

[8)] E.g. acc. to CABI, EPPO, PQR, EPPO Datasheets

[9)] Which pathways are known for the pest and of which relevance are they in respect to the probability of the spread? Primarily the transport over long distances is meant, normally with infested traded plants, plant 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 (native areas and areas of introduction)

[13)] Description of the economic, ecological/environmental 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 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 current distribution resp. by third countries)?

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