**PHYTOSANITARY TEMPERATURE TREATMENT EXPERT GROUP (PTTEG)**

**17-20 August 2015**

**Nelspruit, South Africa**

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# Opening of the meeting

## Welcome by the chair of the PTTEG

Meeting participants were welcomed by the chair of the Phytosanitary Temperature Treatments Expert Group (PTTEG)[[1]](#footnote-1), Mr Guy Hallman. The meeting follows on from the Expert Consultation on Cold Treatments (ECCT) organized by the International Plant Protection Convention (IPPC) held in Buenos Aires, Argentina, in December 2013[[2]](#footnote-2). He thanked officials from Citrus Research International (CRI) for hosting the first PTTEG meeting. He also thanked the participants for attending.

The purpose of the meeting was for participants to engage in discussion about phytosanitary treatments, work collaboratively, and network with other phytosanitary treatment researchers and regulators.

## Welcome by local host

The Chief Executive of CRI, Mr Vaughan Hattingh, welcomed all participants. He stressed that hosting this meeting at CRI was a positive mark for the South Africa citrus industry. He outlined the history of CRI and the development of the citrus industry in South Africa from the planting of the first citrus tree more than 100 years ago.

## Introduction of participants

Participants introduced themselves briefly (Appendix 1 is the participant list).

## Election of chair of meeting

Mr Russell Cant (Australia) was elected the chairperson for the meeting.

## Election of rapporteur

Ms Joanne Wilson (New Zealand) was elected the rapporteur.

## Adoption of the agenda

The agenda was adopted as in Appendix 2 of the report.

# Administrative matters

## Documents list

The chair of the meeting introduced the list of documents presented in Appendix 3. It was pointed out that some participants had problems accessing the IPPC work area page possibly due to firewall protections in their respective departments. It was mentioned that in future this issue will be resolved.

## Local information

The CRI host (Mr Tim Grout) outlined some local information and security procedures.

## Logistical arrangements

Information on the logistical arrangements was provided by the host.

# Report of the Expert Consultation on Cold Treatments (ECCT) (December 2013)

## Reasons for the meeting

The IPPC Secretariat provided a presentation with an overview of the role of IPPC[[3]](#footnote-3) in protecting plants from pests and facilitating international trade[[4]](#footnote-4).

The IPPC Secretariat noted that the ECCT meeting[[5]](#footnote-5) was to serve as a forum for discussion, information sharing, and collaboration on scientific and practical issues related to the development and use of cold treatments and determine acceptable common approaches. The meeting was also to bring together cold treatment experts to understand the constraints and identify common methods to address these constraints, to identify gaps in the research and methodologies used including statistical analyses of data and the limitations of these analyses, and facilitate collaboration to conduct future research. Other reasons were to build an international scientific network of cold treatments experts to share information and data to develop more globally acceptable cold treatments, increase the confidence in the cold treatment evaluation process, and identify critical requirements for operation of cold treatments.

## 2. Conclusions

Participation and subsequent outputs from the ECCT meeting will provide scientific input into the development of phytosanitary treatments that are nationally or regionally approved by a National or Regional Plant Protection Organization (NPPO or RPPO). The agreed outputs from the ECCT meeting are documented in Appendix 4 of the ECCT December 2013 report[[6]](#footnote-6). One of the main outcomes was the creation of the PTTEG, an independent group to serve as a forum to discuss critical issues around phytosanitary treatments (see following section on “*Creation of PTTEG*”).

## 3. Creation of the PTTEG

The PTTEG was formed to be an independent group that would continue the work initiated at the ECCT meeting. The PTTEG would consider all temperature related phytosanitary treatments and serve as a forum where critical phytosanitary treatment issues can be addressed through discussion and collaborative research and where scientific analysis and review of global phytosanitary treatments issues and new information can be provided.

The chairperson stressed the importance of establishing clear goals and objectives for the PTTEG to avoid it being redundant and duplicating efforts elsewhere. It was stressed that there would be limitations on what the group could do and concrete outputs were needed.

It was emphasized that the work of the PTTEG would not duplicate the work of other groups but would maintain independence and provide advice to the Technical Panel on Phytosanitary Treatments (TPPT)[[7]](#footnote-7) by providing the science on which phytosanitary treatments are based on and it was not intended to draft standards.

It was noted that the PTTEG is not an official group of IPPC but will act as a liaison group. It was pointed out that there are other groups that exist which PTTEG may be able to seek guidance from regarding objectives or framework for example the International Forestry Quarantine Research Group[[8]](#footnote-8) (which has been in existence since 2004 and meets annually).

One participant enquired about the IPPC work programme[[9]](#footnote-9) in relation to the development of temperature treatments (annexes to the International Standard for Phytosanitary Measures (ISPM) 28. *Phytosanitary treatments for regulated pests*)[[10]](#footnote-10). It was explained that there are cold and vapour heat treatments under development. The work of the TPPT, how treatments are submitted, the standard setting process including the member consultation stage and adoption were briefly outlined. It was highlighted that the TPPT works under the guidance of, and reports to, the Standards Committee (SC) as mandated by the Commission on Phytosanitary Measures (CPM).

Further discussion on scope and functions of the PTTEG is covered under agenda item E of this report.

# Report of the Expert Consultation on Phytosanitary Treatments for the *Bactrocera dorsalis* Complex (ECBD) (December 2014) (10\_PTTEG\_2015\_Aug)

Mr Toshi Dohino (Japan) made a presentation on the Expert Consultation on Phytosanitary Treatments for the *Bactrocera dorsalis* Complex (ECBD)[[11]](#footnote-11). The meeting was held in Okinawa, Japan, 1 - 5 December 2014, hosted by the Plant Quarantine Office of the Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF), and partly funded by Japan, the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture, and the IPPC Secretariat. The meeting had the participation of twenty-four researchers from twelve countries.

## 1. Reasons for meeting

It was mentioned that the IPPC Standards Committee (SC) was informed about concerns from some countries on the absence of phytosanitary treatments for the control of *Bactrocera invadens,* Drew, Tsuruta & White (Diptera: Tephritidae)*.* After discussion between the IPPC Secretariat and the Plant Quarantine Office of the Japanese MAFF it was agreed to organize an expert consultation meeting on phytosanitary treatments to control fruit flies of economic importance from the *Bactrocera dorsalis* complexin December 2014 in Okinawa.

The TPPT, the Technical Panel on Fruit Flies (TPFF) and the SC have all agreed that such a meeting would be of particular interest to those areas or countries affected by this pest. Collecting the scientific evidence for an NPPO or RPPO to submit a proposed phytosanitary treatment in response to a call by the IPPC Secretariat requires significant effort as submitters try to meet all the requirements prescribed in ISPM 28. Experts with experience in designing and conducting research on phytosanitary treatments for fruit flies, as well as those involved in confirmatory trials (operational conditions) and treatment submissions were invited to participate in this consultation[[12]](#footnote-12).

Objectives of the meeting were to:

* + provide a forum for phytosanitary treatments researchers from around the world to discuss and share the scientific and practical issues related to the development of fruit fly treatments to control pest species within the *B. dorsalis* complex and determine an acceptable common approach;
  + examine scientific/practical constraints in treatment development for the *B. dorsalis* complex;
  + identify phytosanitary treatments for pest species within the B. dorsalis complex used nationally or regionally;
  + provide a forum for phytosanitary treatment experts to understand the constraints with developing fruit fly treatments and identify common methods to address these constraints.

## Conclusions

It was mentioned that the ECBD meeting[[13]](#footnote-13), setting the scene, was a discussion of the implications of the recent taxonomic synonymization of four fruit fly pests in the *Bactrocera* genus[[14]](#footnote-14) on the application of phytosanitary measures particularly in sub-Saharan Africa where *B. dorsalis* outbreaks have been occurring in recent years. Participants presented research in their country on phytosanitary treatments against the different fruit flies. Issues in the design, conduct, operationalization, evaluation, and presentation of the data of postharvest treatments were discussed. Participants collated a comprehensive list of NPPO-approved treatments for *B. dorsalis* complex species. A presentation on a compiled list of current NPPO/RPPO approved treatments was given.

Plans for future collaboration among the experts involved in the meeting notably included the publication of a paper that is to provide a “phytosanitary treatment toolbox” that describes available phytosanitary treatments against *B. dorsalis*, the market access obtained with their use, any problems encountered with treatment efficacy, and possible effects on the quality of the fruit (see section below on “*Publication resulting”)*. It was highlighted that the ECBD concluded that the main mechanism for the continued work towards harmonization would be for the experts to collaborate within the PTTEG to address research concerns, pool experiences, and supply relevant information to the IPPC Technical Panels (reviewed and consolidated by the PTTEG, where appropriate, such as sets of very similar treatment schedules).

## Publication resulting

A review paper authored by the meeting participants was agreed to be developed. This paper “Phytosanitary treatments against *Bactrocera dorsalis* (Diptera: Tephritidae): current situation and future prospects” is under development led by Mr Dohino.

## 4. Continuing efforts

Mr Dohino stressed that the ECBD meeting concluded that the main mechanism for the continued work towards harmonization would be for the experts to collaborate within the PTTEG.

Points of discussion from the PTTEG were:

* + 1. It was stressed by one PTTEG participant that there is a significant need to have treatments validated and published, especially for citrus. It was suggested that the scope of the paper was broadened to include other treatment schedules (or potential treatment schedules).
    2. Another participant mentioned that this paper should not be an “IPPC view” of approved treatments, but include bilateral treatments schedules that have been used already.
    3. The possibility of including these treatment schedules in the PTTEG treatments database was raised. See further discussion under agenda item “F. Initial Work Programme of the PTTEG – 5. Cold treatment database”).

The IPPC Secretariat stressed that members of expert groups work for NPPOs. NPPOs are the IPPC contracting parties and if an NPPO submits a treatment to the IPPC the IPPC can then make these publically available if the contracting party agrees. It was mentioned that this could be done in the future, possibly using the IPPC Phytosanitary Resources page[[15]](#footnote-15).

One participant highlighted that usually these treatments are negotiated bilaterally and therefore remain within the countries, unpublished but not new to science. Another participant emphasized and suggested that these treatments schedules be published in peer reviewed journals as short communications.

* + 1. One participant queried how a treatment submission needs to be added to the IPPC work programme to become an annex to ISPM 28. It was mentioned that the USA has submitted a treatment, but it was based on historical evidence and was not added to the work programme. It was explained that IPPC contracting parties can submit a topic during a call for topics, which occurs every two years, and that the IPPC Secretariat opens a call for treatments separately. It was noted by another member that historical treatments tend to lack efficacy levels, and this is a critical point for the science and for the TPPT assessment and Standards Committee (SC) approval process.

One participant queried about the acceptability of pre-published treatments which are not yet accepted as official treatment schedules for a country. The chair of the PTTEG explained that treatments, which are not yet official protocols, are being considered.

Participants were encouraged to submit treatments schedules and data to be annexes to ISPM 28 during the IPPC call for treatments, via their NPPO contact points. The general opinion was that published science is important for treatment schedule development and the PTTEG should consider this.

# Phytosanitary Temperature Treatment Expert Group

## 1. Mission

The following points were discussed by the group:

* + 1. Understand the differences in treatment standards
    2. Gain global information on treatments
    3. Validate treatments set by NPPOs
    4. How to contribute to the process for getting treatments adopted
    5. Support to TPPT
    6. Learning from other group members
    7. Clarity and guidance before beginning a new research project (acceptable limits, how many probes and positions, unacceptable temperature range and time). Clearly defined starting point
    8. Understanding regulatory protocols and implications for treatment variations
    9. Resolving quarantine problems/finding alternatives
    10. Framework for international acceptance of treatments
    11. Understanding how to get access to international markets through scientific evidence/ recognition of equivalence
    12. Research collaboration to resolve issues around different treatment schedules
    13. Harmonizing methodology (determine why there are differences and what they mean)
    14. Acknowledge research assumptions
    15. Support and assessment by other expert treatment researchers
    16. Advice/comparison of treatments for new emerging pest species
    17. Giving good science advice and information to NPPOs
    18. Phytosanitary systems for low infestation rates
    19. Minimum data for different temperature schedules
    20. Harmonising/standardizing/streamlining treatment schedules for the same commodity and same pest and the operational delivery of the treatment
    21. Recognition of equivalence for varieties/cultivars especially as new ones are developed

After thorough discussions about its mission statement, the group agreed with a new wording for its mission and the new words, such as “Harmonize research on phytosanitary treatments”, “other measures”, and “horticultural commodities” were included. The mission statement was included in the Terms of Reference (Appendix 4).

## Functions

The following main functions of the group were agreed:

* + 1. liaise with the TPPT to support the development of international phytosanitary treatments to be considered and approved by the Standards Committee.
    2. serve as a forum for discussion, information exchange, and clarification of key scientific issues related to phytosanitary treatment application in global trade.
    3. provide scientific analysis and review of global phytosanitary treatment issues and new information.
    4. identify and undertake collaborative scientific research aimed at high priority phytosanitary treatments.
    5. liaise with the International Forestry Quarantine Research Group (IFQRG) to avoid duplication.

The following scope was agreed by the group: “Non-wood commodities such as fruits, vegetables, and ornamentals” (Appendix 4).

## Membership

Membership is from the scientific research community and the phytosanitary regulatory community and will be reviewed by the executive committee.

## Executive committee

The function of the executive committee is to:

1. drive actions/project outcomes
2. maintain membership and contacts

## Meetings

The frequency of meetings determines the output. At present, the aim is to meet approximately every 2 years with suggested regular contact every 3-4 months (e.g. virtual meetings) to ensure projects are on task.

The group does not have an official liaison role with the IPPC but the Secretariat could arrange for virtual meetings, at least for the first ones. These could be for small groups rather than the larger group. It was mentioned that virtual meetings need to be for a maximum of 2 hrs to consider time zones and need to be limited to 2-3 points.

Funding options for meetings might include:

1. United States Department of Agriculture (USDA) Foreign Agricultural Service for international cooperation.
2. USDA Agriculture and Food Research Initiative grants to fund meetings on hot topics such as food safety and security.
3. IPPC funding contribution, potentially for developing countries.

## 6. Re-evaluation of scope, name, and functions of the group

To terms of reference and rules of procedures for the group was amended to include a revised mission statement and functions as agreed above (see section “E”). The agreed amended Terms of Reference are in Appendix 4.

It was also agreed to change the name of the group from PTTEG to “Phytosanitary Measures Research Group” (PMRG) to better fit the new agreed mission of the group.

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| **Action(s)** | **Team** | **Timeline** |
| Inform Group’s Secretary if planning to attend the International Congress of Entomology (ICE) in Florida September 2016 with a view to arranging a brief meeting | All | June 2016 |
| Explore funding options for participants for the next face-to-face PMRG meeting | Moreira, Neven | February 2017 |

# Initial work programme of the PTTEG

The Chairperson of the PTTEG explained that the initial work programme of the group was set up at the ECCT meeting to address issues identified at that meeting. Attendees volunteered to explore each issue, and a lead for each was selected (See Appendix 4 of the ECCT December 2013 report). Reports follow:

## 1. Terminology descriptions (06\_PTTEG\_2015\_Aug)

The paper was presented by Mr Scott Meyers (USA). A copy of the presentation is available on the work area of the group’s webpage (<https://www.ippc.int/en/work-area-pages/phytosanitary-temperature-treatments-expert-group/ptteg-2015/>).

There was discussion about adding these terms or revisions into ISPM 5 (*Glossary of Phytosanitary Terms*) to provide some standardisation. It was mentioned again that NPPOs can submit term proposals if they were considered important to the IPPC during the call for topics.

The group acknowledged the work done and thanked Mr Meyers for leading this research. The group agreed that this project is not a high priority and, therefore, no further action is required. It was suggested if definition of terms is important in the future then the group could do this via virtual meetings or ask an NPPO to submit the term proposal to the IPPC during a call for topics.

## 2. Existing cold treatment schedules (07\_PTTEG\_2015\_Aug)

Mr Myers presented a spreadsheet of 125 cold treatments. A copy of the presentation is available on the work area of the group’s webpage (<https://www.ippc.int/en/work-area-pages/phytosanitary-temperature-treatments-expert-group/ptteg-2015/>). It was noted that many of the treatment parameters are the same or similar, although cold treatments for *Bactrocera tryoni* showed greater variations of temperature and time. Therefore, it was noted that there is potential to harmonize cold treatments.

The advantages of harmonization discussed by the group follow:

* Treatments could be used to address regional needs
* Species could be ranked by tolerance
* Commodity based treatment groups
* Potential for a pest by commodity treatment matrix
* Operational considerations may include:
  + Standardize treatments protocols
  + Monitoring
  + Pre-cooling
  + Temperature thresholds
* Identify areas where research may facilitate this effort
  + Review /compilation of existing data
  + Add any new data

It was agreed that it would be useful for a paper to be developed into a publication. These data may be used to prevent duplication or unnecessary repetition of research.

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| **Action(s)** | **Team** | **Timeline** |
| Develop draft paper into a more analytical analysis with the aim to publish. It was proposed to start with Mediterranean fruit fly using qualitative information if quantitative data are unavailable (*See* Appendix 5, large number of treatment schedules) | Myers (lead), Neven, Willink, Hallman, Jessup | Complete draft by next meeting with updates via virtual meetings |
| Updates to cold treatment schedules with efficacy references where available | All PMRG members | As soon as practicable |

## 3. Consideration of cultivar/varietal effects on efficacy (09\_PTTEG\_2015\_Aug)

The paper was presented by Mr Eduardo Willink (Argentina). A copy of the presentation is available on the work area of the group’s webpage (<https://www.ippc.int/en/work-area-pages/phytosanitary-temperature-treatments-expert-group/ptteg-2015/>).

The conclusion from the research and the presentation given was that there was no evidence that varieties affect the development of cold treatment schedules. Differences in insect mortality occur at sub-lethal treatments like with lethal time (LT) generating 50% mortality (LT50) but these disappear at LT99.

Discussion points were:

* The use of artificial infestation of fruit versus infestation via oviposition was discouraged.
* Factors that could affect the efficacy of cold treatment between varieties included:
  + physiological state of the fruit and varietal differences
  + quality aspects, physical attributes of host fruit, e.g. acid content
  + osmotic concentration effects on metabolism of insect
  + seasonal differences for fruit and maturity
  + interactions of insect with host
* Experimental parameters are potentially very complex.
* There do not appear to be differences in efficacy of cold treatments between varieties/cultivars of citrus.
* There is a lack of agreement regarding the most tolerant life stage of fruit fly to cold. Differences may be a function of methodology to determine life stage at the time of treatment.

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| **Action(s)** | **Team** | **Timeline** |
| Collect more data on cultivars and/or varieties and analyse commonalities and prepare draft paper. (*See* Appendix 5) (TPPT can present to regulators as appropriate) | Willink (lead), Myers, Hallman, Jessup | Complete draft by next meeting with updates via virtual meetings |

## 4. “High”- temperature cold treatments (11\_PTTEG\_2015\_Aug)

The work was presented by Mr Vaughan Hattingh (South Africa). A copy of the presentation is available on the work area of the group’s webpage (<https://www.ippc.int/en/work-area-pages/phytosanitary-temperature-treatments-expert-group/ptteg-2015/>).

This study was initiated as a result of some fruits (e.g. lemons) being unable to be exported with existing cold treatment protocols as the temperature resulted in damage to fruit. The data showed that cold treatments with higher temperatures can have larval survivors after some days but those larvae will not develop. However, the project showed no evidence for treatments above 3.2°C being adopted. Therefore, we are no closer to establishing the upper threshold of efficacy. Higher temperatures for longer time may not be practical.

Suggestions for the way forward included:

* Need for higher temperature cold treatments for some heat-sensitive fruit such as lemons.
* Address the question if it is worth considering prevention of further development as a measure of efficacy instead of always demanding acute mortality. For example, a treatment for *Thaumatotibia* (*Cryptophlebia*) *leucotreta* (false codling moth) to be published shortly shows that development of survivors of milder cold treatments eventually ceases.

One member mentioned that the only requirement for exporting lemons from Argentina to Japan and China, for example, is cold treatment with no acceptance of phytosanitary systems or host status. Lemons do not tolerate cold treatment well, so raising the treatment temperature may help preserve lemon quality.

Conclusions:

The group decided that there is no feasible way forward with the issue of higher temperature cold treatments currently and it was agreed that no further action is required.

## 5. Cold treatment database (12\_PTTEG\_2015\_Aug)

The work was presented by Mr Myers (USA). A copy of the presentation is available on the work area of the group’s webpage (<https://www.ippc.int/en/work-area-pages/phytosanitary-temperature-treatments-expert-group/ptteg-2015/>).

An endnote database has been established and includes approximately 200 PDF references. The project team are looking at providing read-only access in endnote or on the IPPC website. It was advised that once a system is created entries can be tweaked and incorporated into an access database. This database is a useful tool for researchers and regulators. Regulators would also benefit from this database with all of the treatment data, not only the schedule.

It was mentioned that a heat treatment database would also be useful. The IPPC Secretariat was tasked by CPM-10 (2015) to explore options for a cold treatment database and the group believed that in this database it could be beneficial to include heat treatments.

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| **Action(s)** | **Team** | **Timeline** |
| Explore options for posting endnote references into a treatment database on IPPC website. (*See* Appendix 5) | Moreira | Complete by next meeting |
| Explore putting information into a database format suitable for IPPC. A heat treatment database will also be useful. (*See* Appendix 5) | Myers | Complete by next meeting |

## 6. Research guidelines 08\_PTTEG\_2015\_Aug

Presented by Mr Toshi Dohino (Japan) using *Ceratitis capitata* (Medfly) as a test case. A copy of the presentation is available on the work area of the group’s webpage (<https://www.ippc.int/en/work-area-pages/phytosanitary-temperature-treatments-expert-group/ptteg-2015/>).

The scope of the research guideline was to provide technical procedures for cold disinfestation treatments against fruit fly in host commodities.

The project was initiated at the ECCT 2013 meeting with the idea of having a document as a guideline. It is not intended to be a prescriptive protocol template for research but a guide to harmonize methodology. The information is beneficial to researchers and could be posted on the PMRG webpage.

Discussion points included:

* The Regional Standard for Phytosanitary Measures # 34 gives broad guidance and includes a number of insect species.
* When replenishing colonies only wild males should be introduced to colony females. Replenishing population every 2 years is feasible. A colony is a genetic bottleneck which means it is only a subset of the environmental genetic variation. Replenishment may also be dependent on species.
* Regarding calibration of temperature sensors, it was noted that it would be essential to link to some protocol references because this is a crucial step for the success of the treatment. Mr Verschoor will send information on sensor calibration.
* An explanation of why the methodology should be followed is needed. Name the assumptions being made and why they are important. This is about controlling the variables as we currently have very divergent methodologies.
* In temperature monitoring it should be clear that air temperatures do fluctuate but pulp temperatures should not.
* When testing most tolerant insect stage it is better to test all developmental stages at the same time to reduce variability, or infestations could be staggered over several days to ensure different instars are treated. Control numbers may determine inoculation rates for eggs and early instars for test fruits.
* Too much standardisation of methodology may reduce the natural variability in laboratory populations.
* Larvae grown on artificial diet should not be used in stage tolerance tests unless research has demonstrated that these larvae are not easier to kill than those developing in fruit. However, some fruits may be difficult to infest.
* The testing of varieties was questioned given the evidence from Mr Eduardo Willink’s presentation.
* Size of fruit should not be important for cold treatment durations once equilibrium has been reached.
* Importance of replication and optimal number of replications.
* It is important to specify how starting temperatures and upper thresholds are determined in methodology. The establishment of a treatment protocols is supported by the trial data.
* Large scale disinfestation test: These are very laborious and costly and could be avoided if comparison to already scheduled treatments allows for use of an existing treatment.
* How to convert trial temperature to commercial protocols. For cold treatments Japan currently uses the mean of the average temperature in each of 3 replicates of confirmatory testing. These trials usually comprise more than ~30,000 insects (most tolerant stage) as the maximum temperature for treatment schedule.
* Definition of treatment success needs to be considered: larval mortality versus pupation rate versus adult emergence? There may be a disconnect between treatment evaluation and practical regulatory compliance. The group was divided on the need for inclusion into experimental procedures. It was questioned whether we need to change the way we do inspections or the way we do research or both.

It was agreed that further work is needed before the research guideline is publically available.

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| **Action(s)** | **Team** | **Timeline** |
| Information on sensor calibration to Secretary | Jan Verschoor | Intersession |
| Amend guideline to incorporate comments and circulate to group. To include a recommendation on how to convert trial data into a treatment schedule. (*See* Appendix 5) | Dohino (lead), Quenta, Mathieu-Hurtiger, Cant, Hattingh | Intersession, tentative final agreement at next PMRG meeting |
| Investigation and publication on insect viability and the implications to regulatory decision making. (*See* Appendix 5, New Research Issue) | Hallman, Hattingh, Walse | Complete by next meeting |

## 7. Possibility of “generic” cold treatments (13\_PTTEG\_2015\_Aug)

Presented by Mr Guy Hallman. A copy of the presentation is available on the work area of the group’s webpage (<https://www.ippc.int/en/work-area-pages/phytosanitary-temperature-treatments-expert-group/ptteg-2015/>).

One specific treatment schedule is used for a group of pests and or commodities although not all were tested for efficacy. The example used was the successful adoption of generic irradiation treatments. The same concept was explored for cold treatments although there was a vast difference between effective treatments for one species of fruit fly compared with others; e.g. 15 day treatments for *Ceratitis* *capitata* compared with 40 days for *Rhagoletis pomonella -* 40 days is impractical for some commodities.

Questions raised included:

* Is it possible for cold?
* Genus or species specific?
* What information or work is needed?
* What would they look like?
* What work is required?
* Who would do it?

The concept of generic treatments has advantages for:

* new market access
* alignment of treatments for exporting countries
* maintaining market access when new pests emerge

Generic cold treatments could be put forward by NPPOs to be an annex to ISPM 28, as it has already one for irradiation.

|  |  |  |
| --- | --- | --- |
| **Action(s)** | **Team** | **Timeline** |
| Include on the agenda for the next meeting (*See* Appendix 5) | Chair/Secretary | Next meeting |

# New issues

The following new research issues/projects were identified (see Appendix 5):

## 1. New research issues

1. Treatment database: IPPC to explore options
2. Development of CATTS (Controlled Atmosphere Temperature Treatment System) Presentations by Ms Lisa Neven (USA), Mr Jan Verschoor (The Netherlands) and Ms Yu Tong Qiu (The Netherlands) (*see below*)
3. Modelling for more rapid development of quarantine treatments (physiological determination of host and species)
4. Treatment approaches for researchers (heat, fumigation, CATTS)
5. Phytosanitary systems (little in the literature)
6. Larval vs pupal vs adult endpoint determinations (a lot of discussion by the group in this area – a concept for exploring and recorded as an action item)
7. Mixed load treatments (leverage off existing publication)
8. New and novel technologies (e.g. low/high pressure, microwave)

## New regulatory issues

1. Non-target organisms as indicators of treatment failure

## New issues in commercial application

None identified.

Discussions about new research issues were supported by presentations or sought further information. These included:

## CATTS quarantine treatments (14\_PTTEG\_2015\_Aug)

Ms Lisa Neven (USA) provided an overview of Controlled Atmosphere Temperature Treatment System (CATTS) developed for a number of temperate pests of apples (e.g. oriental fruit moth). A copy of the presentation is available on the work page (<https://www.ippc.int/en/work-area-pages/phytosanitary-temperature-treatments-expert-group/ptteg-2015/>).

The CATTS treatment maintains quality and can improve sweetness of fruit. The presentation also demonstrated how modelling can be used to benefit next steps with research on developing quarantine treatments. Commercialization of treatments including description of packaging, temperature probing, airflow, humidity, and critical parameters for treatment success (such as O2, CO2, harvest time, fruit pulp temp.) was discussed.

Mr Jan Verschoor and Ms Yu Tong Qiu (The Netherlands) provided an overview of the commercial application of CATTS in the Netherlands. A copy of the presentation is available on the work page. (15\_PTTEG\_2015\_Aug)

The Netherlands are a big exporter of strawberry runners and with the ban of methyl bromide (MeBr) in Europe, CATTS was considered as an alternative. The target pest on runners was the strawberry mite (tarsonemid); 48h, 35°C 50% CO2 and O2 shown to be equivalent in efficacy to MeBr. Research was privately funded and therefore Mr Verschoor was unable to fully disclose all treatment parameters. Verschoor is also looking at treating for root knot nematode (*Meloidogyne hapla*). The efficacy of CATTS was measured at >99.7% and is now used as an export protocol.

Pest issues include:

* *Tuta absoluta* on tomatoes (concentrating on pupal stages).
* Western flower thrips (*Frankliniella occidentalis*) on flowers; however, treatment time is long at 24hrs.
* Fruit moth (*Cydia*) on pome fruits is also problematic.
* Tobacco white fly (*Bemisia tabaci*) is very difficult to kill.
* Other research pests include wheat curl mite and root knot nematodes (*Meloidogyne chitwoodi*).
* All tiger mosquito life stages are very susceptible to CATTS.
* *Drosophila suzukii* is a big issue in the Netherlands; in 2014 all strawberry fields were infested.

CATTS is non-chemical with which has no residues or legal barriers. It is possible to treat direct from the field. The Thai government is interested in these non-chemical treatments.

Verschoor interested in setting up a group to share expertise in this area.

1. *Killing hitchhikers* (16\_PTTEG\_2015\_Aug)

Presented by Mr Tim Grout (South Africa). A copy of the presentation is available on the work area of the group’s webpage (<https://www.ippc.int/en/work-area-pages/phytosanitary-temperature-treatments-expert-group/ptteg-2015/>).

Key points included:

* Grain chinch bug (GCB) - a wheat pest. Any fruit with a stylar end opening such as pears or navel oranges is an issue but only adults are a problem.
* Insects aestivate in cavities in bark.
* Vapormate (ethyl formate and carbon dioxide) is very effective against GCB.
* Experimental work on *Siculobata sicula (*Hemileiidae) 250 g/m3gives 100% mortality.
* Vapormate plus C02 is effective against citrus mealybug adults but not effective against eggs. Vapormate ineffective against beetles, eggs, and internal pests but very good against aphids, thrips, mites, and mealybug adults
* No MRL issues as it forms formic acid in the insect.

1. *Phytosanitary systems*

Sean Moore is looking for examples of phytosanitary systems approaches preferably with supporting data. Lisa Neven gave an example of apples from the north-western USA exported to China (Taiwan) under a phytosanitary system which uses ecological niche modelling.

|  |  |  |
| --- | --- | --- |
| **Action(s)** | **Team** | **Timeline** |
| Send examples of systems approaches with supporting data to Sean Moore. | All | As they become available |

# Overview and conclusions of the 1st meeting of the PTTEG

## General and specific conclusions

The expected benefits from the group, the generic approach to research, and the platform for presenting results at the meeting was discussed to determine next steps.

## 2. Next steps

An overview of the meeting’s actions, new and ongoing projects, and project teams was presented. These are summarised in the PMRG 2015-2017 work plan in Appendix 5.

## 3. Next meeting date and location

Next Meeting: It was proposed that the next meeting of the group to be held in the USA around the same time as the International Congress of Entomology (ICE) September 2016 (25th-30th in Florida) may be beneficial. This would give the opportunity for members to attend both meetings. It was pointed out that not all members will attend the ICE, and the meeting date might be too soon. Mr Jan Verschoor offered to host the next meeting in the Wageningen, Netherlands in 2017, and this was accepted by the group. Proposed dates: no later than August 2017.

|  |  |  |
| --- | --- | --- |
| **Action(s)** | **Team** | **Timeline** |
| Confirm suitable dates for next meeting in 2017 the Netherlands | Verschoor, Qiu | 6 months prior to meeting |

## Other business

**IPPC Roster of Consultants**

The IPPC Secretariat representative, Ms Adriana Moreira, made an invitation to the group to visit the phytosanitary resources page of the IPPC. The page includes a roster of consultants [www.phytosanitary.info/consultants](http://www.phytosanitary.info/consultants) and participants in the PMRG were encouraged to register. It is intended to be a database of experts in topics related to plant health.

**Newsletter**

It was proposed that a newsletter was created for the PMRG to update participants on project progress between meetings.

|  |  |  |
| --- | --- | --- |
| **Action(s)** | **Team** | **Timeline** |
| Send information/updates/photos etc. to Cant and Wilson for a PMRG newsletter | All | As items become available |

## Close of the meeting

The Chairperson of the group, Mr Hallman and the IPPC Secretariat representative, Ms Moreira thanked the South African organisers and the participants. The Chairperson of the meeting, Mr Cant, also thanked the host and the great organization of the meeting and closed the meeting.

# APPENDIX 1: Agenda

| **AGENDA ITEM** | **DOCUMENT NO.** | **LEAD** |
| --- | --- | --- |
| **A. Opening of the meeting** |  |  |
| 1. Welcome by the Chair of PTTEG | - | HALLMAN |
| 1. Welcome by local host | - | HATTINGH |
| 1. Introduction of participants | 02\_PTTEG\_2015\_Aug | HALLMAN |
| 1. Election of Chair of meeting | - | HALLMAN |
| 1. Election of Rapporteur | - | CHAIR |
| 1. Adoption of the Agenda | 01\_PTTEG\_2015\_Aug | CHAIR |
| **B. Administrative Matters** |  | CHAIR |
| 1. Documents List | 03\_PTTEG\_2015\_Aug | HALLMAN |
| 1. Local Information | [Link to the recommended accommodations options](https://www.ippc.int/static/media/files/partner_publication/2015/05/07/AccommodationNelspruit.pdf)  04\_PTTEG\_2015\_Aug | GROUT |
| 1. Logistical Arrangements | - | GROUT |
| **C. Report of the Expert Consultation on Cold Treatments (ECCT) Meeting (December 2013)** |  | CHAIR |
| 1. Reasons for meeting 2. Conclusions 3. Creation of PTTEG | ([Link to the ECCT Meeting report](https://www.ippc.int/en/core-activities/standards-setting/expert-consultation-on-cold-treatments/)) | MOREIRA |
| **D. Report of the Expert Consultation on Phytosanitary Treatments for the *Bactrocera dorsalis* (oriental fruit fly) complex (December 2014)** |  | CHAIR |
| 1. Reasons for meeting 2. Conclusions 3. Publication resulting 4. Continuing efforts | ([Link to the ECPT for *B. dorsalis* complex Meeting report](https://www.ippc.int/en/core-activities/standard-settings/expert-consultation-phytosanitary-treatments-bactrocera-dorsalis-complex/)) | DOHINO |
| **E. Phytosanitary Temperature Treatment Expert Group** |  | CHAIR |
| 1. Mission 2. Functions 3. Membership 4. Executive Committee 5. Meetings 6. Re-evaluation of scope, name, and functions of the group | ([Link to the PTTEG Terms of Reference and Rules of Procedures](https://www.ippc.int/en/partners/phytosanitarytemperaturetreatmentsexpertgroup/publications/2014/11/terms-of-reference-and-rules-of-procedure-for-phytosanitary-temperature-treatments-expert-group-ptteg/))  05\_PTTEG\_2015\_Aug | HALLMAN (Chair of the PTTEG) |
| **F. Initial Work Programme of the PTTEG** |  | CHAIR |
| 1. Terminology descriptions | 06\_PTTEG\_2015\_Aug | Myers |
| 1. Existing cold treatment schedules | 07\_PTTEG\_2015\_Aug | Myers |
| 1. Consideration of cultivar/varietal effects on efficacy | 09\_PTTEG\_2015\_Aug | WILLINK |
| 1. “High”-temperature cold treatments |  | Hattingh |
| 1. Cold treatment database |  | Myers |
| 1. Research guidelines | 08\_PTTEG\_2015\_Aug | DOHINO |
| 1. Possibility of “generic” cold treatments |  | HALLMAN |
| **G. New issues** |  | CHAIR |
| 1. New research issues |  |  |
| 1. New regulatory issues |  |  |
| 1. New issues in commercial application |  |  |
| **H. Overview and Conclusions of the 1st Meeting of the PTTEG** |  | CHAIR |
| 1. General and specific conclusions |  | CHAIR / HALLMAN |
| 1. Next steps |  | HALLMAN |
| 1. Next meeting date and location |  | HALLMAN |
| 1. Close of the meeting |  | HALLMAN / CHAIR |

# APPENDIX 2: Participant List

| **NAME** | **COUNTRY/ ORGANIZATION** | **POSITION/ADRESS/TELEPHONE** | **EMAIL** |
| --- | --- | --- | --- |
| ALLECK, Mallini | Mauritius | Scientific Officer, Entomology Division, Ministry of Agro Industry and Food Security  Mauritius | [malleck@govmu.org](mailto:malleck@govmu.org) |
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| HALLMAN, Guy | IAEA, Austria | Phytosanitary treatment researcher  Insect Pest Control Laboratory,  Seibersdorf,  Austria  Phone: +01 2600 28450 | [G.J.Hallman@iaea.org](mailto:G.J.Hallman@iaea.org) |
| HATTINGH, Vaughan | South Africa | Chief Executive of Citrus Research International and coordinator of research programme of SPS relevance to the southern African citrus industry, including the coordination of scientific support to new and revised South African citrus fruit export protocols  South Africa  Phone:+ 27 824167274 | [vh@cri.co.za](mailto:vh@cri.co.za) |
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| MANRAKHAN, Aruna | South Africa | Research Entomologist, Fruit fly Programme Co-ordinator  Citrus Research International, P.O Box 28, Nelspruit 1200, South Africa  Phone: +27 137598000  Mobile: +27 8466 95235  Fax:+27 137440578 | [Aruna@cri.co.za](mailto:Aruna@cri.co.za) |
| MATHIEU-HURTIGER, Vincent | France | Engineer in charge of research program, Ctifl – Centre technique interprofessionnel des fruits et légumes  (Technical institute for fruit and vegetables) F-13210, SAINT-REMY-DE-PROVENCE  France  Phone: +33 4.90.92.05.82  Fax : +33 4.90.92.48.87 | [Mathieu-Hurtiger@ctifl.fr](mailto:Mathieu-Hurtiger@ctifl.fr) |
| MOORE, Sean | South Africa | IPM Portfolio Manager, False Codling Moth Programme Coordinator, Citrus Research International,  P.O. Box 20285, Humewood 6013, Port Elizabeth, South Africa (or Citrus Research International, CSIR Building, Gomery Avenue, Summerstrand, Port Elizabeth, South Africa  Phone: +27 41 5835524 | [SeanMoore@cri.co.za](mailto:SeanMoore@cri.co.za) |
| MOREIRA, Adriana | IPPC Secretariat | Agricultural Officer / Standard Setting Programme Specialist  International Plant Protection Convention Secretariat (IPPC) at Food and Agriculture Organisation of the United Nations (FAO/UN)  Viale delle Terme di Caracalla,  00153 Rome, Italy,  Phone: +39 06 570 55 809 | [adriana.moreira@fao.org](mailto:adriana.moreira@fao.org) |
| MYERS, Scott | USA | Entomologist  USDA APHIS Center for Plant Health Science and Technology Otis Laboratory 1398 W. Truck Rd. Buzzards Bay, MA 02542  USA  Phone: 508 563-0959 | [Scott.W.Myers@aphis.usda.gov](mailto:Scott.W.Myers@aphis.usda.gov) |
| NEVEN, Lisa | USA | Research Entomologist, USDA-ARS, Yakima Agricultural Research Laboratory, 5230 Konnowac Pass Road, Wapato, WA 98951  USA  Phone Office: (509) 454-6556  Cell: (509) 949-6556  Fax: (509) 454-5646 | [Lisa.Neven@ARS.USDA.GOV](mailto:Lisa.Neven@ARS.USDA.GOV) |
| QIU, Yu Tong | Netherlands | Entomologist, Applied Plant Research  Wageningen UR, PO Box 430, 8200 AK, Lelystad, The Netherlands | [yutong.qiu@wur.nl](mailto:yutong.qiu@wur.nl) |
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| WILLINK, Eduardo | Argentina | Estación Experimental Agroindustrial Obispo Colombres (EEAOC)  Sección Zoología Agrícola  Tucumán  Argentina  Phone: (54) 381-521000 | [ewillink@eeaoc.org.ar](mailto:ewillink@eeaoc.org.ar); [ewillink@arnet.com.ar](mailto:ewillink@arnet.com.ar) |
| WILSON, Joanne | New Zealand | New Zealand Ministry for Primary Industries (NZ MPI) PO Box 2526, Wellington 6140,  New Zealand  Phone: +64 4 894-0528 | [joanne.wilson@mpi.govt.nz](mailto:joanne.wilson@mpi.govt.nz) |

APPENDIX 3: Documents List

| **DOCUMENT NUMBER** | **AGENDA ITEM** | **DOCUMENT TITLE** |
| --- | --- | --- |
| 01\_PTTEG\_2015\_Aug | A.6 | Provisional Agenda |
| 02\_PTTEG\_2015\_Aug | A.3 | Participants List |
| 03\_PTTEG\_2015\_Aug | B.1 | Documents List |
| 04\_PTTEG\_2015\_Aug | B.2 | Local Information |
| 05\_PTTEG\_2015\_Aug | E.6 | Re-evaluation of scope, name, and functions of the group |
| 06\_PTTEG\_2015\_Aug | F.1 | PTTEG Terminology descriptions |
| 07\_PTTEG\_2015\_Aug | F.2 | Existing cold treatment schedules |
| 08\_PTTEG\_2015\_Aug | F.6 | Research guidelines: Guidelines for the development of  cold disinfestation treatments of fruit fly host commodities |
| 09\_PTTEG\_2015\_Aug | F.3 | Consideration of Cultivar/Variety Effects on Efficacy of Cold Treatments |

| **LINKS to public pages:** | **Agenda item** |
| --- | --- |
| [Recommended accommodation options in Nelspruit](https://www.ippc.int/static/media/files/partner_publication/2015/05/07/AccommodationNelspruit.pdf) | B.2 |
| [ECCT 2013 Meeting Report](https://www.ippc.int/publications/2013-december-ecct-meeting-report) | C |
| [ECPT for *B. dorsalis* complex Meeting report](https://www.ippc.int/en/publications/2702/) | D |
| [PTTEG Terms of Reference](https://www.ippc.int/en/partners/phytosanitarytemperaturetreatmentsexpertgroup/publications/2014/11/terms-of-reference-and-rules-of-procedure-for-phytosanitary-temperature-treatments-expert-group-ptteg/) | E |
| [ISPM 28. *Phytosanitary treatments for regulated pests*](https://www.ippc.int/en/publications/591/) | - |
| [IPPC Adopted Phytosanitary Treatments (IPPC Adopted ISPMs page)](https://www.ippc.int/en/core-activities/standards-setting/ispms/) | - |

# APPENDIX 4: Phytosanitary Measures Research Group

*Terms of reference and rules of procedures*

**Mission**

Harmonize research on phytosanitary treatments and other measures with application to international trade of horticultural commodities to support IPPC Technical Panels, plant protection organizations, and researchers.

**Functions**

The main functions of the group are to:

1. liaise with the TPPT to support the development of international phytosanitary treatments to be considered and approved by the Standards Committee.
2. serve as a forum for discussion, information exchange, and clarification of key scientific issues related to phytosanitary treatment application in global trade.
3. provide scientific analysis and review of global phytosanitary treatment issues and new information.
4. identify and undertake collaborative scientific research aimed at high priority phytosanitary treatments.
5. liaise with the International Forestry Quarantine Research Group (IFQRG) to avoid duplication.

**Membership**

The group draws its membership from the scientific and research community, and the phytosanitary regulatory community. Membership will be reviewed and approved by a membership committee appointed by the Executive Committee.

**Meeting participation**

The Executive Committee of the PMRG may limit participation at the PMRG meetings.

**Executive committee**

The Executive Committee will be composed of a Chair, two Coordinators (one Research and one Operations) and a Secretary. At least one of the Executive Committee members must also be a TPPT member. The Executive Committee members are elected during a face-to-face meeting and serve for the next two face-to-face meetings.

**Decision making**

Decisions will be made by consensus during face-to-face meetings. In urgent situations, intercessional decisions will be taken by the Executive Committee.

**Roles of executive members**

Chair: provides overall guidance to coordinate the work of two Sections (Research and Operations).

Sections Coordinators: oversee the work of the two Sections and coordinate with the PMRG chair. Sections members will be experts in their field and carry out the tasks assigned to their Sections.

Secretary: ensure records of the meetings and other decisions are prepared, adopted, and made publicly available.

**Meetings**

The PMRG meetings will be held approximately every two years.

**Provision of resources**

Funding for participation in the meeting is provided by the host of the meeting. Participants in PMRG meeting activities voluntarily fund their travel and subsistence to attend.

# APPENDIX 5: PMRG 2015-2017 Work plan (In Session)

**G. New issues – New Projects sessions**

| **Area** | **Team** | **Status** | **Outcome** | **Notes** |
| --- | --- | --- | --- | --- |
| **Previous research issues** |  |  |  |  |
| Terminology:  · Clearly describe replication, repetition, block, end point to determine treatment efficacy, Precooling  · validation, confirmatory trial, large scale trials | Myers (lead), Willink | Concluded | Paper presented to PTTEG (PMRG) | (from ECCT) |
| Large number of treatments schedules:  Collect all existing cold treatment schedules approved by a country and make publicly available. | Jessup (lead), Willink, Myers, Hallman | On going | Large list assembled and analysed by PTTEG (PMRG) | More data to be collected |
| Consideration of cultivars and\or variety effects on efficacy:  Collect data on cultivars and\or variety and analyze commonalities (statistical re-interpretation). | Gastaminza (lead), Willink, Myers, Jessup | On going | list assembled and analysed by PTTEG (PMRG) | PMRG to consider further and prepare publication. |
| Consideration of higher temperatures:  Collect established treatments that are using higher temperatures, identify knowledge gaps and establish upper thresholds for the effective treatments. | Stein (lead), Hattingh, Hallman | Completed | Paper presented to PTTEG (PMRG) | Make it available to PMRG members |
| Compile all collected information (CT) in a database to be shared. | Myers (lead) with input from other leads | Ongoing | Presented to PTTEG (PMRG) | (see action point for treatment database development) |
| To develop a research guideline for CT (probably based on Japanese protocol). Issue of plus minus to be addressed.  Make recommendation on how to convert trial data into a treatment schedule. | Dohino (lead), Quenta, Mathieu-Hurtiger, Cant, Hattingh | Ongoing | Draft presented to PTTEG (PMRG) | PMRG to revise the document (intersession). Tentative final agreement at next PMRG meeting |
| Explore the possibility of developing generic cold treatments for pests species and\or hosts species. | Hallman (lead), Jeon, Park, Willink, Myers, Jessup | On going | Draft presented to PTTEG (PMRG) | Review literature; develop a publication for review by PMRG. \*Pending collection of CT information |
| **New Research Issues** |  |  |  |  |
| Development of Controlled Atmosphere Temperature Treatment System (CATTS) treatments research guideline  *Notes: to include commodity type and treatment type (w/ or w/o CATTS)* | Neven (lead), Verschoor, Qiu, Mathieu-Hurtiger | Next PMRG meeting | Document (“guidelines”) |  |
| Modelling for more rapid development of quarantine treatments (physiological determination - host and insect) | Neven (lead), Qiu, Mike Ormsby (to confirm) | Next PMRG meeting | Discussion paper to next PMRG meeting |  |
| Treatments approach to researchers: Heat treatments | Hallman, Dohino | Next PMRG meeting | Draft document to be presented to next PMRG meeting |  |
| Treatments approach to researchers: fumigation | Walse, Grout, Myers, Naito/Dohino | Next PMRG meeting | Draft document to be presented to next PMRG meeting |  |
| Treatments approach to researchers: controlled atmosphere | Neven, Mathieu-Hurtiger, Verschoor | Next PMRG meeting | Draft document to be presented to next PMRG meeting |  |
| Revision of phytosanitary systems used and accepted by regulators published | Moore (lead), Manrakhan, Neven, Walse, Willink, Cant | Next PMRG meeting | Draft document to be presented to next PMRG meeting |  |
| Larvae vs pupae vs adult endpoint determinations | Neven, Hallman, Gazit, Manrakhan | *\*Notes: pending literature review* |  |  |
| Mixed loads - Different species and different varieties in same shipment: how to treat? (air movement and cooling distribution effects) | Cant (lead), Quenta, Myers, Walse | Next PMRG meeting | Draft document to be presented to next PMRG meeting |  |
| Other treatments, e.g. low/high pressure, microwave | Neven (lead), Qiu | Next PMRG meeting | Draft document to be presented to next PMRG meeting |  |
| **New regulatory issues** |  |  |  |  |
| Heat treatments and non-target organisms (mealybugs, mites / tropical fruits) – indicators for the treatment effectiveness | Wilson (lead), Guy | Next PMRG meeting | Draft document to be presented to next PMRG meeting |  |
| **New issues in commercial application** | | |  |  |
| (None identified) |  |  |  |  |

1. Phytosanitary Temperature Treatments Expert Group (PTTEG) webpage: <https://www.ippc.int/en/liason/organizations/phytosanitarytemperaturetreatmentsexpertgroup/> [↑](#footnote-ref-1)
2. Expert Consultation on Cold Treatments (ECCT) meeting main page: <https://www.ippc.int/en/core-activities/standards-setting/expert-consultation-on-cold-treatments/> [↑](#footnote-ref-2)
3. More information about the IPPC can be found at: <https://www.ippc.int/en/> [↑](#footnote-ref-3)
4. A factsheet that describes the IPPC role is available at: [https://www.ippc.int/static/media/files/publications/en/2013/06/03/1368088877\_ippc-factsheet-2011-09-en\_201305101045en.pdf](https://www.ippc.int/static/media/files/publications/en/2013/06/03/1368088877_ippc-factsheet-2011-09-en_201305101045en.pdf3) [↑](#footnote-ref-4)
5. ECCT Concept Note: <https://www.ippc.int/en/publications/2358/> [↑](#footnote-ref-5)
6. 2013 December ECCT meeting report: <https://www.ippc.int/en/publications/2427/> [↑](#footnote-ref-6)
7. Technical Panel on Phytosanitary Treatments (TPPT): <https://www.ippc.int/en/core-activities/standards-setting/expert-drafting-groups/technical-panels/technical-panel-phytosanitary-treatments/> [↑](#footnote-ref-7)
8. International Forestry Quarantine Research Group: <https://www.ippc.int/en/liason/organizations/internationalforestryquarantineresearchgroup/> [↑](#footnote-ref-8)
9. List of topics for IPPC standards: <https://www.ippc.int/en/core-activities/standards-setting/list-topics-ippc-standards/> [↑](#footnote-ref-9)
10. IPPC adopted Standards (ISPMs): <https://www.ippc.int/en/core-activities/standards-setting/ispms/> [↑](#footnote-ref-10)
11. Expert Consultation on phytosanitary treatments for the *Bactrocera dorsalis* complex (ECBD) meeting: <https://www.ippc.int/en/core-activities/standard-settings/expert-consultation-phytosanitary-treatments-bactrocera-dorsalis-complex/> [↑](#footnote-ref-11)
12. ECBD Concept Note: <https://www.ippc.int/en/publications/2509/> [↑](#footnote-ref-12)
13. 2014 December ECBD Report: <https://www.ippc.int/en/publications/2702/> [↑](#footnote-ref-13)
14. Synonymization of key pest species within the *Bactrocera dorsalis* species complex (Diptera: Tephritidae): taxonomic changes based on a review of 20 years of integrative morphological, molecular, cytogenetic, behavioural and chemoecological data: <http://onlinelibrary.wiley.com/doi/10.1111/syen.12113/abstract> [↑](#footnote-ref-14)
15. <http://www.phytosanitary.info/> [↑](#footnote-ref-15)