EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION
ORGANISATION EUROPEENNE ET MEDITERRANEENNE POUR LA PROTECTION DES PLANTES

12-17835

Pest Risk Analysis for

Bactericera cockerelli

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EPPO
21 Boulevard Richard Lenoir
75011 Paris
www.eppo.int
hq@eppo.int

This risk assessment follows the EPPO Standard PM 5/3(4) *Decision-support scheme for quarantine pests* (available at http://archives.eppo.int/EPPOStandards/pra.htm) and uses the terminology defined in ISPM 5 *Glossary of Phytosanitary Terms* (available at https://www.ippc.int/index.php).

This document was first elaborated by an Expert Working Group and then reviewed by core members and by the Panel on Phytosanitary Measures and if relevant other EPPO bodies. It was finally approved by the Council in September 2012.

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12-17835 (12-17384, 11-17161)

Pest Risk Analysis for *Bactericera cockerelli*

This PRA was conducted following EPPO Standard PM 5/3 (4) *Decision-support scheme PRA for quarantine pests*.
A preliminary draft has been prepared by the EPPO Secretariat. This document has been reviewed by an Expert Working Group that met in the EPPO Headquarters in Paris on 2010-11-30/12-03. **This PRA is not a stand-alone document as it includes numerous references the PRA for *Candidatus* Liberibacter solanacearum (doc 12-18189) and should therefore be read together with it**.

This EWG was composed of:
Dr Neil GILTRAP - Food and Environment Research Agency, York (United Kingdom)
Dr Joseph MUNYANEZA **-** USDA-ARS Yakima Agricultural Research Lab- Wapato (USA)
Dr Anne NISSINEN - MTT Agrifood Research Finland -Jokioinen (Finland)
Dr Tarek SOLIMAN - Business Economic Group - Wageningen University - Wageningen (Netherlands)
Dr Emilio STEFANI - Dept.Universita degli Studi UNIMORE - Reggio Emilia (Italy)
Dr Leon TJOU-TAM-SIN - National Reference Laboratory - Wageningen (Netherlands)

Core members
Dr Dirk Jan VAN DER GAAG - Plant Protection Service - Wageningen (Netherlands)
Dr Leif SUNDHEIM - Norwegian Institute for Agricultural and Environment Research - Aas (Norway)

Secretariat
Ms Muriel Suffert – EPPO Secretariat
Ms Fabienne Grousset – Consultant for EPPO who has prepared the draft PRA.

Core members reviewed the PRA in autumn 2011.

Content *(you may click on the title to reach the selected section)*

Stage 1: Initiation

1 - Give the reason for performing the PRA
Other reason

1b - If other reason, specify
Vector of *Candidatus* Liberibacter solanacearum
Justification:
Following a request from the EPPO Working Party, an EPPO-EWG has conducted a PRA for *Ca.* Liberibacter solanacearum. Two vectors have been identified so far for this bacterium: the psyllids *Bactericera cockerelli* and *Trioza apicalis* (Munyaneza *et al*., 2010). *T. apicalis* is a European species attacking carrots, and is widespread in the PRA area. *B. cockerelli* is a Central and North-American species and thought to be the source of introduction of the bacterium in New Zealand (Liefting, 2008). *B. cockerelli* is associated with the solanaceoussolanaceous hosts of *Ca.* Liberibacter solanacearum identified so far: potato, tomato, sweet and chilli pepper, tamarillo and Cape gooseberry. The PRA on *Ca.* Liberibacter solanacearum has concluded that the probability of entry and establishment of the bacterium and the magnitude of its impact largely depends on the presence or introduction of *B. cockerelli*. In addition to the indirect damage it can cause by transmitting the bacterium, *B. cockerelli* can also cause damage by itself. Therefore, the EPPO Secretariat concluded that a PRA is needed not only for *Ca.* Liberibacter solanacearum, but also for *B. cockerelli*, because of its importance as a vector of Ca. L. solanacearum and because of the direct impact it can have.

This PRA has been performed using mostly recent sources compiling information on this pest, and not from older original bibliographic sources. Where relevant, the present PRA refers to the PRA on *Ca.* L. solanacearum.

2a - Name of the pest
Bactericera cockerelli (Sulc) 1909
Synonym: *Paratrioza cockerelli* (Sulc)
Common names: tomato psyllid, potato psyllid.

2b - Indicate the type of the pest
arthropod
Justification:
The pest is a psyllid.

2d - Indicate the taxonomic position
Hemiptera: Triozidae (See Burckhardt & Lauterer, 1997)
Justification:
Domain: Eukaryota
Kingdom: Metazoa
Phylum: Arthropoda
Class: Insecta
Order: Hemiptera
Family: Triozidae
Genus: *Bactericera*
Species: *cockerelli*

3 - Clearly define the PRA area
The PRA area is the EPPO region (see www.eppo.org for map and list of member countries).

4 - Does a relevant earlier PRA exist?
no
Justification:
No relevant PRA is known, but information on *B. cockerelli* can be found in the PRAs performed on *Ca.* Liberibacter solanacearum in Australia (Biosecurity Australia, 2009), Germany (Stefani, 2010) and EPPO (2011).

6 - Specify all host plant species. Indicate the ones which are present in the PRA area.

Justification:

B. cockerelli is found primarily on plants within the family Solanaceae. The psyllid attacks, reproduces, and develops on a variety of cultivated and weedy plant species (Essig 1917, Knowlton & Thomas 1934, Pletsch 1947; Jensen 1954; Wallis 1955), including crop plants such as potato (*Solanum tuberosum*), tomato (*Lycopersicon esculentum*), pepper (*Capsicum annuum*), and eggplant (*Solanum melongena*), and non-crop species such as nightshade (*Solanum* spp.), groundcherry (*Physalis* spp.), and matrimony vine (*Lycium* spp.). Adults have been collected from plants in numerous families, including Pinaceae, Salicaceae, Polygonaceae, Chenopodiaceae, Brassicaceae, Asteraceae, Fabaceae, Malvaceae, Amaranthaceae, Lamiaceae, Poaceae, Menthaceae, and Convolvulaceae, but this is not an indication of the true host range of this psyllid (Pletch 1947; Wallis 1955; Cranshaw 1993). Beside solanaceous species, *B. cockerelli* has been shown to reproduce and develop on some *Convolvulus* species, including field bindweed (*Convolvulus arvensis*) and sweet potato (*Ipomoea batatas)* (Knowlton & Thomas 1934; List 1939; Wallis 1955; Munyaneza, unpublished data).
Recent studies conducted in New Zealand (Martin, 2008) indicated a small number of plants as good hosts; they showed a clear host association with pepper, tomato, potato, eggplant and poor host plant status of *Ipomoea batatas* (sweet potato, Convolvulaceae), *Nicandra physalodes* (weed in New Zealand, used as ornamental in PRA area) and a few other weeds. Nevertheless, this species seems to feed on more species then those it can reproduce on, and in its area of origin it overwinters on wild plant species.

A preliminary study indicates that inoculation of *Ca*. L. solanacearum to carrot with infective *B. cockerelli* can occur at an extremely low rate if the psyllid is forced to feed on carrot (Munyaneza, unpublished data). Further experiments suggested that the potato psyllid does not feed on the phloem of the carrot plant and this would explain the very low transmission rate observed during the transmission studies (Munyaneza, unpublished data). During this experiment a dozen of Chenopodiaceae and Apiaceae species were tested. The psyllids survived (but never reproduced) on the plants for several weeks.

There are uncertainties about the host plant status of several plant species but many of the plant species which are certainly hosts of *B. cockerelli* are widely grown in the PRA area.

7 - Specify the pest distribution

Justification:

See PRA for Ca. L. solanacearum, question 15b.

Stage 2: Pest Risk Assessment - Section A: Pest categorization

8 - Does the name you have given for the organism correspond to a single taxonomic entity which can be adequately distinguished from other entities of the same rank?

yes

Justification:

It is a single taxonomic entity.

10 - Is the organism in its area of current distribution a known pest (or vector of a pest) of plants or plant products?

yes (the organism is considered to be a pest)

Justification:

B. cockerelli has been shown to cause direct damage to tomato and potato ("psyllid yellows") and to indirectly cause damage by transmitting *Ca*. L. solanacearum on potato, tomato, pepper, tamarillo (Pletsch 1947; Wallis 1955, Munyaneza *et al.* 2007a,b; Liefting et al. 2009c, Sengoda *et al.*, 2010)

12 - Does the pest occur in the PRA area?

no

The pest has not been recorded in the PRA area.

14 - Does at least one host-plant occur in the PRA area (outdoors, in protected cultivation or both)?
yes
Justification:
Some of the pest's identified preferred hosts, i.e. potato, eggplant, tomato and sweet pepper are widely cultivated in the PRA area, in the field and under protected conditions. Many of the other hosts (see question 6), are also present in the PRA area (see also EPPO PRA on *Ca*. L. solanacearum)

15a - Is transmission by a vector the only means by which the pest can spread naturally?
no
Justification: *B. cockerelli* is a free-living organism.

16 - Does the known area of current distribution of the pest include ecoclimatic conditions comparable with those of the PRA area or sufficiently similar for the pest to survive and thrive (consider also protected conditions)?
yes
Justification: See PRA on Ca. L. solanacearum, question 16.

17 - With specific reference to the plant(s) or habitats which occur(s) in the PRA area, and the damage or loss caused by the pest in its area of current distribution, could the pest by itself, or acting as a vector, cause significant damage or loss to plants or other negative economic impacts (on the environment, on society, on export markets) through the effect on plant health in the PRA area?
yes
Justification: The pest could cause damage by itself to its host plants, and could cause damage as a vector of *Ca*. L. solanacearum on the solanaceous hosts of the bacterium.

18 - Summarize the main elements leading to this conclusion.
Justification:
- *Bactericera cockerelli* is a known pest where it is present, in the field and in protected conditions
- It is also the vector of *Ca*. L. solanacearum for potato, tomato, sweet and chilli pepper, tamarillo and Cape gooseberry where it is present.
- Some cultivated hosts are widely grown in the PRA area (potato, tomato, sweet and chilli pepper, aubergine), as well as some minor crops and some weed species.
- Suitable eco-climatic conditions are present in the PRA area.

Stage 2: Pest Risk Assessment - Section B: Probability of entry of a pest

1.1 - Consider all relevant pathways and list them

1- Plants for planting of Solanaceae from areas where *B. cockerelli* occurs
2- Fruits of Solanaceae from areas where *B. cockerelli* occurs
3. Plants for planting of *Micromeria chamissonis, Mentha* spp., *Nepeta* spp. and *Ipomoea batatas*
4. Living parts of Solanaceae (except fruits, seeds and plants for planting) from countries where *B. cockerelli* occurs

Justification:
The commodity pathways for this PRA are the same as for the complex *Ca*. L. solanacearum/*B. cockerelli* in the PRA for *Ca*. L. solanacearum. The origin is here "countries where *B. cockerelli* occurs", which in practice at the moment corresponds to the same countries where *Ca*. L. solanacearum occurs plus Canada.

It should be noted:
- *B. cockerelli* has many hosts and not only solanaceaous species. However, the present analysis does not consider the full list given in Wallis (1955) because some plants are not considered as allowing the full life cycle of the pest. It focus on its main solanaceous crop hosts that are also hosts of *Ca*. L. solanacearum, and on *Micromeria chamissonis, Mentha* spp., *Nepeta* spp. and *Ipomoea batatas* as they are considered as allowing the life cycle on *B. cockerelli* (Trumble, 2010, Australian PRA (Biosecurity Australia, 2009)).

Pathways studied in detail in the PRA:
The PRA for *Ca*. L. solanacearum considers association of the bacterium with the vector on the commodities concerned.

1- Plants for planting of Solanaceae from countries where *B. cockerelli* occurs
***See Pathway 1a in the PRA for Ca. L. solanacearum* (detailed study).** In addition, this pathway also includes plants for planting originating from Canada (*B. cockerelli* is known to be present in Canada but not *Ca*. L. solanacearum)

2- Fruit of Solanaceae from countries where *B. cockerelli* occurs
***See Pathway 2a in the PRA for Ca. L. solanacearum* (detailed study).** In addition, this pathway covers fruit coming from Canada (*B. cockerelli* is known to be present in Canada but not *Ca*. L. solanacearum)

3. Plants for planting of *Micromeria chamissonis, Mentha* spp., *Nepeta* spp., *Ipomoea batatas*
***See Pathway 4 in the PRA for Ca. L. solanacearum*.** In addition, this pathway covers plants for planting coming from Canada (*B. cockerelli* is known to be present in Canada but not *Ca*. L. solanacearum)

4. Living parts of Solanaceae (except fruits, seeds and plants for planting) from countries where *B. cockerelli* occurs
This covers especially cut flowers and cut branches. The expert working group considered that this is a relevant pathway but it is not considered in detail due to lack of information on trade. In contrast to Solanaceae plants for planting, there are no restrictions on the movement of this material in some countries of the PRA area (e.g. EU, Norway and Switzerland). All stages of the pest may be associated with living parts of Solanaceae. Nevertheless, it may be considered that if they are used for ornamental purposes, they will be treated with insecticides to avoid any cosmetic damages, which will lower the probability of association. The pest is likely to survive transport at cool temperatures. Transfer is unlikely if such living parts of Solanaceae are imported for ornamental purposes indoor.

Pathways not considered
- Weeds
- Other plants indicated on host lists
- Hitch-hiking
- Natural spread

For all of these, explanations given in the PRA for *Ca*. L. solanacearum are also valid for the present PRA.

Pathways considered impossible
- Potato tubers: the pest is not present on the tubers.
- Seed of host plants: the pest is not present in the seed.

Questions 1.3 to 1.13

These questions are answered in detail in the PRA for *Ca.* L. solanacearum for plants for planting of Solanaceae and fruit of Solanaceae (see pathways 1a and 2a) and, therefore, only the final ratings are given in this PRA.

1.14c - The overall probability of entry should be described and risks presented by different pathways should be identified

Justification:

The probability of entry for the different pathways ranges from low to moderate (see Table below). See also the PRA for *Ca*. L. solanacearum. The overall probability is low to moderate for countries where import of plants for planting of Solanaceae is forbidden and moderate for other countries.

Commodity	**Risk of entry of *B. cockerelli***
Plants for planting of Solanaceae [Not relevant for countries where the pathway is closed (e.g. EU)]	Moderate
Fruits of Solanaceae	Moderate/low
Plants for planting of *Micromeria chamissonis*, *Mentha* spp., *Nepeta* spp., *Ipomoea batatas*	Low (not preferred hosts, probably low import volume). The uncertainty is high because of lack of import data and data on association of the psyllid with these plants.
Living part of Solanaceae	Low

Stage 2: Pest Risk Assessment - Section B: Probability of establishment

All elements of answer for questions 1.15 to 1.29b are given in the PRA for Ca. L. solanacearum.

1.29c - The overall probability of establishment should be described.

The probability of establishment of *B. cockerelli* in the PRA area is high with a low uncertainty, in glasshouses and in areas with suitable climatic conditions, i.e in the Southern and Central European part of the PRA area, as well as in areas with mild winters in the Northern part of the PRA area, comparable to those of Christchurch, New Zealand. It is unlikely to establish in the Eastern part of the region (east of Poland). However transient populations could occur there after migration.

The host plants are widely distributed, the pest's reproductive strategy and migratory habit would favour establishment. *B. cockerelli* has already established outside of its original range.

Stage 2: Pest Risk Assessment - Section B: Probability of spread

All elements of answer for questions 1.15 to 1.29b are considered in the PRA for Ca. L. solanacearum.

1.32c - The overall probability of spread should be described.

The probability of spread is high (e.g. several hundreds kilometres a year). The pest is a good flyer and is also known to be transported by wind over long-distances during its migrations in North America.

Stage 2: Pest Risk Assessment - Section B: Conclusion of introduction and spread and identification of endangered areas

1.33a - Conclusion on the probability of introduction and spread.

The probability of entry is rated as low to moderate, and the probability of establishment is high. This results in a moderate probability of introduction. The probability of spread is high.

1.33b - Based on the answers to questions 1.15 to 1.32 identify the part of the PRA area where presence of host plants or suitable habitats and ecological factors favour the establishment and spread of the pest to define the endangered area.

For glasshouse crops, the whole PRA area.

For field crops, it is not possible to exclude any of the PRA area. The endangered area covers areas where *B.*

cockerelli could overwinters outdoors (i.e. Southern and Central European part of the PRA area, as well as areas in the Northern part of the PRA area which have mild winters, comparable to those in and near Christchurch in New Zealand, but also the areas that could be reached by annual migration. i.e. most of the PRA area. For example it is not expected that *B. cockerelli* could survive cold winters e.g. in Scandinavian regions and Eastern PRA area, but it might reach these regions through annual migration (similarly to the situation in Canada).

Stage 2: Pest Risk Assessment - Section B: Assessment of potential economic consequences

2.1 - How great a negative effect does the pest have on crop yield and/or quality to cultivated plants or on control costs within its current area of distribution?

massive
Level of uncertainty: low
Justification:
B. cockerelli has an impact both as a pest and as a vector of *Ca*. L. solanacearum. It is not easy to determine which part of the damage by the complex *B. cockerelli*/*Ca.* L. solanacearum is due to *B. cockerelli* alone. However, impact has been reported from regions where the bacterium is not present. The psyllid was also reported as a pest of glasshouse tomato in Ontario (Ferguson & Shipp, 2002).

Until recently, *B. cockerelli* has been reported mainly as a major pest of potato with periodic outbreaks on tomato and pepper in western USA (Abdullah, 2008). Serious yield losses on tomato and pepper have been reported in recent years (Liu & Trumble, 2006; Munyaneza *et al.* 2007, Gao *et al.*, 2009, Liefting *et al.*, 2009a). Losses on eggplant were also observed in Texas (Yang & Li, 2008).

Historically, the extensive damage to solanaceous crops that was observed during the outbreak years of the early 1900's is thought to have been due to *B. cockerelli*'s association with a physiological disorder in plants referred to "psyllid yellows" (Richards & Blood 1933), presumably caused by a toxin that is transmitted during the insect's feeding activities, especially nymphs (Eyer & Crawford 1933; Eyer 1937). However, the nature of this toxin has not yet been demonstrated. "Psyllid yellows" is characterized by yellowing and curling of foliage, stunting or death of plants, and loss in yield (Richards & Blood 1933; Eyer 1937). Infected tomato plants produce few or no marketable fruits (List 1939; Daniels 1954). In potatoes, psyllid yellows results in yellowing or purpling of foliage, early death of plants, and low yields of marketable tubers (Eyer 1937; Pletsch 1947; Daniels 1954; Wallis 1955). In areas of outbreaks of psyllid yellows, the disorder was often present in 100% of plants in affected fields, with yield losses exceeding 50% in some areas (Pletsch 1947). In USA, the first outbreak of *B. cockerelli* was recorded in California in 1940, and the second major outbreak in Midwestern USA in 1970. Until 2001, little consequences were noted, but since 2001 a series of outbreaks occurred every year in some USA states and Mexico, in particular in controlled environment facilities for fresh market tomato production in Arizona, California and Mexico (California - over 80% losses in tomato production). In 2003-2004, it was recorded for the first time to overwinter in vegetable fields in California. It became more important at the end of the 1990s, possibly due to its association with various pathogens. It is not known why damage increased in recent years, and several biotypes might be involved (e.g. Crosslin *et al.*, 2010, Pletsch, 1947, Wallis, 1955).

In recent years, potato, tomato, and pepper growers in a number of geographic areas have suffered extensive economic losses associated with outbreaks of potato psyllid (Trumble 2008, 2009; Munyaneza *et al.*, 2009c; Crosslin *et al.* 2010). Damage is due to a previously unknown liberibacter, tentatively named "*Candidatus* Liberibacter solanacearum" (syn. *Ca*. L. psyllaurous") (Hansen *et al.*, 2008, Liefting *et al.*, 2009c), now known to be vectored by B. *cockerelli* (Munyaneza *et al.* 2007a,b). *B. cockerelli* also vectors this bacterium to eggplant, tamarillo, Cape gooseberry. See EPPO PRA on *Ca.* L. solanacearum for the evaluation of the *B. cockerelli/Ca* L. solanacearum complex).

Sengoda *et al.* (2010) describe the phenotypic and etiological differences between psyllid yellows and zebra chip diseases of potato. Above ground symptoms are similar but zebra chip is mainly characterized by symptoms that develop in fried chips (striped pattern of necrosis in tubers). They showed that plants exposed to liberibacter-free psyllid continuously for 70 days died. However, it cannot be excluded that another yet-unknown pathogen may be associated with the psyllid.

Goolsby *et al.* (2010) showed that high populations of non-infective psyllids can result in reduced yield and undesirable color of potatoes. In experiments, 55.2 to 93% yield loss is observed in potato plants exposed to psyllids (Munyaneza *et al.*, 2008). Early sprouting was also observed. The yield was reduced even for populations that did not show ZC symptoms, suggesting that the psyllid might cause economic losses on its own (although apparently less than if associated with the bacterium): 70% in 2005 in cages with some browning of tubers which could be due to the bacterium (Diaz-Valasis *et al.*, 2008), average yield reduced by 49.4% in 2004.

2.2 - How great a negative effect is the pest likely to have on crop yield and/or quality in the PRA area without any control measures?

massive

Level of uncertainty: low

Justification: If only non-infective psyllids are introduced impact may be moderate. However establishment of *B. cockerelli* also increases the likelihood of a successful introduction and spread of *Ca*. L. solanacearum (see PRA for *Ca*. L. solanacearum, where all probabilities are higher if the vector is introduced at the same time). It is also likely that both pests are introduced simultaneously, which will result in massive impact.

2.3 - How easily can the pest be controlled in the PRA area without phytosanitary measures?

with much difficulty

Level of uncertainty: low

Justification: See PRA for Ca. L. solanacearum

2.4 - How great an increase in production costs (including control costs) is likely to be caused by the pest in the PRA area?

major

Level of uncertainty: high

Justification: See PRA for Ca. L. solanacearum.

Even if damage caused by the pest on its own does not require intensive control, it is likely that intensive eradication measures will be applied to avoid establishment of this pest and subsequently of *Ca*. L. solanacearum.

2.5 - How great a reduction in consumer demand is the pest likely to cause in the PRA area?

moderate

Level of uncertainty: medium

Justification:

Potato, tomato and other host crops are important food in many EPPO countries. No reduction in consumption is expected but production costs may increase, which can result in consumer reduction.

2.6 - How important is environmental damage caused by the pest within its current area of distribution?

minimal

Level of uncertainty: low

Justification: No direct effect on environment is reported for this pest. However, the pest has an indirect impact on the environment due to the need for an intensive pesticide control programme in infested areas. IPM strategies for tomato and potatoes have been threatened or abandoned in the USA and New Zealand (e.g. Berry *et al*., 2009; Teulon *et al*., 2009). In New Zealand, further development of IPM in potatoes has been threatened and in tomatoes, the established IPM programme have been disrupted, with increased number of application, risk of resistance development and chemical groups employed (add reference). In tamarillo, the viability of low input/organic systems is threatened (Watson in Nelson, 2009).

2.7 - How important is the environmental damage likely to be in the PRA area

minor

Level of uncertainty: medium

Justification: See PRA for Ca. L. solanacearum.

2.8 - How important is social damage caused by the pest within its current area of distribution?

minor

Level of uncertainty: high

Justification: Social damage might occur only in association with *Ca*. L. solanacearum and will be due to the bacterium, not to the vector (see PRA for *Ca*. L. solanacearum).

2.9 - How important is the social damage likely to be in the PRA area?

minor

Level of uncertainty: high

Justification: Same as above

2.10 - How likely is the presence of the pest in the PRA area to cause losses in export markets?

very likely/certain

Level of uncertainty: medium

Justification:

Although the closing of export markets has been reported in connection to *Ca.* L. solanacearum or the association vector/bacterium (see details in PRA for *Ca.* L. solanacearum), it is likely that presence of *Bactericera cockerelli* itself would have a similar effect because of its potential role as a vector of *Ca*. L. solanacearum.

Uncertainty. whether effect on export markets would depend on the presence of the bacterium or would be applied as a precaution, assuming presence of the bacterium

2.11 - How likely is it that natural enemies, already present in the PRA area, will not reduce populations of the pest below the economic threshold?

likely

Level of uncertainty: medium

Justification: See PRA Ca. L. solanacearum.

2.12 - How likely are control measures to disrupt existing biological or integrated systems for control of other pests or to have negative effects on the environment?

very likely/certain

Level of uncertainty: low

Justification: See PRA for Ca. L. solanacearum.

2.13 - How important would other costs resulting from introduction be?

major

Level of uncertainty: low

Justification: Similar to PRA for Ca. L. solanacearum.

2.14 - How likely is it that genetic traits can be carried to other species, modifying their genetic nature and making them more serious plant pests?

Impossible/very unlikely

Level of uncertainty: low

Justification: This is not thought to be possible for this pest.

2.15 - How likely is the pest to cause a significant increase in the economic impact of other pests by acting as a vector or host for these pests?

very likely/certain

Level of uncertainty: low

Justification: *B. cockerelli* is the vector of *Ca*. L. solanacearum. It may also be a vector for other pathogens such as phytoplasmas (see Annex 2 in the PRA for *Ca*. L. solanacearum) that are present on its hosts in the PRA area, although there is no specific data on this.

Uncertainty. Low. Pathogens other than *Ca*. L. solanacearum vectored by *B. cockerelli*.

2.16 - Referring back to the conclusion on endangered area (1.33): Identify the parts of the PRA area where the pest can establish and which are economically most at risk.

Justification:

All areas where the host plants are grown, i.e. the entire PRA area. The pest is likely to cause damage in all parts of the PRA area, on one or other of its hosts, both in the field or in glasshouse. In the Eastern part of the PRA area, only transient populations may occur in the field.

For protected host crops, the whole PRA area is potentially at risk.

For field grown potatoes and tomatoes, the risk will be higher where *B. cockerelli* can survive all year round (presence of potential host plants). The Mediterranean basin seems to be most suitable because of the climate and the cropping pattern (availability of hosts all year round). It is difficult to estimate how far north and east in the PRA area *B. cockerelli* will reach outdoors (uncertainties on migration, host plants, survival at low temperatures). The reasons why *B. cockerelli* does not survive in winter in the north-western part of its range (e.g. Washington) are not clear, i.e. whether this is due to climatic conditions (too cold?) or to other factors (absence of overwintering plant).

Stage 2: Pest Risk Assessment - Section B: Degree of uncertainty and Conclusion of the pest risk assessment

2.17 - Degree of uncertainty: list sources of uncertainty

Justification:

Major uncertainties regarding B. cockerelli are given among uncertainties in the PRA for Ca. L. solanacearum.

2.18 - Conclusion of the pest risk assessment

The probability of introduction is moderate, and the probability of spread is high. *B. cockerelli* would have moderate impact as a pest but a massive impact as a vector of *Ca*. L. solanacearum.

Stage 3: Pest Risk Management

3.1 - Is the risk identified in the Pest Risk Assessment stage for all pest/pathway combinations an acceptable risk?

No

Questions 3.2 to 3.36

See pathways 1a and 2a in the PRA for *Ca*. L. solanacearum for detailed consideration of the pathways plants for planting of Solanaceae and fruit of Solanaceae.

B. cockerelli is a threat for the EPPO region, both on its own and as a vector of *Ca*. L. solanacearum. Measures identified in the PRA for *Ca*. L. solanacearum associated with its vector will be efficient to prevent introduction of *B. cockerelli***.**

The following measures are recommended against this pest.

Plants for planting of Solanaceae	Country freedom for *B. cockerelli* and *Ca*. L. solanacearum in Solanaceae
Fruits of Solanaceae	Country freedom for *B. cockerelli* **OR** Pest-free site under screenhouse for *B. cockerelli* (on the basis of bilateral agreement) **OR** Systems approach: growing under complete physical protection against *B. cockerelli* with inspection, monitoring and packing on site *cockerelli* (on the basis of bilateral agreement)**OR** For tomato only: removal of green parts (loose tomatoes) followed by washing, and inspection of consignment (on the basis of bilateral agreement)
Plants for planting of *Micromeria chamissonis*, *Mentha* spp., *Nepeta* spp., *Ipomoea batatas*	Country freedom *for B. cockerelli* and *Ca*. L. solanacearum in Solanaceae
Living parts of Solanaceae (except fruits, seeds and plants for planting)	Country freedom *for B. cockerelli* and *Ca*. L. solanacearum in Solanaceae

Annexes and references: see PRA for Ca. L. solanacearum.