

Scientific Panel on Plant Health

Minutes of the 10th meeting of the Working Group on Citrus Black Spot

Held on 3 and 4 May 2016, by web

(Agreed on 4 May 2016)

Participants

- **Working Group Members:**

Mike Jeger (Chair), Richard Baker, David Makowski (second day), Stephen Parnell (first day), Jonathan Yuen

- **EFSA:**

ALPHA Unit: Gritta Schrader, PTT Unit: Carsten Behring (partially)

1. Welcome and apologies for absence

The Chair welcomed the participants. Apologies were received from Simone Orlandini, Trond Rafoss, and Vittorio Rossi.

2. Adoption of agenda

The agenda was adopted without changes.

3. Declarations of Interest of Working Groups members

In accordance with EFSA's Policy on Independence and Scientific Decision-Making Processes¹ and the Decision of the Executive Director on Declarations of Interest², EFSA screened the Annual Declarations of Interest and the Specific Declarations of Interest filled in by the working group members invited for the present meeting. No Conflicts of Interest related to the issues discussed in this meeting have been

¹ <http://www.efsa.europa.eu/en/keydocs/docs/independencepolicy.pdf>

² <http://www.efsa.europa.eu/en/keydocs/docs/independencerules2014.pdf>

identified during the screening process. In addition, no Conflicts of Interest related to the issues discussed in this meeting have been identified at the Oral Declaration of Interest at the beginning of this meeting.

4. Scientific topic for discussion

4.1 Assessment of the new scientific information regarding *Phyllosticta citricarpa*

The current state of the work was presented and discussed, in order to reply to the request by April 2016 concerning the assessment of the new scientific information regarding *Phyllosticta citricarpa* (EFSA-Q-2015-00601).

The Working Group discussed the comments received from the Panel after the first reading of the opinion. The draft opinion was then finalised to be sent out for written adoption.

Scientific Panel on Plant Health

Minutes of the 9th meeting of the Working Group on Citrus Black Spot

Held on 18 -19 April 2016, Parma (Italy)

(Agreed on 28 April 2016)

Participants

- **Working Group Members:**

Mike Jeger (Chair), David Makowski, Simone Orlandini (via web)
Stephen Parnell, Trond Rafoss, Vittorio Rossi (via web), Jonathan Yuen

- **EFSA:**

ALPHA Unit: Gritta Schrader, PTT Unit: Carsten Behring

1. Welcome and apologies for absence

The Chair welcomed the participants. Apologies were received from Richard Baker.

2. Adoption of agenda

The agenda was adopted without changes.

3. Declarations of Interest of Working Groups members

In accordance with EFSA's Policy on Independence and Scientific Decision-Making Processes¹ and the Decision of the Executive Director on Declarations of Interest², EFSA screened the Annual Declarations of Interest and the Specific Declarations of Interest filled in by the working group members invited for the present meeting. No Conflicts of Interest related to the issues discussed in this meeting have been

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identified during the screening process. In addition, no Conflicts of Interest related to the issues discussed in this meeting have been identified at the Oral Declaration of Interest at the beginning of this meeting.

4. Scientific topic for discussion

4.1 Assessment of the new scientific information regarding *Phyllosticta citricarpa*

The current state of the work was presented and discussed, in order to reply to the request by April 2016 concerning the assessment of the new scientific information regarding *Phyllosticta citricarpa* (EFSA-Q-2015-00601).

The Working Group went on to further draft the opinion, which will then be sent out to the panel for a first reading.

5. Next meeting

The next meeting will take place on 3 and 4 May 2016 via web.

Scientific Panel on Plant Health

Minutes of the 8th meeting of the Working Group on Citrus Black Spot

Held on 8 and 11 April 2016 via web

(Agreed on 21 April 2016)

Participants

- **Working Group Members:**

Richard Baker

- **EFSA:**

ALPHA Unit: Gritta Schrader

1. Welcome and apologies for absence

The participant was welcomed.

2. Adoption of agenda

The agenda was adopted without changes.

3. Declarations of Interest of Working Groups members

In accordance with EFSA's Policy on Independence and Scientific Decision-Making Processes¹ and the Decision of the Executive Director on Declarations of Interest², EFSA screened the Annual Declarations of Interest and the Specific Declarations of Interest filled in by the working group members invited for the present meeting. No Conflicts of Interest related to the issues discussed in this meeting have been identified during the screening process. In addition, no Conflicts of Interest related to the

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issues discussed in this meeting have been identified at the Oral Declaration of Interest at the beginning of this meeting.

4. Scientific topic for discussion

4.1 Assessment of the new scientific information regarding *Phyllosticta citricarpa*

The current state of the work was presented and discussed, in order to reply to the request by April 2016 concerning the assessment of the new scientific information regarding *Phyllosticta citricarpa* (EFSA-Q-2015-00601).

The opinion was drafted further.

5. Next meeting

The next meeting will take place on 18-19 April 2016 in Parma.

Scientific Panel on Plant Health

Minutes of the 7th meeting of the Working Group on Citrus Black Spot

Held on 4 April 2016, Manchester (UK)

(Agreed on 4 April 2016)

Participants

- **Working Group Members:**

Mike Jeger (Chair), Richard Baker, Stephen Parnell

- **EFSA:**

ALPHA Unit: Gritta Schrader

1. Welcome and apologies for absence

The Chair welcomed the participants.

2. Adoption of agenda

The agenda was adopted without changes.

3. Declarations of Interest of Working Groups members

In accordance with EFSA's Policy on Independence and Scientific Decision-Making Processes¹ and the Decision of the Executive Director on Declarations of Interest², EFSA screened the Annual Declarations of Interest and the Specific Declarations of Interest filled in by the working group members invited for the present meeting. No Conflicts of Interest related to the issues discussed in this meeting have been identified during the screening process. In addition, no Conflicts of Interest related to the

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issues discussed in this meeting have been identified at the Oral Declaration of Interest at the beginning of this meeting.

4. Scientific topic for discussion

4.1 Assessment of the new scientific information regarding *Phyllosticta citricarpa*

The current state of the work was presented and discussed, in order to reply to the request by April 2016 concerning the assessment of the new scientific information regarding *Phyllosticta citricarpa* (EFSA-Q-2015-00601).

The Working Group went on to further draft the opinion.

Critical aspects requiring clarification were further identified. Tasks were distributed among the participants in preparation to the eighth meeting.

5. Next meeting

The next meeting will take place on 8 and 11 April 2016 via web.

Scientific Panel on Plant Health

Minutes of the 6th meeting of the Working Group on Citrus Black Spot

Held on 14-15 March 2016, Parma (Italy)

(Agreed on 18 April 2016)

Participants

- **Working Group Members:**

Mike Jeger (Chair), Stephen Parnell, Trond Rafoss (via web), Vittorio Rossi (partly via web), Jonathan Yuen

- **EFSA:**

ALPHA Unit: Gritta Schrader, PTT Unit: Carsten Behring

1. Welcome and apologies for absence

The Chair welcomed the participants. Apologies were received from Simone Orlandini. Stephen Parnell only participated on 15 March 2016.

2. Adoption of agenda

The agenda was adopted without changes.

3. Declarations of Interest of Working Groups members

In accordance with EFSA's Policy on Independence and Scientific Decision-Making Processes¹ and the Decision of the Executive Director on Declarations of Interest², EFSA screened the Annual Declarations of Interest and the Specific Declarations of Interest filled in by the working group members invited for the present meeting. No Conflicts of Interest related to the issues discussed in this meeting have been identified during

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the screening process. In addition, no Conflicts of Interest related to the issues discussed in this meeting have been identified at the Oral Declaration of Interest at the beginning of this meeting.

4. Scientific topic for discussion

4.1 Assessment of the new scientific information regarding *Phyllosticta citricarpa*

The current state of the work was presented and discussed, in order to reply to the request by April 2016 concerning the assessment of the new scientific information regarding *Phyllosticta citricarpa* (EFSA-Q-2015-00601).

The Working Group went on to further draft the opinion.

Critical aspects requiring clarification were further identified. Tasks were distributed among the participants in preparation to the 7th meeting.

5. Next meeting

The next meeting will take place on 4 April 2016 in Manchester (UK).

Scientific Panel on Plant Health

Minutes of the 5th meeting of the Working Group on Citrus Black Spot

Held on 18 and 19 February 2016, Parma (Italy)

(Agreed on 19 February 2016)

Participants

- **Working Group Members:**

Mike Jeger (Chair), Simone Orlandini, Stephen Parnell (via web), Trond Rafoss, Vittorio Rossi, Jonathan Yuen

- **EFSA:**

ALPHA Unit: Gritta Schrader; PTT Unit: Carsten Behring

1. Welcome and apologies for absence

The Chair welcomed the participants. Apologies were received from Stephen Parnell and Vittorio Rossi for the first day (18 February 2016).

2. Adoption of agenda

The agenda was adopted without changes.

3. Declarations of Interest of Working Groups members

In accordance with EFSA's Policy on Independence and Scientific Decision-Making Processes¹ and the Decision of the Executive Director on Declarations of Interest², EFSA screened the Annual Declarations of Interest and the Specific Declarations of Interest filled in by the working group members invited for the present meeting. No Conflicts of Interest related to the issues discussed in this meeting have been identified during

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the screening process. In addition, no Conflicts of Interest related to the issues discussed in this meeting have been identified at the Oral Declaration of Interest at the beginning of this meeting.

4. Scientific topic for discussion

4.1 Assessment of the new scientific information regarding *Phyllosticta citricarpa*

The current state of the work was presented and discussed, in order to reply to the request by April 2016 concerning the assessment of the new scientific information regarding *Phyllosticta citricarpa* (EFSA-Q-2015-00601).

The Working Group went on to further organise the work and to review the two papers directly addressed in the mandate (Magarey et al. 2015, Martínez-Minaya et al. 2015). The results of the hearing were further discussed and the minutes of that meeting (4th meeting, 26 January 2016) were finalised. The opinion was drafted further.

Critical aspects requiring clarification were further identified. Tasks were distributed among the participants in preparation to the sixth meeting.

5. Next meeting

The next meeting will take place on 14-15 March 2016 in Parma.

Scientific Panel on Plant Health

Minutes of the 4th meeting of the Working Group on Citrus Black Spot

Held on 26 January 2016, Parma (Italy)

(Agreed on 18 February 2016)

Participants

- **Working Group Members:**

Mike Jeger (Chair), Simone Orlandini, Stephen Parnell, Trond Rafoss, Vittorio Rossi, Jonathan Yuen

- **Hearing experts:**

Paul Fourie, Roger Magarey (via web), Antonio Vicent

- **EFSA:**

ALPHA Unit: Gritta Schrader, Giuseppe Stancanelli, Svetla Kozelska; PTT Unit: Carsten Behring

1. Welcome and apologies for absence

The Chair welcomed the participants.

Mike Jeger did not attend section 4.1.3.

2. Adoption of agenda

The agenda was adopted without changes.

3. Declarations of Interest of Working Groups members

In accordance with EFSA's Policy on Independence and Scientific Decision-Making Processes¹ and the Decision of the Executive Director on Declarations of Interest², EFSA screened the Annual Declarations of Interest and the Specific Declarations of Interest filled in by the working group members invited for the present meeting. No Conflicts of Interest related to the issues discussed in this meeting have been identified during the screening process. In addition, no Conflicts of Interest related to the issues discussed in this meeting have been identified at the Oral Declaration of Interest at the beginning of this meeting.

4. Scientific topic for discussion

4.1 Assessment of the new scientific information regarding *Phyllosticta citricarpa*

4.1.1 Assessment of the new scientific information regarding *Phyllosticta citricarpa*

The current state of the work was briefly presented and discussed, in order to reply to the request by April 2016 concerning the assessment of the new scientific information regarding *Phyllosticta citricarpa* (EFSA-Q-2015-00601). Following this brief discussion a hearing was conducted with authors of the two main publications to be assessed in detail, as requested in the Mandate to this opinion. The hearing experts were asked to give a presentation on their papers and to answer to the questions that had been sent to them by the Working Group beforehand.

4.1.2 Hearing with Antonio Vicent on the paper Martínez-Minaya et al. 2015

In the morning, one of the authors of the paper by Martínez-Minaya et al. (2015), Antonio Vicent, participated in the hearing. In his presentation, CBS symptoms and impact were described on different species and the

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disease cycle was explained. Following this meeting, the hearing expert received the draft minutes of the questions and answers and was given the opportunity to correct or complement the information. The questions and answers are provided in the annex to these minutes.

4.1.3 Hearing with Paul Fourie and Roger Magarey on the paper Magarey et al. 2015

In the afternoon, Paul Fourie and Roger Magarey, two of the authors of the paper by Magarey et al. (2015) participated, presenting also the two different modelling approaches (hourly infection leaf wetness model and ascospore maturation model) referred to in the paper. Paul Fourie presented information on epidemiological modelling of CBS and provided background information to CBS including origin of citrus and CBS and its distribution. Roger Magarey discussed the question whether Citrus black spot can establish in Europe and can cause economic impact in major citrus production areas based on the paper under discussion (Magarey et al., 2015). Following this meeting, the hearing experts received the draft minutes of the questions and answers and were given the opportunity to correct or complement the information. The questions and answers are provided in the annex to these minutes.

4.1.4 Discussion of the outcome of the hearing

After the hearing, the WG discussed the outcome of the hearing and how to proceed with the opinion.

5. Next meeting

The next meeting will take place on 18 and 19 February 2016 in Parma.

Annex to the Minutes of the 4th meeting of the Working Group on Citrus Black Spot

Antonio Vicent – Questions and Answers

1. Could you please justify the use in your paper of two systems for climatic classification: Köppen- Geiger and Aschmann? Explain differences and criticisms.

The scope was to check the statement that 'CBS does not occur in Mediterranean climates' (e.g. Kotzé, 2000; Yonow et al. 2013). How could Mediterranean climates be defined? Our study shows that in the Köppen-Geiger Mediterranean-type climates, CBS is absent in South Africa, as well as in the Aschmann's Mediterranean-type climate. However, in climates similar to those occurring in the Mediterranean Basin, CBS is present in South Africa. Therefore, these two different systems (Köppen-Geiger and Aschmann) were used and compared.

Described parameters in the Köppen-Geiger system are e.g.: mean temperature in hottest month and how that is defined exactly (as given in paper) (hottest month $T_{hot} \geq 22$, This is to differentiate between the two Mediterranean types, Csa and Csb. See table 1 for Mediterranean-type (Cs) classification.

-)
- parameters to be met specified for Mediterranean climates

Described parameters in the Aschmann system are e.g.:

- used in other studies e.g. Plos One paper (Klausmeyer and Shaw 2009)
- Parameters outlined

Köppen-Geiger maps were shown for 1950 and for 2014 (South Africa and the Mediterranean Basin; overlaid with CBS areas for South Africa), Aschmann maps were shown for South Africa and the Mediterranean Basin (again overlaid with CBS areas for South Africa) A comparison of the maps shows that climatic areas where CBS occurs in South Africa nowadays are also found in the Mediterranean Basin.

Additional question by the WG: Based on your statement in the paper that "The strong spatial autocorrelation detected in the current CBS

distribution data (...) suggest that climate itself might not be the main factor limiting the spread of CBS in South Africa”, do you think that CBS is absent from areas of South Africa because it did not arrive yet or because these areas are not suitable?

Maps of prohibited movement of citrus plants in South Africa suggest that it is the related dispersal constraints that have limited spread, not climatic suitability.

In fact in the paper this issue is discussed in detail, stating the following:

*“In general, the potential for natural spread of CBS by *P. citricarpa* ascospores and conidia is poorly understood”*

“Although the origin of CBS introductions remains generally unknown, human-assisted movement of infected plant material is considered the most important means of disease spread.”

“The introduction of citrus plants into the Western Cape, Eastern Cape and Northern Cape provinces was banned by this phytosanitary regulation (Anonymous 1984).”

“The movement of citrus plants from KwaZulu-Natal, Mpumalanga, Gauteng, Limpopo, North West and Eastern Cape to the Western Cape, Northern Cape and Free State was banned due to CBS. Within the Western Cape, the movement of citrus plants was also banned from the easternmost to the westernmost magisterial districts due to CBS (Anonymous 2002, 2005a, 2005b; DAFF 2009).”

“The strong spatial autocorrelation detected in the current CBS distribution data (...) suggest that climate itself might not be the main factor limiting the spread of CBS in South Africa. However, further modelling studies are necessary to weigh the relative contribution of environmental variables and spatial effects in disease distribution.”

“Among the ten climates present in citrus-growing areas in South Africa, the only ones where CBS was not detected were the Mediterranean-type Csa and Csb as well as the BWk arid cold dessert (Figs. 2a and 4). However, these three climates together represented only about 13 % of the citrus area in the country and are restricted to locations in the

Western Cape and Northern Cape furthest from CBS-affected areas (>450 km)."

"The introduction of citrus plants into the Western Cape, Eastern Cape and Northern Cape provinces was banned by this phytosanitary regulation (Anonymous 1984)."

"The movement of citrus material in South Africa was not regulated until 1984, but quantitative trade data among provinces was not found. In any case, it seems conceivable that larger amounts of plant material were moved from CBS-affected areas to nearby regions than to distant provinces. Consequently, the potential for introduction might have been higher in regions adjacent to CBS-affected areas."

2. Can the conclusion in your paper that "CBS expanded in South Africa from its original geographic range in summer rainfall areas to arid regions in the nearby provinces of Limpopo and the Eastern Cape" be linked to the increase of citrus growing areas and the use of irrigation?

Irrigation is required in South Africa (as well as worldwide) for commercial citrus production.

Pre 70s/80s = flood and furrow irrigation

Post 70s/80s = drip and sprinkle irrigation (mainly drip used worldwide)

In the 1990s new export markets for South Africa citrus (e.g. EU

Mediterranean countries) were opened, the citrus growing area increased

From 1950-2014 there was an increase in South African citrus distribution

and also in CBS prevalence (new improved dataset of CBS distribution

was assembled based on the Land Cover 2013-14 GIS from the Ministry

of Environmental Affairs of South Africa, with similar results to those

published by Martínez-Minaya et al., 2015).

CBS expanded into wet regions but also nearby dry regions from 1950 to 2014 (figure shown as in paper Martínez-Minaya et al. 2015, fig 4), particularly into Arid Steppe areas (Limpopo and Eastern Cape provinces). A histogram of CBS and summer rainfall (BIO₁₈, precipitation of warmest quarter) indicates that from 1950 to 2014 CBS expanded into drier regions. As indicated before, dispersal constraints due to phytosanitary barriers may have also influenced distribution (via spread).

See also the paper Martínez-Minaya et al. 2015, stating "Furthermore, citrus areas in South Africa increased from 28,900 ha in 1961 to 73,900 ha in 2012 (FAO 2014) and regions in the Northern Cape province were not even cropped with citrus in 1950 (Reuther et al. 1967)".

3. Did you verify the quality of the data from the WorldClim database by comparing with stations data?

WorldClim is widely used (4754 articles available). It provides interpolated data from weather stations (high density of stations in South Africa).

Station data are available (Agricultural Research Council, South Africa) but for different timeframes and locations than used by WorldClim so it is difficult to compare. Some stations in areas of the Eastern Cape and Limpopo showing more outlying data were checked. Data were in line with those from WorldClim though no formal validation was conducted. Therefore WorldClim was trusted.

4. The WorldClim data set is monthly data at 5 arc-minute spatial resolution. Do you think that the selected resolution was suitable for describing the climatic variability of the growing areas? Is there sufficient spatial and temporal resolution to capture the dynamics of the disease?

Data used for climate were a 50-year monthly average from 1950-2000. Previous studies have used a 30 arc-min resolution (Paul 2005, Yonow 2013). WorldClim goes to 30 secs (~1km x 1km) but by interpolation. Considering the extent of the study, this high spatial resolution could be computationally problematic in further modelling studies.

A resolution of 5 arc min (~10 x 10km) is more computationally efficient and is in line with other bio-geographical studies (Franklin 2010) It is adequate to describe climatic variability of the citrus areas in South Africa and the two temporal scenarios available (1950 to 2014), with a trade off with computational time and accuracy. Data from WorldClim can be downloaded at 30", 2.5', 5' and 10' (<http://www.worldclim.org/current>).

As stated in the paper "This preparatory work was part of a larger modelling project where the potential geographical range of CBS will be estimated based on relevant environmental variables and spatial effects".

5. How large were the relevant squares in the spatial autocorrelation analysis?

Spatial resolution 5 arc min (~10 x 10km). Only citrus areas were considered in the spatial autocorrelation analysis.

Moran's Index at different distances was analysed and is available for future work. The analysis showed that clustering was evident at a range of spatial scales.

Roger Magarey (RM) and Paul Fourie (PF) – Questions and Answers

1. What is the rationale for requiring 0.2 mm rain to trigger an ascospore infection period?

Answer RM: While ascospores were trapped in the absence of measured rainfall (Fourie et al., 2013), other studies found that rainfall was a requirement for ascospore release (Kotze, 1963; McOnie, 1964; Lee and Huang, 1973). The 0.2 mm threshold was based on Gibberella zeae because no threshold was available for P. citricarpa. This is a small amount of rainfall. Some measurable rainfall makes infection more effective.

Additional question by the WG: Some papers indicate that rainfall does not have an effect. What is your opinion on not considering ascospore in no rain situations?

Answer RM: Given that so much rain is needed for infection (in order to cause such long-lasting leaf wetness as required by the leaf wetness duration parameters in the infection model for P. citricarpa), requiring 0,2 mm rain is not consequential to the model. I cannot remember if we tried with and without rain but my opinion is that it would have a negligible effect.

PF informed the WG that the 0.2 mm rain was a trigger to the infection model, not ascospore dispersal. In Magarey et al. 2015, ascospore dispersal was predicted by the Fourie-ascospore dispersal model, which was driven by degree days accumulated on wet/moist conditions (DDwet accumulated when >0.1 mm rain or < 5 hPa VPD conditions).

Additional question by the WG: Please comment on the probability that infection could also happen with dew, no rain.

Answer RM: My opinion is that dew would not be sufficient to sustain enough infection/wetness period but this could be looked at in a model.

2. Furthermore, precipitation requirement is allowed to accumulate over 2h. Does this mean 0.2 mm per hour for 2 hours or 0.2 mm total in 2 hours?

A precipitation total of 0.2 mm in 2 hours is needed to start an infection event. This is a very small amount of rain.

Additional question by the WG: This is such a small amount that it is below the threshold able to be measured.

Answer RM: from memory 0.2 was a minimum.

Answer PF: Simulated weather data was used; hence the mechanical measurement concern is inconsequential.

3. Why were 527.3 degree days (DDtemp) selected in Magarey et al. (2015) for initiating the calculation of infection periods? It seems there is no evidence in Fourie et al. (2013) for using that as a threshold. Can you provide/indicate the evidence for the choice of this value?

Answer RM: A value of 527.3 degree days was used because this represented the lowest DD value when ascospores were observed in field. This serves as a substitute for the observed first ascospore. I apologize this value does not appear to be in Fourie et al. 2013. PF advised that this figure be used as it represents the lowest DD value when ascospores are observed.

Answer PF: Yes that was an absolute minimum, so that the model would not miss any ascospores dispersal events. The 1st percentile was 768.3°C (Fourie et al. 2013); this may have been more realistic.

Additional comment by the WG: The distribution should be used rather than the minimum, or at least a min-max range (to avoid cutting off the maturation curve too early and to avoid anticipation of the end of the ascospore season).

Answer PF: but the ascospores dispersal model accurately predicted the initial lag phase. RM: it may have been a problem in warm sites (extreme sites such as Darwin Australia) but not a problem in less warm i.e. Mediterranean climates. PF referred the WG to the delta-PAT results in the article, which at no site reached 1.0, indicating that the dispersal curve was not ended too early.

Additional question by the WG: What is the effect of irrigation? It should provide enough humidity? This is an uncertainty.

Answer PF: Yes, but in general citrus orchards are all irrigated so it should be a normalising factor.

Additional question by the WG: But it will be more of a factor in dry climates than wet climates.

Answer PF: Positive and negative control sites with dry/arid climates were included in our study and so this concern has been captured and thus it should be a normalising effect.

4. Why was the T-model applied in the Fourie et al. 2013 assessment not used in the model in Magarey et al. 2015?

Answer RM: The use of the T-model might have improved the Magarey-2015 model. However, the dispersal model fairly accurately predicted the lag phase following actual and predicted onset of dispersal bio-fix.

5. Why are there moving averages for proportion of ascospores trapped (PAT)? Does this reduce the opportunity to have days (or periods) with PAT=0?

Answer RM: A moving average smooths the data and increases the number of days when PAT >0.

Additional question by the WG: Using a 7-day moving average should reduce the number of days with PAT = 0?

Answer RM: it increased the number of days with PAT>0 i.e. we are in agreement. Moving average is used because a weekly PAT is more accurate than daily.

6. Can you clarify what "smoothed PAT for days of infection was accumulated on days when the daily infection risk was greater than zero" means?

Answer RM: On days when infection is greater than zero, the PAT was accumulated. This provides a measure of the proportion of ascospores that contribute to infection as opposed to those released on days that are not suitable for infection and do not contribute to disease severity. I apologize that these values were not reported in the manuscript. This is a minor error in the paper.

7. Apart from a preliminary sensitivity test to a single model parameter, why was a sensitivity analysis not looked at?

Answer RM: A sensitivity analysis of the generic infection model was published elsewhere (Makowski et al. 2011). The sensitivity analysis was performed on D_{50} because there was no information as to its value, so it was useful to determine that its value was not critical (in this particular case). A sensitivity analysis was not needed for other parameters because their values were known with greater confidence. Information on all parameters was fairly solid except for D_{50} . We had greater confidence in the values of the other parameters and so no sensitivity analysis was done. An informal sensitivity analysis was performed as far as I remember.

8. Can you clarify on equation No. 3 – subscripts instead of superscripts?

Answer RM: These should have been sub-scripts. Sorry. A minor error in the paper is noted.

9. Can you clarify on the use of D_{50} ?

Answer RM: D_{50} is the dry interruption or the minimum dry hours that will stop an infection period. It's value was not known with confidence so we used 3 h as was used by EFSA.

10. In the calculations of vapour pressure deficit VPD (equations No. 5 and 6) there is a change in units from days to hours. Would this make a difference to the calculation of DDwet2? Please elaborate on temperature also for this question.

Answer RM: VPD was calculated on an hourly basis and the average value on a given day was used to calculate DDwet2. The base temperature was 10°C and degree days were calculated from hourly data. The change from hourly to daily should not be critical provided we did not underestimate the impact of VPD on spore release. If I was repeating this work, I would consider using the minimum hourly VPD per day. This would have been an improvement.

Additional question by the WG: is this consistent with the work carried out with PF? How did you calculate daily from hourly? The two papers used two different approaches (daily vs hourly values for VPD) and this might cause a difference.

Answer RM: looking at the paper I did calculate it on an hourly basis. We are looking at extreme wetting events at high temperature, those events

would be driven by heavy rainfall. VPD didn't have much contribution. It may have made a larger contribution if calculated differently. But since we had negative controls it would just have had uniform effect across sites.

Roger Magarey – Questions and Answers

1. Could you please provide the data/readings for the values assessed in table 1 of the Annex to the Magarey et al. 2015 paper?

I do not have the CFSR and station weather data used to calculate these statistics, which were calculated by the vendor ZedX inc. You would need to contact them for these data (Russo@zedxinc.com).

2. In the interpretation of the grid cell data, did you adjust for humidity and the other meteorological variables as well as for temperature in taking into account the elevation of the citrus grove? What source did you use for the elevation of the citrus groves?

The elevation correction only accounted for temperature. RH, leaf wetness and other variables were not corrected. Temperature typically decreases, while RH and leaf wetness likely increase with increasing elevation. Since citrus groves in the EU are often at lower elevation, we likely overestimated leaf wetness and predicted CBS infection levels. In future studies, it would be best to correct for both RH and leaf wetness. However, we believe failure to correct for elevation for RH and leaf wetness could only lead to an overestimation of infection. We used Google Earth to estimate elevation from grove latitude and longitude.

3. Is a grid size of 38 km adequate to minimize the variability inside the grid?

Ideally, the analysis should be conducted at the highest possible resolution and this was 38 km at the time of the study, as far as available global data. So, preferably we would go to finer resolution. But the problem with this is that there is no global availability of fine resolution data, hence no comparable datasets between countries at that resolution. In my opinion, the use of a global grid data set is important to ensure that the variables are as consistent as possible between regions (see below). The study should be repeated if higher resolution data were available. If repeating this exercise we would use a calibration dataset from Europe. Using a finer resolution might likely decrease the calculated

risk, as the elevation of citrus groves is likely lower than the mean elevation of the grid (see comment above).

4. Can you expand on the advantage to use gridded data instead of station data?

The CFSR data sets provide a globally consistent source of weather data. This minimizes issues with variables such as RH and leaf wetness where there may be differences between weather stations in terms of instrumentation used to measure these variables. Another issue with station data is missing values which need to be filled in before modelling can begin. There are also errors associated with the use of grid data as was described in the paper; most notably inaccuracies in mountainous areas, especially when using coarse resolution.

5. How is the general applicability of the infection model, and which thresholds are related to disease severity?

I think an infection model approach is very applicable to determining CBS risk, as regularity of infection is likely the limitation to establishment. I believe that in determining if a location is likely to be at risk, both ascosporic and pycnidiosporic infection levels should be considered. Thresholds should be determined through comparison with positive and negative control sites, including marginal sites. This does miss other factors like overwintering, but infection is likely to be the most limiting factor in establishing the disease. The need for positive and negative controls (including marginal sites) should be reiterated.

6. How do you get from the infection prediction derived from your model to a prediction of establishment?

This is determined by the infection threshold for both spore types. The threshold is based on positive and negative control sites, including marginal sites. In order for CBS to establish the infection score, it would need to be at least as high as the marginal sites. This is explained in detail in the paper. The unique thing about the paper by Magarey et al. 2015 is the count of numbers of favourable years (high frequency of favourable years needed for successful establishment). RM noted the need for regular frequency of suitable years, otherwise climate would not be suitable.

7. How might irrigation influence or change the probability of establishment of the pathogen?

Irrigation if applied overhead could extend the duration of an infection period and thus increase risk if applied at the right time. Under tree irrigation probably has negligible influence. Required leaf wetness duration needed for infection is not probable under conventional irrigation conditions, the CBS expert panel concluded that irrigation would not have an effect (see comments of CBS Expert Panel on EFSA 2013 and 2014).

Additional question by the WG: In Europe many orchards have branches touching the soil, could this change the effect of irrigation on leaf wetness?

Yes, the soil surface could stay wet and remain wet longer than leaf wetness. This could be something for management in Europe i.e. by pruning away branches in contact with the ground.

Paul Fourie – Questions and Answers

1. In the model, any ascospore release can potentially cause infection. Is this true?

This was assumed in the Magarey et al. (2015) model when leaf wetness and temperature conditions were met and smoothed PAT was >0. However, a minor ascospore release in nature will have a lower likelihood to cause infection given the low inoculum potential. Therefore, one needs negative and positive control sites for a realistic interpretation of the model output. Using the threshold from marginal sites is important for interpreting the model.

2. Do you have information on the relationship between ascospore dose and disease incidence/severity?

No, specific information is not available for CBS. There is some ongoing research. The logical assumption, as in other pathosystems, is that the greater the inoculum dose, the greater the incidence/severity.

Additional question by the WG: But higher severities will be reached with higher doses. So how can we manage different inoculation doses with an infection model?

At the moment it is just a yes/no.

Comment RM: This is a great question, it relates to PAT on days with infection. For apple scab the PAT had a big impact on final severity. In this case, as the disease needs long infection events, it was not as well correlated. There are limited numbers of events to cause infection, so for CBS the exact amount of inoculum is not the issue, more the issue is if it is present or not. For CBS, in my opinion, it is the number of wetness events that is important, not the inoculum load. P. citricarpa survives and persists in infected leaves. Citrus leaf has a lifespan of 2 years, so if there is not a string of favourable years then new leaf infection won't occur, and potential ascospore inoculum will be depleted.

3. 10°C are used as a basal temperature for DD accumulation – a justification for this is not given in the paper. Why was this temperature used?

Basal temperature of 10°C was used as equivalent of the lower cardinal temperature for the organism (Lovell, 2004 – A perspective on the measurement of time in plant disease epidemiology. Plant Pathol. 53:705-712; EFSA, 2008; Kotze, 1963; Noronha, 2002) 10°C was also linked to the lower threshold of ascospore infection period. See review paper. In fact, this basal temperature could have been made higher as cold stress was identified as the biggest limiting factor for P. citricarpa.

4. Why was 1 January defined as mid-winter?

1 July was used for Southern Hemisphere, while 1 January was used for Northern Hemisphere (Rossi et al., 2009 - Predicting the dynamics of ascospore maturation of Venturia pirina based on environmental factors. Phytopathology 99:453-461).

Additional questions/comments

Question by the WG: 0.6 was used as an adjustment for lapse rate (adjustment of temperature due to elevation), why?

Answer RM: 0.6 is the value that is used as a standard for a parcel of air that cools.

Comment by the WG: 0.6 is the rate used for humid air. But for dry air it should be 1.0 i.e. 0.6 will underestimate conditions on ground.

Answer RM: Ok, but we are interested in the times when there is wet potential (wet and dry adiabatic rate).

Question by the WG: In his presentation PF mentioned that both spore trap and weather station were located inside the orchard. This is a concern as weather data should be recorded under standard weather conditions (e.g. open field etc). How would this effect model?

Answer PF: This is not correct, the paper says that weather stations were not inside but were close (1km). This was a mistake in a comment made in the presentation.

Question WG: In case we need input or output data from these studies, what data would be available?

Answer PF: My question would be what do you want to do with data?

Answer RM: Some data may be available via the vendor (Zedx inc) and I would need to check with them if the data can be shared. Ideally this would be done as a cooperative exercise rather than a critique. It would need to be a negotiation and cooperative exercise.

Comment by the WG: RM raised the question in slide 24 that EFSA predicted fewer pycnidiospore infection events than ascospore infection events, why? We don't have a perfect answer but the main difference is that in EFSA simulations we only had this requirement for initial rain event for pycnidiospores, not for ascospores.

Comment PF: Also EFSA did not restrict to citrus susceptibility events/periods. This would be good to look at with an independent model validation exercise.

Question PF: The EFSA mandate was to consider the two papers as well as other relevant scientific information. What did you consider? Did you also consider the critiques of the different papers, specifically the Martinez-Minaya et al. critique, and the Perryman et al. critique? The Perryman et al. critique is particularly relevant as the Perryman paper was used by EFSA to argue that fruit is a probable pathway.

Comment WG: Today the agenda is to just look at the two papers. The WG is working also on other publications, however unpublished (non-peer reviewed) manuscripts as those referred to above, were not considered as per EU mandate.

RM: Would you consider making a recommendation that a blind, independent model comparison be considered to resolve this impasse?

Scientific Panel on Plant Health

Minutes of the 3rd meeting of the Working Group on Citrus Black Spot

Held on 4 and 5 January 2016, Parma (Italy)

(Agreed by written procedure on 7 January 2016)

Participants

- **Working Group Members:**

Mike Jeger (Chair), Simone Orlandini, Stephen Parnell (via web), Trond Rafoss, Vittorio Rossi, Jonathan Yuen,

- **EFSA:**

ALPHA Unit: Gritta Schrader, Giuseppe Stancanelli; AMU Unit: Olaf Mosbach-Schulz (5 January 2016 morning); PTT Unit: Carsten Behring

1. Welcome and apologies for absence

The Chair welcomed the participants.

2. Adoption of agenda

The agenda was adopted without changes.

3. Declarations of Interest of Working Groups members

In accordance with EFSA's Policy on Independence and Scientific Decision-Making Processes¹ and the Decision of the Executive Director on Declarations of Interest², EFSA screened the Annual Declarations of Interest and the Specific Declarations of Interest filled in by the working group members invited for the present meeting. No Conflicts of Interest related to the issues discussed in this meeting have been identified during

¹ <http://www.efsa.europa.eu/en/keydocs/docs/independencypolicy.pdf>

² <http://www.efsa.europa.eu/en/keydocs/docs/independencerules2014.pdf>

the screening process. In addition, no Conflicts of Interest related to the issues discussed in this meeting have been identified at the Oral Declaration of Interest at the beginning of this meeting.

4. Scientific topic for discussion

4.1 Assessment of the new scientific information regarding *Phyllosticta citricarpa*

The current state of the work was presented and discussed, in order to reply to the request by April 2016 concerning the assessment of the new scientific information regarding *Phyllosticta citricarpa* (EFSA-Q-2015-00601).

The Working Group went on organising the work and reviewing the two papers directly addressed in the mandate (Magarey et al. 2015, Martínez-Minaya et al. 2015).

Critical aspects requiring clarification were further identified. The need for additional expertise was identified and agreed. Tasks were distributed among the participants in preparation to the fourth meeting, also with regard to the preparation of the meeting with hearing experts on 26 January 2016.

5. Agreement of the minutes of this Working Group meeting

The minutes of the 3rd Working Group meeting were agreed by written procedure on 7 January 2016.

6. Next meeting

The next meeting will take place on 26 January 2016 with a hearing in Parma.

Scientific Panel on Plant Health

Minutes of the 2nd meeting of the Working Group on Citrus Black Spot

Held on 9 December 2015, Parma (Italy)

(Agreed on 4 January 2016)

Participants

- **Working Group Members:**

Mike Jeger (Chair), Trond Rafoss, Vittorio Rossi, Jonathan Yuen (via web)

- **EFSA:**

ALPHA Unit: Gritta Schrader, Giuseppe Stancanelli; AMU Unit: Olaf Mosbach-Schulz (via web)

1. Welcome and apologies for absence

The Chair welcomed the participants. Apologies were received from Stephen Parnell and Simone Orlandini.

2. Adoption of agenda

The agenda was adopted without changes.

3. Declarations of Interest of Working Groups members

In accordance with EFSA's Policy on Independence and Scientific Decision-Making Processes¹ and the Decision of the Executive Director on Declarations of Interest², EFSA screened the Annual Declarations of Interest and the Specific Declarations of Interest filled in by the working

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group members invited for the present meeting. No Conflicts of Interest related to the issues discussed in this meeting have been identified during the screening process. In addition, no Conflicts of Interest related to the issues discussed in this meeting have been identified at the Oral Declaration of Interest at the beginning of this meeting.

4. Scientific topic for discussion

4.1 Assessment of the new scientific information regarding *Phyllosticta citricarpa*

The current state of the work was presented and discussed, in order to reply to the request by April 2016 concerning the assessment of the new scientific information regarding *Phyllosticta citricarpa* (EFSA-Q-2015-00601).

The Working Group focused on the review of the two papers concretely addressed in the mandate (Magarey et al. 2015, Martínez-Minaya et al. 2015).

Critical aspects requiring clarification were further identified and tasks were distributed among the participants in preparation to the third meeting, also with regard to the preparation of the meeting with hearing experts on 26 January 2016.

5. Next meeting

The next meeting will take place on 4 and 5 January 2016 in Parma.

Scientific Panel on Plant Health

Minutes of the 1st meeting of the Working Group on Citrus Black Spot

Held on 19-20 November 2015, Parma (Italy)

(Agreed on 26 November 2015)

Participants

- **Working Group Members:**

Mike Jeger (Chair), Trond Rafoss, Vittorio Rossi (20 November 2015)

- **EFSA:**

ALPHA Unit: Gritta Schrader, Giuseppe Stancanelli; PTT Unit: Carsten Behring

1. Welcome and apologies for absence

The Chair welcomed the participants. Apologies were received from Stephen Parnell and Olaf Mosbach-Schulz.

2. Adoption of agenda

The agenda was adopted without changes.

3. Declarations of Interest of Working Groups members

In accordance with EFSA's Policy on Independence and Scientific Decision-Making Processes¹ and the Decision of the Executive Director on Declarations of Interest², EFSA screened the Annual Declarations of Interest and the Specific Declarations of Interest filled in by the working group members invited for the present meeting. No Conflicts of Interest

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² <http://www.efsa.europa.eu/en/keydocs/docs/independencerules2014.pdf>

related to the issues discussed in this meeting have been identified during the screening process. In addition, no Conflicts of Interest related to the issues discussed in this meeting have been identified at the Oral Declaration of Interest at the beginning of this meeting.

4. Scientific topic for discussion

4.1 Assessment of the new scientific information regarding *Phyllosticta citricarpa*

The activity plan was discussed and agreed, in order to reply to the request by April 2016 concerning the assessment of the new scientific information regarding *Phyllosticta citricarpa* (EFSA-Q-2015-00601).

A review of the available literature was started and further references in support to the preparation of the opinion were searched.

Critical aspects requiring clarification were identified and tasks in preparation to the second meeting distributed among the participants.

5. Next meeting

The next meeting will take place on 9 December 2015 in Parma.