REPORT

Rome, Italy
31 March - 4 April 2014

Ninth Session of the Commission on Phytosanitary Measures

31 March- 4 April, 2014

Food and Agriculture Organisation of the United Nations

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APPENDIXES

1. Opening of the Session

[1] The Chairperson of the Commission on Phytosanitary Measures (CPM), Mr Stephen Ashby, opened the meeting.

[2] The Food and Agriculture Organization (FAO) Assistant-Director-General Mr Ren Wang welcomed CPM members to FAO. Referring to the new Strategic Objectives of the FAO and the expected contributions from the IPPC within the framework, he wished members a successful and productive week. Mr Wang emphasised the accomplishments of the national plant protection organizations (NPPOs) and the IPPC even when faced with decreasing resources and affirmed that increased collaboration will lead to greater efficiency and effectiveness.

[3] The Minister of Primary Industries of New Zealand, Mr Nathan Guy, made his remarks via video message. The Minister recognised the importance of the Commission's work at all levels including in helping developing countries trade and protect their environment through the IPPC standards. He thanked the current and future Chairpersons for their work and wished members a successful meeting.

[4] The Secretary of the IPPC thanked those present for their continuous support to the IPPC Secretariat. The Secretary noted that there are still many challenges facing the IPPC and plant protection in general as trade and international movements continue to grow, pests continue to negatively affect plants, and countries still face challenges to prioritize plant protection when working with tight budget constraints.

2. Adoption of the Agenda

2.1 Provisional agenda

[5] The Chairperson detailed changes to the agenda and the order in which items would be addressed.

[6] The CPM:

(1) *adopted* the Agenda (Appendix 1) and *noted* the Documents list (Appendix 2) and Participants list (Appendix 3).

3. EU Statement of Competence

[7] The CPM:

(1) *noted* the Statement of Competencies and Voting Rights[1] submitted by the European Union (EU) and its 28 member states.

4. Election of the Rapporteur

[8] The CPM:

(1) *elected* Mr Rajesh Ramarathnam from Canada as Rapporteur.

5. Establishment of the Credentials Committee

[9] The IPPC Secretariat explained that a Credentials Committee was needed to conform to FAO rules. It would be composed of seven members, one per FAO region, as well as one CPM Bureau member. The Committee would be assisted by the FAO Legal Office in determining the validity of members' credentials.

[10] The Credentials Committee accepted a total of 125 credentials. The CPM was informed that the Credentials Committee will no longer be maintaining two lists. Given the number to establish a quorum for the Commission was set at 91, the quorum was achieved.

[1] CPM 2014/CRP/01

[11] The CPM:

(1) *elected* a Credentials Committee to conform to FAO rules (Appendix 4); and,

(2) *elected* Ms Vicioso (Dominican Republic) as the Chairperson of the Credentials Committee.

6. Report by the Chairperson of the Commission on Phytosanitary Measures

[12] The CPM Chairperson referred to his report[2] and presented additional comments. He emphasized the importance of raising awareness about the IPPC, the vital importance of plant health and thanked the Bureau members and Secretariat for their collaborative efforts.

[13] The CPM:

(1) *noted* the report from the CPM Chairperson.

7. Report by the IPPC Secretariat

[14] The Secretariat introduced the report[3] noting that this year, to enhance communication of IPPC Secretariat activities, a new, modern and improved format was used.

[15] The Secretariat highlighted main goals for the coming year and the major achievements from the past year. Some members welcomed the new format and the CPM thanked the Secretariat for its work.

[16] The CPM:

(1) *noted* the IPPC Secretariat report.

8. Governance: Commission on Phytosanitary Measures

8.1 Partnerships

[17] The Secretariat presented a paper[4] to provide clarity regarding the relationships which the Secretariat maintains with other bodies. The paper focuses on the different types of relationships (partnerships, liaisons, and collaborations) in which the Secretariat is engaged and also provides a proposed procedure for determining whether or not to go forward with a full partnership.

[18] The paper proposes a procedure for considering the examination and approval of different levels of agreement with other organizations. This procedure will enhance the development of a pro-active approach to partnerships and therefore effectively contribute to the IPPC's strategic objectives.

[19] The CPM:

(1) *approved* the Secretariat's proposed flexible system of use of models for partnerships, based on the FAO Strategy for Partnerships;

(2) *noted* the description of the relationships with other organizations outlined in Tables 1 and 2 of CPM 2014/21 Rev.1; and,

(3) *asked* the Secretariat, with input from the Bureau, to examine new proposals for partnerships from the Secretariat or other organizations on a case by case basis, using the criteria and processes provided in CPM2014/21 Rev.1, paying special attention to the resources available to the Secretariat for engaging in any proposed partnership.

[2] CPM 2014/08

[3] CPM 2014/26

[4] CPM 2014/21 Rev.1.

8.2 Process for adopting recommendations

[20] The Secretariat presented the paper[5]. There was a proposal that should a recommendation need revision, it should be sent to the appropriate body for review and revision and returned to the CPM for adoption.

[21] Following further discussions, a process for developing and adopting CPM recommendations was agreed as listed below:

Proposed process for developing and adopting CPM recommendations:

- A contracting party (CP) or the Secretariat may propose a topic for a CPM recommendation and present it for consideration at a CPM meeting. An initial draft of the proposed recommendation and the rationale or justification for its need should be presented to CPM for consideration.
- The need for a new CPM recommendation should then be discussed and agreed by CPM.
- A draft or, if necessary, a revised draft CPM recommendation should then be prepared by the Secretariat (or where appropriate the CP making the proposal) and along with the rationale or justification for its need, circulated for country comments for a period of three months.
- The Secretariat will revise the draft CPM recommendation based on comments received, and then submit the revised draft to the CPM Bureau for consideration, revision if necessary, and recommendation to the CPM for adoption.
- The draft CPM recommendation is submitted to the CPM for adoption.
- If the draft CPM recommendation is not adopted and needs further review, the CPM may decide to send it to an appropriate IPPC body or group for further revision. The revised CPM recommendation is then sent to the next CPM for consideration and adoption.
- Adopted CPM recommendations are numbered and formatted by the Secretariat.

[22] The CPM:

(1) *adopted* the proposed process for developing and adopting CPM recommendations; and,

(2) *requested* the Strategic Planning Group (SPG) to discuss criteria for CPM recommendations, including the criteria suggested in the interventions during CPM-9 (2014), and report its recommendations back to CPM.

9. International standard setting

9.1 Report on the activities of the Standards Committee

[23] The Standards Committee (SC) Chairperson reflected on a successful and productive year of the SC thanking everyone involved in the standard setting process, including CPs, SC members, who are called upon throughout the year, and technical experts. Engaging experts in the standard setting process continues to be a challenge and she urged CPs and RPPOs to support the important work carried out by the SC by nominating experts and ensuring they have sufficient time to fully participate in the SC activities.

[24] The SC Chairperson presented the SC report[6] and highlighted the positive progress made to increase confidence in the underpinning science of phytosanitary treatments through two expert consultations, one held in December 2013 on cold treatments and one planned for December 2014 on treatments for the *Bactrocera dorsalis* complex, and expressed her gratitude to the hosts of these consultations, Argentina and Japan respectively. Despite this progress, she expressed disappointment that formal objections had been received on the cold treatments presented for adoption at CPM-9 (2014) recalling that the treatments present options for CPs, not obligations and urging those CPs who had presented

[5] CPM 2014/07

[6] CPM 2014/18

formal objections to participate in the expert consultations. The SC will address the issues raised and may consider recommending them for a vote in the future.

[25] Guidance on the use of *should*, *shall*, *must* and *may* has been included in the IPPC Style Guide and will be used by Expert Working Groups (EWG) and Technical Panels when drafting ISPMs.

[26] Regarding the use of the term "IPPC members" who can comment during member consultation, legal advice had confirmed that this term had been used incorrectly. The SC had acknowledged this and a proposal for change would be made in 2016. In the meantime, reference was made to the current footnote 7 of the 2013 Procedural Manual for Standard Setting[7], which appropriately reflects the SC's intent.

[27] Following the SC Chairperson's comments, there was widespread support from CPs for the initiatives planned on the expert consultation.

[28] The CPM:

(1) *noted* the update on the 2013 activities of the SC and thanked the SC Chairperson and all the members of the SC.

9.2 Adoption of International Standards for Phytosanitary Measures

[29] The Secretariat introduced the paper[8] on the draft ISPMs proposed for adoption.

[30] The Secretariat informed the CPM that formal objections 14 days prior to the CPM-9 (2014) session had been received for the following ISPMs:

- *Determination of host status of fruit to fruit fly (Tephritidae)* (2006-031)
- Cold treatment for *Ceratitis capitata* on *Citrus sinensis* (2007-206A) as contained in CPM 2014/03_04.
- Cold treatment for *Ceratitis capitata* on *Citrus reticulata x Citrus sinensis* (2007-206B) as contained in CPM 2014/03_05.
- Cold treatment for *Ceratitis capitata* on *Citrus limon* (2007-206C) as contained in CPM 2014/03_06.
- Cold treatment for *Bactrocera tryoni* on *Citrus sinensis* (2007-206E) as contained in CPM 2014/03_07.
- Cold treatment for *Bactrocera tryoni* on *Citrus reticulata x Citrus sinensis* (2007-206F) as contained in CPM 2014/03_08.
- Cold treatment for *Bactrocera tryoni* on *Citrus limon* (2007-206G) as contained in CPM 2014/03_09.
- Cold treatment for *Ceratitis capitata* on *Citrus paradisi* (2007-210) as contained in CPM 2014/03_10.

[31] These draft ISPMs will be returned to the SC for their consideration. Details on the formal objections were presented separately[9].

[32] The draft diagnostic protocol on *Phyllosticta citricarpa* (McAlpine) Aa on fruit (2004-023) had received a formal objection during the notification period (15 December 2013 - 30 January 2014). Details on this formal objection can be found on the IPP [10].

[7] https://www.ippc.int/sites/default/files/documents/20140113/ippcproceduremanual_stset_2014-01-10_2014011312%3A12--3.75%20MB.pdf

[8] CPM 2014/03 and attachments CPM 2014/03_01; CPM 2014/03_02; CPM 2014/03_03

[9] CPM 2014/INF/05

[x] Footnote # 47 of 2013 Procedural Manual – Standard Setting

[33] The Secretariat informed CPM that due to the high volume of diagnostic protocols that are foreseen to be finalized for member consultation in the coming few years, two member consultation periods for diagnostic protocols will be held in 2015, with the additional period starting on 1 February 2015 and the regular member consultation starting 1 July 2015.

[34] The CPM:

(1) *adopted* Appendix 1 to ISPM 12:2011 (*Phytosanitary Certificates*) on *Electronic phytosanitary certificates, information on standard XML schemes and exchange mechanisms* (2006-003) contained in Appendix 7 to this report;

(2) *adopted* Annex 2 to ISPM 26:2006 (*Establishment of pest free areas for fruit flies (Tephritidae)*) on *Control measures for an outbreak within a fruit fly-pest free area* (2009-007) contained in Appendix 7 to this report;

(3) *adopted* the Vapour heat treatment for *Bactrocera cucurbitae* on *Cucumis melo* var. *reticulatus* (2006-110) to be included as an annex in ISPM 28:2007 *(Phytosanitary Treatments)* contained in Appendix 7 to this report; and,

(4) *noted* that the SC adopted on behalf of CPM the diagnostic protocol for *Tilletia indica* Mitra (2004-014) as an annex to ISPM 27:2006 (*Diagnostic protocols for regulated pests*) contained in Appendix 7 to this report.

9.3 Noting translation adjustments to International Standards for Phytosanitary Measures adopted at CPM-8 (2013)

[35] The Secretariat introduced the paper[11] noting that the Language Review Groups (LRGs) for Chinese, French, Russian and Spanish had reviewed the ISPMs adopted at CPM-8 (2013) in collaboration with FAO translation services.

[36] It was noted that new coordinators for the LRG for Russian and for French were needed for the LRGs to function for the CPM-9 (2014) adopted ISPMs. The Coordinator for the LRG for Spanish expressed concerns about the timeframe for receiving the reviewed versions of the standards. The Chairperson raised concerns that what had been expected to be a cost neutral process was becoming expensive.

[37] The LRG coordinators were thanked for their dedicated work.

[38] The CPM:

(1) *noted* that ISPM 11:2013 (*Pest risk analysis for quarantine pests*) and ISPM 15:2009 (*Regulation of wood packaging material in international trade*) have been reviewed by the Chinese, French, Russian and Spanish LRGs and FAO translation services;

(2) *noted* that other ISPMs adopted in Russian at CPM-8 (2013) have not been reviewed by the Russian LRG;

(3) *noted* that Coordinators for the Russian and French LRGs are needed;

(4) *urged* its members who participate in LRGs to ensure that the deadlines for the CPM adopted LRG process are followed and due dates respected; and,

(5) *requested* the Secretariat to accept all changes as indicated in track changes in the Attachments 1 to 8 of CPM 2014/19 Rev. 1 and replace the Chinese, French, Spanish and Russian ISPM 11:2013 and ISPM 15:2009 adopted at CPM-8 (2013) with these modified versions.

[10] https://www.ippc.int/publications/2004-023-phyllosticta-citricarpa-formal-objection

[11] CPM 2014/19 Rev. 1

9.4 Topics for IPPC standards

9.4.1 Adjustments to the List of topics for IPPC standards

[39] The Secretariat presented the paper[12] on adjustments to the *List of topics for IPPC standards* since CPM-8 (2013).

[40] In the 2013 call for topics, *General principles for operation of laboratories* had been submitted as a topic but not agreed to by the SC. Several members felt that strategic issues associated with pest diagnosis should be discussed by the SPG.

[41] Several members objected to the deletion of the topic *Safe handling and disposal of waste with potential pest risk generated during international voyages* (2008-004), noting the high importance of this topic especially for the Caribbean region and the Pacific Islands. After discussion, the topic was retained in the *List of Topics* and the Chairperson encouraged the concerned CPs to make nominations in response to a second call for experts.

[42] Several members suggested topics be adopted only after the *Framework for standards* and gap analysis had been completed and adopted by the CPM. Other members, while agreeing that the framework should be used as appropriate for identifying and prioritizing topics in the future, stressed the need to be able to continue adding topics to the list.

[43] The CPM:

(1) *adopted* the addition of the following topics, with the indicated priorities and IPPC Strategic Objectives:

· *Guidance on pest risk management*, with priority 1 and IPPC Strategic Objectives A and C

· *Authorization of non-NPPO entities to perform phytosanitary actions*, with priority 3 and IPPC Strategic Objective C

· *Requirements for the use of chemical treatments as a phytosanitary measure*, with priority 3 and IPPC Strategic Objectives A, B and C

· *Requirements for the use of fumigation as a phytosanitary measure*, with priority 1 and IPPC Strategic Objectives A, B and C

· *Requirements for the use of temperature treatments as a phytosanitary measure*, with priority 1 and IPPC Strategic Objectives A, B and C

· *Requirements for the use of modified atmosphere treatments as a phytosanitary measure*, with priority 2 and IPPC Strategic Objectives A, B and C

· *Requirements for the use of irradiation as a phytosanitary measure* (Revision to ISPM 18), with priority 2 and IPPC Strategic Objectives A, B and C

(2) *noted* that the following submissions will be returned to the SC for further consideration:

· *Criteria for determination of the host status for pests based on available information*

· *Harmonization of descriptive elements in phytosanitary certificates*

(3) *adopted* the deletion of the following topics:

· *Surveillance for citrus canker* (Xanthomonas axonopodis pv. citri) (2002-001)

· *Systems approach for management of citrus canker* (Xanthomonas axonopodis pv. citri) (2003-001)

The following specific topics under the Technical Panel for Phytosanitary Treatments:

· *Irradiation treatments* (2006-014)

· *Wood packaging material treatments* (2006-015)

[12] CPM 2014/04; CPM 2014/INF/11

- *Fruit fly treatments* (2006-024)
- *Soil and growing media in association with plants: treatments* (2009-006)

(4) *adopted* the new priority 1 of the following topics:
- *Revision of ISPM 6:1997 Guidelines for surveillance* (2009-004)
- *Revision of ISPM 8:1998 Determination of pest status in an area* (2009-005)

(5) *requested* the SPG to have a discussion on strategic issues associated with pest diagnosis;

(6) *agreed* to adopt the Framework for standards once finalized;

(7) *agreed* that once the Framework for standards has been adopted, priorities for the whole *List of topics* would be reviewed and appropriate adjustments considered; and,

(8) *requested* the Secretariat to update the CPM adopted *List of topics for IPPC standards* accordingly, and post the updated version on the IPP.

9.4.2 Update on the topic: International movement of grain (2008-007)

[44] The Secretariat introduced the paper[13] updating the CPM on the progress on this topic and asking guidance from the CPM on how to consider the concept of *traceability* in the phytosanitary context. Suggestion had been made to (i) organize an open-ended working group on the issue, (ii) invite the SPG to consider it, or (iii) have discussions during the CPM session.

[45] Members introduced their positions, including some in writing[14].

[46] Some members did not deem it appropriate for the SC to work on *diversion from intended use*, but others underlined the importance of this issue for their countries.

[47] It was agreed that the concept and mechanism of traceability in the phytosanitary context and *diversion of intended use* needed further discussion. It was stressed that these issues should be dealt with as cross-cutting issues, not only related to grain.

[48] Australia offered to host the EWG on grain and to provide funding to develop guidance material after the experts had identified implementation issues and the draft had been developed.

[49] The CPM:

(1) *agreed* the concept and mechanism of *traceability* in the phytosanitary context and *diversion from intended use* should be considered further by the SPG; and,

(2) *reiterated* the decision made at CPM-8[15] that the need for supplementary material would be reconsidered after the draft standard had been developed.

9.4.3 Update on the topic: Minimizing pest movement by sea containers (2008-001)

[50] The Secretariat introduced the papers[16] explaining the progress made so far on the topic of *Minimizing pest movement by sea containers* (2008-001), including an update on the requested survey on pest interception on sea containers.

[51] Several members suggested that the proposed survey on interception of pests should only be reconsidered after the SC had discussed the member comments on the preliminary draft ISPM.

[52] The Secretariat informed the CPM that dialogue with the World Customs Organization (WCO) had progressed. The WCO had considered positively the IPPC request to add data fields on sea container cleanliness in the WCO data model and indicated that this would be possible once business requirements on sea container cleanliness are clear and stable.

[13] CPM 2014/06

[14] CPM 2014/INF/10Rev.1; CPM 2014/CRP/04

[15] Report of the CPM-8 (2013), section 8.1.4.B, available at: https://www.ippc.int/cpm

[16] CPM 2014/11, CPM 2014/23; CPM 2014/INF/10 Rev.1

[53] Several members stressed that the topic of *Minimizing pest movement by sea containers* (2008-001) was important and should be retained on the *List of topics for IPPC standards*.

[54] The CPM:

(1) *noted* that the SC will discuss the comments from member consultation and how to proceed with the development of the ISPM on *Minimizing pest movement by sea containers* (2008-001), including the possible need for further survey work;

(2) *recognized and appreciated* the joint initiative by the International Maritime Organization (IMO), the International Labour Organization (ILO) and United Nations Economic Commission for Europe (UNECE) of revising the *Code of Practice for Packing of Cargo Transport Units (CTU Code)*. With the support from the IPPC EWG on Sea Containers, those organizations have incorporated into the revised Code several elements of phytosanitary relevance, e.g. information on pests and other contamination which may be associated with cargo transport units, as well as very useful practical guidelines for cleanliness, cleaning, packing and handling;

(3) *welcomed* the recent adoption of the CTU Code by UNECE and looked forward to the adoption also by IMO and ILO of the revised CTU Code later this year;

(4) *emphasized* that the careful implementation of the revised CTU Code by all operators responsible for and involved in the packing and handling of sea containers is crucial for preventing the spread of pests and invasive alien species;

(5) *encouraged* contracting parties and the Secretariat to liaise with national and international counterparts respectively to express their appreciation for the work done by IMO/ILO/UNECE and seek further collaboration;

(6) *requested* the Secretariat in association with the EU, USA, Japan, Argentina and Gabon to prepare a draft recommendation for possible adoption at CPM-10 (2015).

(7) *requested* the IPPC Secretary to send the statements above to the heads of IMO, ILO and UNECE;

(8) *requested* the Secretariat to highlight those same statements on the IPP; and,

(9) *requested* the Secretariat to provide a link on the IPP to the *Code of Practice for Packing of Cargo Transport Units* as adopted by UNECE.

9.5 Update on the development of a *Framework for standards*

[55] The Secretariat updated the CPM on the progress made for the *Framework for standards*[17] based on the Task force meeting convened in Ottawa, Canada, in September 2013. The SPG and the SC have both agreed that the *Framework for standards* could be used for a wide range of IPPC activities.

[56] It was highlighted that extra-budgetary funds were needed to finalize the work on the *Framework*. In this context, the CPM Chairperson thanked Costa Rica for offering to host a *Framework for Standards* meeting in August 2014.

[57] The *Framework for Standards* was also discussed in relation to adjustments to the *List of topics for IPPC standards* (Section 9.4.1).

[58] The Secretariat reported that work is ongoing and that the SC will review further in 2014 the proposed *Framework for standards* and perform a gap analysis, before presenting final recommendations to the CPM.

[59] The CPM:

(1) *noted* the update on the outcome of the *Framework for standards* Task force meeting and on the analysis undertaken by the SC;

(2) *noted* the possible uses of the *Framework for standards*; and,

[17] CPM 2014/05 Rev. 1

(3) *urged* the SC to finalize the *Framework for standards* gap analysis and to present this to the CPM.

10. IPPC Strategic Framework and Resource Mobilisation

10.1 Report on the activities of the Strategic Planning Group

[60] The vice-Chairperson of CPM presented a report on the SPG. He presented the main strategic issues that were discussed by the SPG and invited members to read the full report[18] on the meeting that took place (Rome 8-11 October 2013).

[61] The CPM Chairperson stressed the importance of the SPG for strategic discussions and encouraged all members to become involved in the work of the group.

10.2 Implementing the IPPC Strategic Framework and Resource Mobilization

10.2.1 Implementation Process

[62] New Zealand presented the document[19] revised based on the discussions of the CPM-8 and the SPG meeting in November 2013. The presentation called for greater emphasis on implementation of standards by CPs. It recognized that CPs face continuing implementation challenges in achieving IPPC objectives.

[63] During discussions CPs raised many issues and the report's author was invited to revise the proposed terms of reference (ToR) for an Open Ended Working Group (OEWG) on Implementation.

[64] The ToR[20] were presented to the CPM.

[65] The CPM:

(1) *noted* that as requested at CPM-8 (2013) discussions have been held in Bureau and SPG meetings to consider broadening work on implementation of the IPPC and ISPMs and establishing a CPM-directed implementation programme;

(2) *discussed* the key conclusions of the Bureau and SPG discussions as described in CPM 2014/20 Rev 1;

(3) *agreed* to strengthen the focus of the CPM on implementation, recognizing that this will require strong commitment from each CPM member and the Secretariat, and additional financial resources;

(4) *requested* the Secretariat to work with an OEWG and the Bureau to establish the required mechanisms to focus on implementation, and ensure the work of the Secretariat staff and CPM bodies are able to be coordinated and work together to deliver a coherent programme of work;

(5) *requested* the Secretariat to identify extra-budgetary resources so the Secretariat can consider funding assistance for participants from developing countries;

(6) *requested* the Secretariat to discuss the outcomes of the OEWG with SPG, subsidiary bodies and the CDC as necessary, and report back to CPM-10 (2015);

(7) *requested* the Secretariat to work with an OEWG to develop and define the scope of a pilot work plan to implement ISPM 6:1997*(Guidelines for surveillance)* (2009-004) and to submit a strategic work plan to CPM-10 (2015) for approval; and,

(8) *agreed* the results and impact of the pilot programme should be reviewed at an appropriate time to determine if an implementation programme should be continued or formalized in the future.

[18] https://www.ippc.int/publications/link-strategic-planning-group-meeting-report-june-2013

[19] CPM 2014/20 Rev.1

[20] CPM 2014/CRP/09 – revision of CPM/2014/20

10.2.2 Resource Mobilisation Efforts and results

[66] The Secretariat introduced the paper[21] and reported on some of the highlights of the Secretariat's resource mobilization efforts over the past year. For a comprehensive picture, the Secretariat has established a web page dedicated to tracking resource contributions[22].

[67] The CPM:

(1) *noted* the on-going efforts and results within resource mobilization;

(2) *thanked* donors and contributors for their generous support for the IPPC; and,

(3) *encouraged* CPs and other donors to provide additional resource contributions for 2014 and subsequent years.

10.2.3 IPPC Secretariat Enhancement Evaluation

[68] Canada introduced the paper[23] submitted jointly with the United States and supported by Australia and New Zealand. It was stressed that for the successful implementation of the standards and the Convention, leading to improved plant protection, all parts of the system must function well. The Secretariat is at the core of this process. The IPPC's *Strategic Framework* includes a functional objective to "strengthen the capacity of the IPPC Secretariat towards greater effectiveness and efficiency". This can be achieved through continuous review and evaluation of its procedures, which will best position the Secretariat to be successful in a dynamic and challenging environment. An external evaluation was proposed to review the Secretariat and its activities.

[69] Members showed wide support for the proposal but also raised concerns regarding evaluation, timing, funding and more specific ToRs for the proposal.

[70] A working group was formed and returned to plenary with a revised ToR[24]. Guidance and advice was also received from staff of the FAO Office of Evaluation regarding the feasibility of the proposal.

[71] The CPM:

(4) *considered* the proposal for an IPPC Secretariat enhancement evaluation and contractual engagement of dedicated external consultants;

(5) *agreed* that such an evaluation shall be undertaken in 2014;

(6) *confirmed* the scope of this evaluation;

(7) *identified* potential sources of funding including from Australia and the USA; and,

(8) *agreed* with the revised ToRs (Appendix 5) and time frames for completion of the evaluation and presentation of the recommendations to CPM-10 (2015).

10.3 Financial Report 2013 - Budget and Operational Plans 2014/2015

10.3.1 IPPC 2013 Financial report

[72] The Secretariat presented the IPPC 2013 financial report[25]. In 2013, the FAO Regular programme allotment to the IPPC amounted to USD 3 million, which was a slight increase in resources of 1.6% from 2012.

[73] It was highlighted that the IPPC Multi-donor trust fund has proved to be the most useful and flexible additional resource for administering the IPPC work programme and that it has been used for standard

[21] CPM 2014/09; CPM 2014/INF14

[22] Resource contribution web page: https://www.ippc.int/resource-mobilisation

[23] CPM 2014/INF/09 Rev.01

[24] CPM 2014/CRP/08

[25] CPM 2014/25 Rev.1

setting, capacity development and communication activities. Nevertheless, contributions have declined over the past few years, which may have a significant impact on the IPPC work programme unless the trend is reversed.

[74] The CPM :

(1) *adopted* the IPPC 2013 Financial report;

(2) *encouraged* CPs to contribute to the IPPC Multi-donor trust fund to ensure that the CPM approved work programme may be carried out fully; and,

(3) *congratulated* the staff of the Secretariat for its detailed and excellent budget report.

10.3.2 IPPC 2014-2015 Biennium Operational Budget

[75] The Secretariat introduced the operational budget for 2014-15[26]. The FAO Conference in June 2013 approved the 2014-2015 biennium allotment to IPPC of USD 5.9 million (USD 2.95 million per year), a 2.8% decrease compared to the previous 2012-2013 biennium.

[76] The Secretariat proposed that CPM-9 (2014) reviewed the IPPC 2014-2015 biennium operational budget (regular programme) and approved the IPPC 2014-2015 biennium operational budget (IPPC Multi-donor trust fund), highlighting that the creation and efforts of the IPPC Financial Committee have improved the overall management of IPPC funds.

[77] In developing the budget for 2014 and 2015, the Secretariat proposed spending estimates which would exceed the FAO regular programme allotment by 5.6%. The proposed regular programme budget is USD 6.232 million for the biennium or USD 3.116 per year. This slight budget deficit has proved, and should continue to prove, to be a good driving force for the completion of IPPC activities.

[78] The CPM:

(1) *noted* the anticipated allotments, contributions and budgeted expenditures of the IPPC Secretariat for 2014-2015 biennium (Annex 1 to CPM 2014/15 Rev.1);

(2) *noted* the IPPC 2014-2015 biennium operational budget for regular programme and *approved* the IPPC multi-donor trust fund budget;

(3) *encouraged* CPs to contribute to the IPPC trust fund to ensure delivery of the activities on the CPM work plan; and,

(4) *encouraged* CPs to contribute in-kind to activities in the CPM's Operational Plan.

10.4 Implementation of the IPPC and ISPMs

10.4.1 Status of ISPM 15 Symbol Registration

[79] The Secretariat presented a paper[27] on ISPM 15 symbol registration noting all the renewal processes required in 2013 have been completed. Only one country needs renewal by the end of 2015. The focus in the next two years should be on new registrations, which is to start as soon as the criteria for prioritization have been developed.

[80] The CPM:

(1) *noted* the developments in regard to registration and renewal of the ISPM 15 symbol;

(2) *encouraged* CPs to continue actively pursuing the process of national registration of the ISPM 15 symbol, including the renewals that are due to expire soon; and,

(3) *encouraged* CPs to reimburse the Secretariat for renewal costs as soon as practically possible.

[26] CPM 2014/15Rev.1

[27] CPM 2014/13

10.4.2 ePhyto and ePhyto Hub Feasibility Study

[81] The Chairperson of the ePhyto Steering Group presented a report[28] on the group's activities.

[82] The CPM Bureau member of the Steering Group presented a summary of a feasibility study[29] on an ePhyto Hub on behalf of the report's author. He encouraged CPs to review the content and the case studies.

[83] Contracting parties raised detailed questions and made productive suggestions on a range of issues including security; cost; capacity and opportunities for potential support; implications for border controls and transit requirements; implications for free trade; potential co-existence of more than one ePhyto system; standards and compatibility. They also raised the issue of the legal implications of NPPOs charging for transmission of phytosanitary certification data through an ePhyto system and the IPPC charging for the use of an ePhyto hub.

[84] Experts, including an FAO legal representative, responded to the issues raised. The experts recognized that many questions need to be answered but the current material presented should be seen as an update on progress and support for work to continue.

[85] The CPM Chairperson underlined the need to move forward with multilateral action in CPM, taking into account the genuine difficulties some CPs may have initially until systems become more accessible.

[86] The CPM:

(1) *noted* the activities of the ePhyto Steering Group;

(2) *noted* the summary of the ePhyto Hub Feasibility Study provided in CPM 2014/INF/13;

(3) *noted* the recommendations in the summary of the ePhyto Hub Feasibility Study provided in CPM 2014/INF/13;

(4) *supported* the continued work of the ePhyto Steering Group under the oversight of the CPM Bureau;

(5) *encouraged* the ePhyto Steering Group urgently to continue its work including:

- increasing awareness
- facilitating capacity development opportunities (with the Capacity Development Committee)
- finalising procedures for maintenance of harmonised terms, codes and transmission protocols
- updating transmission protocols and the databases of harmonised terms and codes
- continuing with the analysis of a possible ePhyto hub taking into account the recommendations in the summary of the ePhyto Hub Feasibility Study provided in CPM 2014/INF/13; and,

(6) *requested* the CPM Bureau to report back to CPM-10 (2015) on the progress made on ePhyto, including the issues raised by CPs referred to above, and providing adequate information to the CPM to make decisions on how to proceed with ePhyto.

10.5 Implementation Review and Support System

[87] The Secretariat presented a document[30] updating the progress of the Implementation Review and Support System (IRSS) programme under the first cycle and the shift to the second cycle. The EU

[28] CPM 2014/30

[29] CPM 2014/INF/13

[30] CPM 2014/24

encouraged the Secretariat to build on the programme and to apply resources for closer integration with implementation activities.

[88] The CPM:

(1) *noted* the update on the IRSS programme;

(2) *acknowledged* the support and commitment of the EU for the implementation of the IRSS;

(3) *noted* that the IRSS lacks the full funding for the second cycle;

(4) *acknowledged* the support of CPs to the IRSS and in particular to those CPs that have actively participated in its activities;

(5) *noted* the indicative work programme framework of the second IRSS cycle;

(6) *encouraged* CPs to provide resources for the second IRSS cycle; and,

(7) *noted* Switzerland's offer to provide resources for the second IRSS cycle.

10.6 Contracting Parties Reports of Successes and Challenges of Implementation

[89] This experimental agenda item was an opportunity for CPs briefly to present any successes or challenges they would like to highlight.

[90] Two reports were presented. The first[31] report was from an FAO Sub-regional Plant Production and Protection officer on phytosanitary capacity building in ten central African countries. The second was a verbal report from Canada to inform CPM about the successful implementation of, and ongoing challenges related to, the *Asian Gypsy Moth Pre-departure Vessel Certification Programme* and to request CPs to raise awareness of the certification requirements among their maritime industries. A weblink is available for further information on this programme[32].

[91] The Chair invited CPs to share their experience and confirmed that more such presentations would be sought through the Bureau for presentation at CPM-10.The Bureau would consider rules for presentation of ideas.

11. Capacity Development

11.1 Regional workshops on draft ISPMs

[92] The Secretariat introduced a paper[33] on the 2013 Regional IPPC Workshops, noting that the workshops had changed in concept to develop capacity in a broader range of work of the IPPC. It was noted that the workshops are one of few opportunities for the Secretariat to meet and listen directly to CPs and to get a better understanding of their needs at a regional level; the Secretariat considers this very valuable and essential to develop phytosanitary capacity for IPPC's contracting parties.

[93] Members expressed widespread appreciation for the workshops, while the Inter-African Phytosanitary Council expressed concerns about continuation of the workshops given funding challenges.

[94] The CPM:

(1) *encouraged* donors, CPs and RPPOs to contribute funding the Regional IPPC workshops;

(2) *encouraged* CPs to prepare for participation at all levels (including the NPPO and designated participants) and fulfill their commitments to submit at least one comment on each draft ISPM;

[31] CPM 2014/CRP/02

[32] http://www.aphis.usda.gov/plant_health/plant_pest_info/gypsy_moth/downloads/agm_industry_notice.pdf

[33] CPM 2014/16

(3) *noted* that the change of content in the Regional IPPC workshops to include a broader range of IPPC issues has been a successful strategy to increase the national phytosanitary capacity in IPPC related issues in all regions;

(4) *noted* that the Secretariat provides virtual training on the Online Comment System by request;

(5) *noted* the lessons learned and the actions proposed for improvement; and,

(6) *encouraged* the Regional IPPC workshop organizers to follow the "*Guidelines for the organizational arrangements for Regional workshops to discuss IPPC related issues*"[34].

11.2 Next steps for the Capacity Development Committee (CDC)

[95] The Secretariat introduced a paper[35] on next steps for evaluation and work planning for the Capacity Development Committee (CDC) and explained that the review of the CDC would take place at CPM-10 (2015) instead of CPM-9 (2014) so that evaluation period will cover the full initial two-year period of CDC activities. It was noted that the plan of activities for the remainder of the CDC timeframe is considered a living document that the Secretariat and CDC will implement and maintain collaboratively.

[96] The CPM:

(1) *noted* the Bureau decision that the review of the CDC will be presented to CPM-10 (2015) instead of CPM-9 (2014), with the CDC continuing its activities in the meantime;

(2) *noted* that the term of service of members of the CDC lasts until December 2014 and that the Secretariat will open a call in mid-2014 for extension requests or new candidates for members and alternates, to be presented to the Bureau for decision in October 2014;

(3) *noted* that CPs, NPPOs and other IPPC stakeholders may be contacted to provide information relevant to the review of the CDC; and,

(4) *encouraged* NPPOs and RPPOs to undertake a study of the global work plan contained within the IPPC National Phytosanitary Capacity Building Strategy to develop plans for activities for which they are identified as the lead entity and report back to the Secretariat.

12. National Reporting Obligations

[97] The Secretariat noted[36] that the National Reporting Obligations Advisory Group (NROAG) had been established with some delays and the review of the NRO programme is now underway. The option of undertaking pest reports through RPPOs is nearing finalization with ongoing collaboration between the IPPC and EPPO Secretariats. This mechanism will then be offered to other RPPOs.

[98] The Secretariat clarified technical and financial concerns raised by CPs regarding the use of the EPPO Plant Protection Thesaurus (EPPT) system for the pest reporting on the IPP. Some members requested that EPPO be invited to give a presentation on the EPPT at CPM-10.

[99] The CPM:

(1) *encouraged* CPs to meet their reporting obligations;

(2) *encouraged* CPs to ensure information in the WTO notifications, that could be used to meet IPPC reporting obligations, are also reported by the IPPC contact points on the IPP;

(3) *asked* the NROAG to consider issues related to the use of the EPPO EPPT; and

(4) *asked* the NROAG to consider and simplify its Terms of Reference and to produce a work plan.

[34] Attachment 2 of CPM 2014/16
[35] CPM 2014/17
[36] CPM 2014/27

13. Communications

13.1 Results of the Needs Assessment

[100] The Secretariat presented a report[37] on the summary results of the IPPC Communications Needs Assessment conducted by an external communications company, Green Ink for which there had been an impressive response rate.

[101] The report noted that improving IPPC internal communications might also improve external communications, which should be discussed more frequently when new activities are considered. The report underlined the need for experienced senior staff to be dedicated to communications.

[102] The assessment suggested that the website would also benefit from a thorough overhaul focused on a unifying design, improved information architecture and more functional search and find-ability.

[103] Generally, IPPC communications were well regarded.

13.2 The IPPC Communications Work Plan

[104] The Secretariat announced that due to unplanned delays in conducting the Communications needs assessment in time, a draft Communications work plan was delivered but development of a final work plan is still in process.

[105] The Chairperson indicated that the Bureau will steer the communication activity and encouraged CPs to assist the Bureau by nominating communication experts.

[106] The CPM:

(1) *noted* the comments presented as a result of the Communication needs assessment report;

(2) *encouraged* the Secretariat to develop a communications work plan for presentation to CPM-10 (2015) which addresses the needs identified in the assessment; and,

(3) *requested* that the Secretariat investigate how to create an international day/year of plant health.

14. Liaison and Partnership of the IPPC and Cooperation with Relevant Regional and International Organizations

14.1 Report of the 25th Technical Consultation among Regional Plant Protection Organizations

[107] The representative from COSAVE presented the report[38] on the 2013 Technical Consultation among RPPOs by looking back and focusing on the organization's origin and growth over the last 25 years. Reflecting on the activities of the very first meeting she emphasized the importance of the regional organizations and how technical consultations have been so important for the Interim Commission on Phytosanitary Measures and for the implementation of the IPPC today. She closed describing new opportunities and challenges for the future.

14.2 Reports from Observer Organizations with joint work programmes

14.2.1 Report by the Secretariat of the SPS Committee

[108] The representative from the WTO-SPS gave a brief presentation on the activities of the organisation as detailed in their report[39]. She highlighted and updated the CPM on the most important aspects of SPS's work and encouraged the IPPC to participate in all technical assistance activities.

[37] CPM 2014/28

[38] CPM 2014/INF/01

[39] CPM2014/INF/03

14.2.2 Report by the Secretariat of the STDF

[109] A member of the Secretariat of the Standard and Trade Development Facility (STDF) presented highlights from the STDF report[40] to CPM. In reviewing coordination activities and various STDF funded projects, she expressed appreciation for the involvement and guidance of the IPPC Secretariat.

[110] She reported that an independent midterm review concluded that the STDF has successfully established itself as a "highly relevant body to the need of the partners", including the IPPC. She invited members to read the full report on the STDF website.

14.2.3 Report by the CBD Secretariat

[111] The Coordinator referred to the Convention on Biological Diversity (CBD) report[41] and spoke briefly about the growing relationship with the CBD.

14.3 Reports from other Observer Organisations

[112] In presenting the papers[42], the Secretariat thanked organisations and urged CPs to review the documents and participate in the activities of the observer organisations, a sentiment echoed by the Chairperson.

15. Adoption of CPM recommendations

[113] The Secretariat introduced the paper[43] and invited the CPM to adopt the recommendations proposed.

[114] There followed a brief discussion with members recommending a slight change in wording of the recommendation for Internet trade. One member requested future guidance from the Secretariat on developing an effective communications strategy for this issue.

[115] The CPM:

(1) *adopted* the recommendation CPM-9/2014/01 on *IPPC coverage of aquatic plants* (Appendix 6), and;

(2) *adopted*, as amended, the recommendation CPM-9/2014/02 on *Internet trade (e-commerce) in plants and other regulated articles* (Appendix 6).

16. Effective Dispute Settlement Systems

16.1 Report on the activities of the Subsidiary Body on Dispute Settlement

[116] The Subsidiary Body for Dispute Settlement (SBDS) Chairperson spoke about the activities of the body since CPM-8 (2013) and advised that a written report will be posted on the IPP in due course.

16.2 Review of the SBDS

[117] The Secretariat introduced the paper[44]. The SBDS consulted CPs on the review of the IPPC Dispute Settlement system.

[118] After consideration of the comments from the SBDS, CPs and Bureau, recommendations were developed and attached to CPM 2014/22.

[119] The Secretariat noted that there is significant work for the SBDS in 2014 to implement these recommendations.

[40] CPM2014/INF/04

[41] CPM2014/INF06

[42] CPM2014/INF02, 07, 08

[43] CPM 2014/14

[44] CPM 2014/22

[120] The CPM:

(1) *considered* the recommendations by the SBDS, and;

(2) *adopted* the SBDS recommendations as presented in Appendix 1 of CPM 2014/2.

17. Scientific Session

17.1 New Inspection Technologies

[121] Ms Laurene Levy from the United States Department of Agriculture – Animal and Plant Health Inspection Service (USDA-APHIS) gave a presentation[45] highlighting the dilemma of safe and free trade in the context of massive trade volumes entering the USA. She raised the issue of effective inspection requiring new tools, which are easy to use but able to detect pests in large spaces. She called for greater collaboration to bring regional groups together to work internationally. She presented examples highlighting work being done on new detection technology and the APHIS risk-based sampling tool which dramatically increases the number of boxes or containers that can be covered by inspection.

17.2 Pest Risk Assessment Techniques

[122] The presentation[46] on PRAs for pest risk was delivered in three parts. Mr. Sam Bishop spoke for the need for NPPOs to optimise resources and their tools and the shift in the UK to use of rapid assessment tools to cope with the ever increasing number of risks more quickly and more effectively. Ms Emmanuelle Soubeyran then spoke about the French approach to prioritisation, highlighting the problems of the operational aspect of regulations and the financial implications of implementation. Mr Bishop concluded by describing the United Kingdom Plant Health Risk Register designed to identify threats and allow for rapid prioritisation of responses.

17.3 Experiences in ePhyto

[123] Mr Walter Fabían Alessandrini gave a presentation[47] on the Argentinean Phytosanitary Certification System detailing its main functions. He talked of the challenges to implementing an ePhyto system and called for a standardised transmission protocol and a global understanding of certificate codes: ideally one system.

[124] Ms Maoyu Chen gave a presentation[48] on China's experiences with developing and implementing an ePhyto system. She introduced the system, its key features and benefits. She then described current achievements and future goals for their work in this area.

[125] All the scientific sessions were extremely well received and CPs were encouraged to study the presentations, which will be made available on the IPP. Contracting parties were also invited to network with fellow members and organisations to further their understanding of the topics presented.

18. Election of the CPM: Chairperson, Vice Chairperson, other Bureau Members and potential replacements

[126] The Chairperson introduced the paper[49] and the Secretary urged members to consider their processes and the timing of nominations from the regions. The Chairperson recognized that the process also required close engagement by the Secretariat with the FAO Regional Chairpersons.

[45] available at https://www.ippc.int/publications/presentations-cpm-9

[46] available at https://www.ippc.int/publications/presentations-cpm-9

[47] available at https://www.ippc.int/publications/presentations-cpm-9

[48] available at https://www.ippc.int/publications/presentations-cpm-9

[49] CPM 2014/12 and CPM 2014/CRP/11

[127] The CPM:

(1) *elected* Ms Kyu-Ock Yim as Chairperson of the CPM;

(2) *elected* Mr Peter Thomson as Vice-Chairperson of the CPM, and;

(3) *confirmed* new members and potential replacements for the Bureau as described in CPM 2014/12 and CPM 2014/CRP/11.

19. Membership and potential replacements for CPM subsidiary bodies

19.1 Standards Committee

[128] The Secretariat presented the paper[50].

[129] The CPM:

(1) *noted* the current membership and the potential replacements for the SC as described in Annex 1A of CPM 2014/10, and;

(2) *confirmed* new members and potential replacements for the SC as described in Annex 1A of CPM 2014/10.

19.2 Subsidiary Body on Dispute Settlement

[130] The CPM:

(1) *noted* the current membership and the potential replacements for the SBDS as described in Annex 2A of CPM 2014/10, and;

(2) *confirmed* new members and potential replacements for the SBDS as described in Annex 2A of CPM 2014/10.

20. Other business

20.1 WTO Agreement on Trade Facilitation

[131] The Secretariat introduced the paper[51] noting that the focus should be to ensure the shared understanding among CPs and stakeholders for the proper implementation of the WTO Agreement on Trade Facilitation.

[132] Contracting parties raised concerns regarding a perceived lack of consultation at various levels, relationships with customs authorities within a country, possible conflicts with the ongoing phytosanitary measures as well as the scope of application of the agreement.

[133] In responding, the WTO-SPS representative stressed the attempts they had made to make the process leading up to the agreement as inclusive as possible.

[134] The Chair reflected on members' concerns and urged further discussions to take place.

[135] The CPM:

(1) *encouraged* the CPs to be fully aware of the ongoing WTO Agreement on Trade Facilitation review process and to contact their national representations who participate in the WTO Agreement on Trade Facilitation review process to share views and possible concerns in terms of plant health issues;

(2) *noted* the actions taken by the Secretariat before CPM-9 (2014);

(3) *requested* the Secretariat to enhance dialogue with other International Standard Setting Organizations for the SPS-related areas, and further to seek opportunities to contribute to

[50] CPM 2014/10

[51] CPM 2014/29

international discussions to clarify rights and obligations under the WTO Agreement on Trade Facilitation in relation with those under the IPPC and ISPMs; and,

(4) *requested* the Bureau to carry out further analysis, with the assistance of the Secretariat, discuss this in its June meeting, and make recommendations to the CPs and the Secretariat.

20.2 Translation of CPM related documents

[136] A representative of GRULAC made a statement[52] on behalf of GRULAC raising concerns over the quality of the Spanish translation of CPM and CPM-related documents. The representative of the Near East region shared the same concerns about translation into Arabic. The delegate from China also raised concerns about the Chinese translations.

[137] The Chairperson noted this is a serious concern for all translations and referred the issue to be discussed at CPM Bureau. The Bureau will report back on this issue to CPM-10.

20.3 Paperless CPM

[138] Tonga raised the issue of moving towards a truly paperless CPM, as noted in CPM-8 (2013). To facilitate this, Tonga requested the Secretariat look into the possibilities of supplying power to all country desks in the plenary room.

20.4 NPPOs' experiences: Planning and responding to natural disasters

[139] Chile requested the Secretariat to explore the possibility of implementing a virtual open ended forum among countries with experience of natural disasters in order to exchange experiences about those natural disasters and the action of NPPOs in affected countries.

21. Date and venue of the next session

[140] The Secretariat informed members that the tenth session of the CPM was provisionally scheduled for 16-20 March 2015 in Rome.

22. Adoption of the report

[141] The CPM:

(5) *adopted* the report.

[52] CPM 2014/CRP/13

APPENDIX 1 – Detailed Agenda

Commission on Phytosanitary Measures, Ninth Session

31 March – 4 April 2014, Rome, Italy

1. Opening of the Session
2. Adoption of the Agenda
3. EU statement of competence
4. Election of the Rapporteur
5. Establishment of the Credentials Committee
6. Report by the Chairperson of the Commission on Phytosanitary Measures
7. Report by the IPPC Secretariat
8. Governance: Commission on Phytosanitary Measures

8.1 Partnerships

8.2 Process for adopting recommendations

9. International standard setting

9.1 Report on the activities of the Standards Committee

9.2 Adoption of International Standards for Phytosanitary Measures

9.3 Noting translation adjustments to International Standards for Phytosanitary Measures adopted at CPM-8 (2013)

9.4 Topics for IPPC standards

9.4.1 Adjustments to the List of topics for IPPC standards

9.4.2 Update on the topic: International movement of grain (2008-007)

9.4.3 Update on the topic: Minimizing pest movement by sea containers (2008-001)

9.5 Update on the development of a Framework for standards

10. IPPC Strategic Framework and Resource Mobilization

10.1 Report on the activities of the Strategic Planning Group

10.2 Implementing the IPPC Strategic Framework and Resource Mobilization

10.2.1 Implementation Process

10.2.2 Resource Mobilization Efforts and Results

10.3 Financial Report 2013 - Budget and Operational Plans 2014/2015

10.4 Implementation of the IPPC and ISPMs

10.4.1 Status of ISPM 15 Mark Registration

10.4.2 ePhyto and ePhyto Hub Feasibility Study

10.5 Implementation Review and Support System

10.6 Contracting Parties Reports of Successes and Challenges of Implementation

11. Capacity Development

11.1 Regional workshops on draft ISPMs

11.2 Next steps for the Capacity Development Committee (CDC)

12. National Reporting Obligations

13. Communications

13.1 Results of the Needs Assessment

13.2 The IPPC Communications Work Plan

14. Liaison and Partnership of the IPPC and cooperation with relevant regional and international organizations

14.1 Report of the 25th Technical Consultation among Regional Plant Protection Organizations

14.2 Reports from Observer Organizations with joint work programmes

14.2.1 Report by the Secretariat of the SPS Committee

14.2.2 Report by the Secretariat of the STDF

14.2.3 Report by the CBD Secretariat

14.3 Reports from other Observer Organizations

15. Adoption of CPM Recommendations

16. Effective dispute settlement systems

16.1 Report on the activities of the Subsidiary Body on Dispute Settlement

16.2 Review of the SBDS

17. Scientific Session

17.1 New Inspection Technologies

17.2 Pest Risk Assessment Techniques

17.3 Experiences in ePhyto

18. Election of the CPM: Chair, Vice Chair, other Bureau members and potential replacements

19. Membership and potential replacements for CPM subsidiary bodies

19.1 Standards Committee

19.2 Subsidiary Body on Dispute Settlement

20. Other business

21. Date and venue of the next session

22. Adoption of the report

APPENDIX 2 – List of Documents

Commission on Phytosanitary Measures, Ninth Session

31 March – 4 April 2014, Rome, Italy

Document number	Agenda item	Document Title	Available Languages
01	02	Provisional Agenda	EN/ES/FR/AR
02 Rev.01	02	Provisional Detailed Agenda	ES/FR/ES/RU/AR/ZH
03	09.2	Adoption of International Standards	ES/FR/ES/RU/AR/ZH
04	09.4.1	Adjustments to the List of Topics for IPPC Standards	ES/FR/ES/RU/AR/ZH
05	09.5	Update on Framework for Standards	ES/FR/ES/RU/AR/ZH
06	09.4.2	Update on the topic: International movement of grain	ES/FR/ES/RU/AR/ZH
07	8.2	Process for Adopting of CPM Recommendations	ES/FR/ES/RU/AR/ZH
08	06	CPM Chairperson's report	ES/FR/ES/RU/AR/ZH
09	10.2.2	Resources Mobilization Efforts and Results	ES/FR/ES/RU/AR/ZH
10	19.1 and 19.2	Membership and potential replacements for CPM Subsidiary Bodies	ES/FR/ES/RU/AR/ZH
11	09.4.3	Update on the Topic: Minimizing Pest Movement by Sea Containers (2008-001): Proposed Survey	ES/FR/ES/RU/AR/ZH
12	18	Election of the CPM Bureau and Bureau Replacements	ES/FR/ES/RU/AR/ZH
13	10.4.1	Status of ISPM 15 Mark Registration	ES/FR/ES/RU/AR/ZH
14	15	CPM Recommendations	ES/FR/ES/RU/AR/ZH
15	10.3	IPPC 2014-2015 Biennium Operational Budget	ES/FR/ES/RU/AR/ZH
16	11.1	Regional IPPC Workshops 2013	ES/FR/ES/RU/AR/ZH
17	11.2	Next Steps for the Capacity Development Committee	ES/FR/ES/RU/AR/ZH
18	09.1	Report of the activities of the Standards Committee	ES/FR/ES/RU/AR/ZH
19	09.3	Adjustments in translations of International Standards for Phytosanitary Measures at CPM-8 (2013)	ES/FR/ES/RU/AR/ZH
20	10.2.1	Strengthening Implementation of the IPP and ISPMs	ES/FR/ES/RU/AR/ZH
21	08.1	IPPC Secretariat's Relationship with Other Organizations	ES/FR/ES/RU/AR/ZH
22	16.2	SBDS Recommendations on Dispute Settlement Review	ES/FR/ES/RU/AR/ZH
23	9.4.3	Update on the Topic: Minimizing Pest Movement by Sea Containers (2008-001): processing of the draft standard through the IPPC standard setting process	ES/FR/ES/RU/AR/ZH
24	10.5	IPPC Implementation Review and Support System	ES/FR/ES/RU/AR/ZH
25	10.3	IPPC 2013 Financial Report	ES/FR/ES/RU/AR/ZH
26	7	IPPC 2013 Secretariat Report	ES/FR/ES/RU/AR/ZH
27	12	National Reporting Obligations	ES/FR/ES/RU/AR/ZH
28	13.1	IPPC Communications Needs Assessment Results	ENGLISH ONLY
29	20	Implications of WTO Agreement on Trade Facilitation	ENGLISH ONLY
30	10.4.2	ePhyto and ePhyto Hub Feasibility Study: Report of the Activities of the	ENGLISH ONLY

Document number	Agenda item	Document Title	Available Languages
		ePhyto Steering Group	
31	2	List of Documents	ENGLISH ONLY

Information Papers (INF)

Document number	Agenda item	Document Title	Available Languages
INF 01	14.1	Summary Report of the Twenty-five Technical Consultation among Regional Plant Protection Organizations	ENGLISH ONLY
INF 02 Rev.01	14.3	IAEA Statement	ENGLISH ONLY
INF 03	14.3	WTO Report	ENGLISH ONLY
INF 04	14.2.1	STDF Report	ENGLISH ONLY
INF 05	14.2.2	Formal objections to draft ISPMs presented for adoption to CPM-9 (2014)	ENGLISH ONLY
INF 06	09.2	CBD Report	ENGLISH ONLY
INF 07	14.2.3	IICA Report	EN/ES
INF 08	14.3	GICSV Report	EN/ES
INF 09 Rev.01	14.3	Proposal for IPPC Secretariat Enhancement Study prepared by Canada and US	EN/FR/ES
INF 10 Rev.01	20	Statements from the European Union and it's 28 Member States regarding various CPM agenda items	ENGLISH ONLY
INF 11	8.2; 9.4.2; 9.4.3; 10.2.1; 15	Flashdrive Table of Contents	ENGLISH ONLY
INF 12	20	Adjustments to the List of topics for IPPC standards – US Paper	ENGLISH ONLY
INF 13	9.4.1	ePhyto and ePhyto Hub Feasibility Study: Summary of the findings of the ePhyto Hub Feasibility Study	ENGLISH ONLY
INF 14	10.2.2	Resource Mobilization Efforts and Results	ENGLISH ONLY
INF 15	2	Modification of Provisional Detailed Agenda proposed by Costa Rica, with the support of OIRSA member countries	EN/ES

APPENDIX 3 – List of Participants

Commission on Phytosanitary Measures, Ninth Session

31 March – 4 April 2014, Rome, Italy

MEMBER COUNTRIES (CONTRACTING PARTIES)

PAYS MEMBRES (PARTIES CONTRACTANTES)

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APPENDIX 4 – Credentials Committee

Commission on Phytosanitary Measures, Ninth Session

31 March – 4 April 2014, Rome, Italy

Credential Committee was composed of seven members, one per FAO region, as well as one CPM Bureau member.

Credentials Committee established by the CPM-9

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APPENDIX 5 - IPPC Secretariat Enhancement Evaluation

Commission on Phytosanitary Measures, Ninth Session

31 March – 4 April 2014, Rome, Italy

Terms of Reference
as developed by the Small Working Group held at CPM 9
3 April 2014

1. Background

The successful and efficient operation and organization of the Secretariat of the International Plant Protection Convention (IPPC) is fundamental to the achievement of the IPPC objectives and Commission on Phytosanitary Measures (CPM) work program. Efforts should be taken to ensure that the Secretariat's capacity and success continue into the future. Because of the ever dynamic, changing environment, organizations periodically review their procedures and systems in order to adapt and continue functioning effectively and efficiently. This is as vital for the IPPC as for any other private or public organization.

Many organizations have adopted a philosophy and process of "continuous improvement" as a means to continually evolve and maintain their organizational health, performance, and effectiveness. Such an approach is in the interests of both the IPPC Secretariat and Contracting Parties. Accordingly, it is proposed that an external consultant be engaged to conduct a review of the Secretariat procedures, structures and systems and to provide recommendations for enhancing the Secretariat capacity to achieve the CPM's strategic goals and meet Contracting Parties' expectations in the years ahead. The following are terms of reference (TORs) to guide this review.

2. Purpose

Undertake an analysis which identifies existing strengths in the Secretariat's structure and operations, current constraints to performance and delivery of services, and recommendations for enhancing the Secretariat's capacity to facilitate, coordinate, support, and advance the CPM's strategic goals and annual work program, taking particular account of the focus on implementation, communication and partnerships.

3. Scope of Evaluation

- Review the existing organizational structure of the Secretariat and its relationships within the FAO, CPM, CPM Bureau, IPPC subsidiary bodies, and other multilateral bodies.
- Consider the findings of previous evaluations of the IPPC and progress made since those evaluations.
- Conduct a benchmarking exercise based on the review of and comparison with relevant multilateral, regional or national organizations (include Secretariats of the two sister international standard setting bodies, Codex and OIE and the CBD).
- Consult with Contracting Parties on perceived strengths, constraints, and possible initiatives for the Secretariat.
- Examine current hiring and staffing practices, including their merits, drawbacks, and constraints in terms of building and sustaining a strong professional Secretariat staff in relation to its support of the IPPC and CPM.
- Review current mechanisms and processes used by the Secretariat to manage performance relative to the requirements of the Convention, and ensure accountability of the Secretariat and assess its effectiveness.

- Examine whether the current Secretariat structure, practices, relationships, team-working and processes, as well as resources made available, are fit for the purpose of effectively and efficiently delivering on current goals and priorities of the IPPC.
- Identify successful Secretariat organizational structures, procedures and practices that are critical to the IPPC to facilitate the cooperative approach needed for the implementation of the IPPC and its ISPMs.
- Identify business processes that must be maintained and areas where enhancements and or new initiatives could be considered.
- Prepare a report that presents findings and recommendations should be delivered to CPM, CPM Bureau and relevant FAO management.

4. Funding

Additional funding (that is, not coming from existing regular programme budget/funds) will be necessary to undertake this review. Some contracting Parties have offered dedicated funding for this evaluation and others may be in a position to also contribute. Funding may also be available through existing trust funds.

5. Evaluation Process

As the host organisation, the FAO, through its Office of Evaluation, would be commissioned to manage the enhancement evaluation. The Bureau will assist the FAO Office of Evaluation in its work by representing the CPM and its contracting parties. The external consultants should have the following skills and experience:

- Expert in organizational design and reviews.
- Expert in management performance review.
- Expert in business improvement processes.
- Experience with international multilateral organizations.
- Experience in assessing organizational performance.
- Knowledge of Secretariat-type organizations or staffing arrangements.
- Ability to understand the FAO processes and staff regulations.
- Familiarity with the IPPC and CPM structures and goals.

6. Timetable

To optimise the opportunities associated with the implementation of the IPPC and its ISPMs, the draft of this evaluation should be available for consideration at the next SPG meeting (October 2014) and the Bureau, with the objective that the final report and recommendations be presented at CPM-10 (2015).

APPENDIX 6 – CPM Recommendations

Commission on Phytosanitary Measures, Ninth Session

31 March – 4 April 2014, Rome, Italy

Background

At CPM-8 the Secretariat introduced a paper presenting two proposed Recommendations and reminded members that over a period of several years (2008–2009), the CPM had discussed the need for a category of decisions that are not ISPMs but would serve as lasting reference material and benefit from a higher profile than being published only within the text of a CPM report.

At CPM-8 there were members who supported immediate adoption of the Recommendations presented and others who sought additional consultation before moving forward having noted that Recommendations have a high profile.

CPM-8 asked the Secretariat to:

(1) Invite members to provide comments on both Recommendations by 30 May 2013
(2) Refer the comments to the Bureau for consideration
(3) Present the comments and the revised Recommendations for discussion at the SPG meeting in October 2013
(4) Present final versions of the Recommendations at CPM-9 (2014).

Having completed all the steps, the Secretariat presents the following two recommendations for CPM consideration and approval.

The CPM is invited to:

(1) *Adopt* the recommendations CPM-9/2014/01 on IPPC coverage of aquatic plants and CPM-9/2014/02 on Internet trade (e-commerce) in plants and other regulated articles.

CPM Recommendation Number: CPM-9/2014/01

Recommendation on the IPPC Coverage of Aquatic Plants

Background:

The IPPC, having the purpose of "securing common and effective action to prevent the spread and introduction of pests of plants and plant products", does not distinguish between terrestrial and aquatic plants and does not specifically refer to aquatic plants. Furthermore, as clarified by the CPM on several occasions, the IPPC deals with the protection of plants whether cultivated, managed or wild.

Aquatic plants may, as other plants, be infested by pests, provide a pathway for pests or themselves be pests to other plants.

"Aquatic plants," are mentioned in several International Standards for Phytosanitary Measures (ISPMs) as plants that should be protected under the IPPC framework. CPM-1 (2006) noted the IPPC Secretariat's liaison with other international organizations to clarify the mandate of the IPPC with respect to invasive aquatic plants. The IPPC Business Plan 2007 - 2011, adopted at CPM-2 (2007), identified marine and other aquatic plants as an emerging issue to be considered, and it was stated that ISPMs should be developed or modified to take aquatic invasive plants into account.

At CPM-5 (2010) a scientific session on aquatic plants was held, outlining the pest risks to and from aquatic plants. CPM members agreed that in principle aquatic plants were covered under the scope of the IPPC.

At CPM-6 (2011) it was agreed that the issue of aquatic plants (including the question on algae) under the IPPC should be further considered by the Bureau and SPTA and the conclusions be reported back to the CPM (CPM-6, Report, Para 193).

Accordingly, a "Scoping study on aquatic plants and their significance to the IPPC" was conducted under the Implementation Review and Support System (IRSS) project and presented at the IPPC Symposium at CPM-7 (2012).

This recommendation synthesizes these discussions, taking into account the findings from the IRSS study and concludes with a set of recommended actions for contracting parties (including NPPOs), RPPOs and the Secretariat.

Addressed to:

Contracting parties, National Plant Protection Organizations (NPPOs), Regional Plant Protection Organizations (RPPOs) and the IPPC Secretariat.

Recommendation:

1. The CPM *confirms* that aquatic plants should be protected and invasive aquatic plants considered as potential pests under the IPPC framework.

2. Therefore:

A. Contracting Parties are encouraged to:

(1) include an assessment of pest risks to aquatic plants in their pest risk analysis processes.

(2) ensure that relevant government agencies, importers, exporters, shipping service companies and/or agencies (for ship ballasts and tanks) and other stakeholders are aware of the pest risks related to the import and movement of aquatic plants.

(3) prevent the spread of regulated aquatic plants as pests in the ornamental and other trade sectors, using appropriate phytosanitary measures, with support from other national organizations positioned to enforce such measures.

(4) ensure that aquatic plants, as potential pests and pathways, become subject to, or included in, pest risk analysis whenever relevant, in particular in cases where aquatic plants are intentionally imported for intended uses as plants for planting, e.g. in aquaculture or other aquatic habitats.

(5) ensure that, in accordance with the outcome of a pest risk analysis, aquatic plants as pathways or pests become subject to official control and that adequate phytosanitary measures such as phytosanitary import requirements, surveillance, eradication, containment etc. are established.

B. RPPOs are encouraged to:

(1) coordinate regional cooperative efforts on pest risk analysis for aquatic plants as pathways or pests.

(2) coordinate communication among NPPOs and other stakeholders to strengthen regional approaches to managing risk and identifying appropriate management options for aquatic plants as pathways or pests.

C. The IPPC is:

(1) encouraged to consider aquatic plants in future capacity development activities on pest risk analysis, establishment of phytosanitary regulation and the development of pest management plans etc.

(2) encouraged to continue liaising with relevant international organizations (CBD in particular) and other partners to strengthen the coordination and cooperation on the protection of aquatic plants as well as the prevention of the introduction and spread of aquatic plants as pathways or pests.

Recommendation(s) superseded by the above:

None.

CPM Recommendation Number: CPM-9/2014/2
Recommendation on Internet Trade (E-Commerce) in Plants and other Regulated Articles

Background:
Sales of plants and plant products ordered through the internet (e-commerce) have increased significantly in the years since the IPPC and most ISPMs were adopted. E-commerce is fuelling an increasing volume of traded commodities. In many cases online traders of plants and plant products do not take into account a customer's location before agreeing to a sale and shipping their purchases to them. This lack of knowledge of a customer's location can lead to consignments of regulated articles being imported into a country without the phytosanitary certificates which may be required by the NPPO of that country.

A number of studies, including an IRSS study on internet trade presented at CPM-7 (2012), have shown that regulated articles ordered over the internet are routinely not accompanied by appropriate phytosanitary certificates during import. Similar concerns have also been identified with other forms of distance selling, such as mail order companies who trade via advertisements in newspapers and magazines.

In order for the global plant protection framework to keep pace with this, NPPOs, RPPOs and the IPPC Secretariat should collaborate with other stakeholders to monitor internet trade and to ensure that goods ordered in this way comply with the relevant phytosanitary regulations on the basis of risk analysis. This requires improvements in collaboration, monitoring and enforcement across the pathways known for transporting those goods, particularly postal and express delivery services.

Addressed to:

Contracting parties, national plant protection organizations (NPPOs), regional plant protection organizations (RPPOs) and the IPPC Secretariat.
Recommendation:

(1) This recommendation applies to a variety of products ordered and delivered through e-commerce. It includes plants for planting, other articles such as plants for consumption, soils, growing media, and living organisms in a wide range of taxa that are known or have the potential to be plant pests and are sold to and exchanged by hobbyists, collectors, researchers etc. Many of these articles may be sold in a variety of product configurations that may incorporate or be infused with plants for planting, though the product itself may not be recognized immediately as containing them (e.g. articles of clothing, footwear, packaging, greeting cards, paper products, home accessories, novelty products etc.).

To respond to this developing situation, the CPM encourages:

A. NPPOs and RPPOs to:

(1) develop mechanisms for identifying e-commerce traders based within their countries and regions.

(2) establish mechanisms to identify products of concern that may be purchased via e-commerce, with a focus on potential high-risk pathways such as plants for planting, soils and growing media, living organisms etc. and to explore options for ensuring they comply with implementing appropriate phytosanitary regulations based on risk assessment.

(3) promote compliance by customers and traders operating through e-commerce with the phytosanitary import requirements of importing countries and provide adequate information on the risks posed by bypassing such requirements.

(4) strengthen coordination with postal and express courier services to ensure that relevant information of the phytosanitary risks and phytosanitary measures are conveyed to e-commerce traders.

(5) investigate the phytosanitary risks posed by all forms of distance selling and if necessary to include these purchasing methods in their risk management activities

B. NPPOs, RPPOs and the IPPC Secretariat to:

(1) raise awareness of the risks of bypassing phytosanitary regulations.

Recommendation(s) superseded by the above:
None.

APPENDIX 7 – Adopted International Standards for Phytosanitary Measures by the CPM-9

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

ISPM 12

PHYTOSANITARY CERTIFICATES

(2011)

Produced by the Secretariat of the International Plant Protection Convention

Publication history

This is not an official part of the standard.

1996-05 CEPM-3 added the topic *Phytosanitary certificates* (1996-003)

1996-08 EWG developed draft text

1997-10 CEPM-4 postponed the discussion

1998-05 CEPM-5 discussed draft text

1999-05 CEPM-6 revised draft text and approved for member consultation

1999-06 member consultation

2000-11 ISC-2 revised draft for adoption

2001-04 ICPM-3 adopted standard

ISPM 12. 2001. *Guidelines for phytosanitary certificates*. Rome, IPPC, FAO.

2006-04 CPM-1 added topic *Revision of ISPM 12* (2006-035)

2006-11 SC approved Specification 38 *Revision of ISPM 7 and ISPM 12*

2008-02 EWG revised draft

2009-05 SC revised draft and approved for MC

2009-06 Member consultation

2010-02 Steward revised the draft based on member comments

2010-05 SC-7 revised draft

2010-11 SC approved draft to be submitted for adoption, revision to Appendix 1 unfinished

2011-03 CPM-6 adopted revised ISPM 12:2011

ISPM 12. 2011. *Phytosanitary certificates*. Rome, IPPC, FAO.

2011-06 open-ended working group on electronic certification

2012-02 Steward and IPPC steering committee on ePhyto developed drafted text

2012-04 SC revised and approved draft for member consultation

2012-06 Member consultation

2012-11 Steward revised draft based on member comments

2013-05 SC-7 revised draft

2013-06 Substantial concerns commenting period

2013-10 Steward revised draft based on member comments

2013-11 SC approved draft to be submitted for adoption

2014-04 CPM-9 adopted revised Appendix 1 to ISPM 12:2011

2014-09 Secretariat corrected the title in English of Appendix 1, which had been erroneously modified after adoption, as following *Electronic phytosanitary certificat~~ion~~es, information on standard XML schemas, and exchange mechanisms* (2014). The title now accurately reflects the Appendix 1 as adopted by CPM.

ISPM 12. 2011: **Appendix 1** *Electronic phytosanitary certificates, information on standard XML schemas, and exchange mechanisms* (2014). Rome, IPPC, FAO.

Publication history last modified: 2014-09

CONTENTS

Adoption

This standard was first adopted by the Third Session of the Interim Commission on Phytosanitary Measures in April 2001 as *Guidelines for phytosanitary certificates*. The first revision of the standard was adopted by the Sixth Session of the Commission on Phytosanitary Measures in March 2011 as the present standard, ISPM 12:2011. The revised Appendix 1 was adopted by the Ninth Session of the Commission on Phytosanitary Measures in April 2014.

INTRODUCTION

Scope

This standard provides the requirements and guidelines for the preparation and issuance of phytosanitary certificates[1] (phytosanitary certificates for export and phytosanitary certificates for re-export).

Specific guidance on requirements and components of a phytosanitary certification system to be established by national plant protection organizations (NPPOs) is provided in ISPM 7:2011.

References

IPPC. *International Plant Protection Convention*. Rome, IPPC, FAO.

ISPM 1. 2006. *Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade*. Rome, IPPC, FAO.

ISPM 5. *Glossary of phytosanitary terms*. Rome, IPPC, FAO.

ISPM 7. 2011. *Phytosanitary certification system*. Rome, IPPC, FAO.

ISPM 13. 2001. *Guidelines for the notification of non-compliance and emergency action*. Rome, IPPC, FAO.

ISPM 18. 2003. *Guidelines for the use of irradiation as a phytosanitary measure*. Rome, IPPC, FAO.

ISPM 25. 2006. *Consignments in transit*. Rome, IPPC, FAO.

ISPM 32. 2009. *Categorization of commodities according to their pest risk*. Rome, IPPC, FAO.

Definitions

Definitions of phytosanitary terms used in this standard can be found in ISPM 5 (*Glossary of phytosanitary terms)*.

Outline of requirements

Phytosanitary certification is used to attest that consignments meet phytosanitary import requirements and is undertaken by an NPPO. A phytosanitary certificate for export or for re-export can be issued only by a public officer who is technically qualified and duly authorized by an NPPO.

A phytosanitary certificate for export is usually issued by the NPPO of the country where the plants, plant products or regulated articles were grown or processed. A phytosanitary certificate for re-export is issued by the NPPO of the country of re-export (a country where the commodity has not been grown or processed) when the consignment has not been subjected to the risk of infestation and complies

[1] The IPPC refers to a "phytosanitary certificate" for export purposes and a "phytosanitary certificate for re-export" for re-export purposes. In order to keep the use of these terms simple and clear in this standard "phytosanitary certificate for export" and "phytosanitary certificate for re-export" are used. The term "phytosanitary certificates" (plural) is used to cover both types of certificate.

with the phytosanitary import requirements of the importing country, and the original phytosanitary certificate or a certified copy is available.

NPPOs shall use the model phytosanitary certificates of the IPPC.

Where the required phytosanitary information exceeds the space available on the phytosanitary certificates, an attachment may be added with this information.

Phytosanitary certificates should accompany the consignment or may be transmitted by mail or other means, or where agreed between countries, NPPOs may use electronic phytosanitary certificates, using standardized language, structure of the message and exchange protocols.

Phytosanitary certificates may have a limited duration of validity as the phytosanitary status of consignments may change after issuance of phytosanitary certificates. The NPPO of the exporting country or the importing country may make relevant stipulations.

Specific procedures should be followed in the case of replacement phytosanitary certificates, certified copies of phytosanitary certificates, and alterations to phytosanitary certificates. Invalid or fraudulent phytosanitary certificates should not be accepted.

Special consideration is given to situations of re-export, particularly when the issuance of a phytosanitary certificate for export is not required by the country of re-export and when specific phytosanitary measures need to be conducted in the country of origin.

BACKGROUND

Phytosanitary certification is used to attest that consignments meet phytosanitary import requirements and is applied to most plants, plant products and other regulated articles that are traded internationally. Phytosanitary certification contributes to the protection of plants, including cultivated and uncultivated/unmanaged plants and wild flora (including aquatic plants), habitats and ecosystems in the importing countries. Phytosanitary certification also facilitates international trade in plants, plant products and other regulated articles by providing an internationally agreed document and related procedures.

Article V.2(a) of the IPPC stipulates how phytosanitary certificates should be issued:

> Inspection and other related activities leading to issuance of phytosanitary certificates shall be carried out only by or under the authority of the official national plant protection organization. The issuance of phytosanitary certificates shall be carried out by public officers who are technically qualified and duly authorized by the official national plant protection organization to act on its behalf and under its control with such knowledge and information available to those officers that the authorities of importing contracting parties may accept the phytosanitary certificates with confidence as dependable documents.
>
> [See also ISPM 7:2011]

This was clarified at the FAO Conference in 1997 during adoption of the 1997 revision of the IPPC: "It is understood that … 'public officers who are technically qualified and duly authorized by the national plant protection organization' include officers from the national plant protection organization". "Public" in this context means employed by a level of government, not by a private company. "Include officers from the national plant protection organization" means that the officer may be directly employed by the NPPO, but does not have to be directly employed by the NPPO.

The IPPC also states requirements for the use of model phytosanitary certificates (in Article V.3):

> Each contracting party undertakes not to require consignments of plants or plant products or other regulated articles imported into its territories to be accompanied by phytosanitary certificates inconsistent with the models set out in the Annex to this Convention. Any requirements for additional declarations shall be limited to those technically justified.

REQUIREMENTS FOR PHYTOSANITARY CERTIFICATION

1. Phytosanitary Certificates

1.1 Purpose of phytosanitary certificates

Phytosanitary certificates are issued to attest that plants, plant products or other regulated articles meet the phytosanitary import requirements of importing countries and are in conformity with the certifying statement. Phytosanitary certificates may also be issued to support re-export certification to other countries. Phytosanitary certificates should be issued only for these purposes.

1.2 Types and forms of phytosanitary certificates

In the Annex to the IPPC, there are two types of certificates: a "phytosanitary certificate" (see Annex 1 of this standard) for export purposes and a "phytosanitary certificate for re-export" (see Annex 2 of this standard) for re-export purposes[2].

A phytosanitary certificate for export is usually issued by the NPPO of the country of origin. A phytosanitary certificate for export describes the consignment and, through a certifying statement, additional declarations and treatment records, declares that the phytosanitary status of the consignment

[2] See Scope, footnote 1, concerning terminology.

meets phytosanitary import requirements. A phytosanitary certificate for export may also be issued in certain re-export situations for plants, plant products and other regulated articles originating in countries other than the country of re-export if the phytosanitary status of the consignment can be determined by the country of re-export (e.g. by inspection).

A phytosanitary certificate for re-export may be issued by the NPPO of the re-exporting country in the case where the commodity in the consignment was not grown or processed to change its nature in that country and only where an original phytosanitary certificate for export or a certified copy is available. The phytosanitary certificate for re-export provides the link to a phytosanitary certificate issued in a country of export and takes into account any changes in phytosanitary status that may have occurred in the country of re-export.

Procedures for managing the issuance of the two types of phytosanitary certificates and the systems that ensure their legitimacy are the same.

According to Article V.2(b) of the IPPC, the IPPC model phytosanitary certificates provide standardized wording that shall be followed for the preparation of phytosanitary certificates. The standardization of the phytosanitary certificates is necessary to ensure consistency, that they are easily recognized, and that essential information is reported. NPPOs are encouraged to use a single format for their phytosanitary certificates for export and a single format for phytosanitary certificates for re-export and to place a sample of the phytosanitary certificates' format on the International Phytosanitary Portal (IPP) (https://www.ippc.int) in a manner that prevents falsification.

Phytosanitary certificates can be in paper form or, where it is accepted by the NPPO of the importing country, in electronic form.

Electronic phytosanitary certificates are the electronic equivalent of the wording and data of phytosanitary certificates in paper form, including the certifying statement, transmitted by authenticated and secure electronic means from the NPPO of the exporting country to the NPPO of the importing country. Electronic phytosanitary certification does not constitute text processing or other electronic generation of paper forms, which are then distributed non-electronically. Nor is it the transfer of an electronic version of the paper certificate (e.g. through e-mail).

NPPOs should apply safeguards against falsification of paper phytosanitary certificates, for example special papers, watermarks or special printing. When electronic certification is used, appropriate safeguards should also be applied.

Phytosanitary certificates are not valid until all requirements have been met and they are dated, signed and stamped, sealed, marked or completed electronically by the NPPO of the exporting or re-exporting country.

1.3 Attachments to phytosanitary certificates

If the information required to complete phytosanitary certificates exceeds the available space on the form, an attachment may be added. The information in the attachment should only include what is required on the phytosanitary certificates. All pages of attachments should bear the number of the phytosanitary certificates and should be dated, signed and stamped in the same manner as required for the phytosanitary certificates. Phytosanitary certificates should refer to any attachments in the appropriate section. If an attachment has more than one page, the pages should be numbered and the number of pages indicated on the phytosanitary certificates. Other documents such as the Convention on International Trade in Endangered Species (CITES) certificates may accompany the consignment along with the phytosanitary certificate, but such documents should not be considered attachments to the phytosanitary certificates nor should they be referenced on the phytosanitary certificate.

1.4 Electronic phytosanitary certificates

Electronic phytosanitary certificates may be issued where accepted by the NPPO of the importing country.

When using electronic phytosanitary certificates NPPOs should develop systems that generate certificates using standardized language, message structure and exchange protocols. Appendix 1 provides guidance on standardized language, message structure and exchange protocols.

Electronic phytosanitary certificates may be used subject to the following provisions:

- The mode of issue, transmission and level of security is acceptable to the NPPO of the importing country and if relevant to NPPOs of other countries involved.
- The information provided is consistent with the IPPC model phytosanitary certificates.
- The purpose of phytosanitary certification under the IPPC is realized.
- The identity of the issuing NPPO can be adequately established and authenticated.

1.5 Mode of transmission

Phytosanitary certificates should accompany the consignments for which they have been issued. Phytosanitary certificates may also be transmitted separately by mail or other means if accepted by the NPPO of the importing country. In the case of electronic phytosanitary certificates, they should be directly available to the relevant NPPO officials. In all cases, phytosanitary certificates should be available to the NPPO of the importing country upon the consignment's arrival.

1.6 Duration of validity

The phytosanitary status of consignments may change after issuance of phytosanitary certificates and therefore the NPPO of the exporting or re-exporting country may decide to restrict the duration of the validity of phytosanitary certificates after issuance and prior to export.

The NPPO of the exporting or re-exporting country may assess the situation and define an appropriate period of validity before export occurs, taking into account the likelihood of the consignment becoming infested or contaminated prior to export or re-export. Such likelihood may be affected by packaging (sealed carton or loose packing) and storage environment (open air or enclosed), type of commodity and conveyance, time of year and type of pests. A phytosanitary certificate for export may still be used after this period for issuing a phytosanitary certificate for re-export, provided that the consignment has not been subjected to the risk of infestation and that the commodity still achieves the phytosanitary import requirements of the importing country.

NPPOs of importing countries may also stipulate as part of the phytosanitary import requirements the duration for which phytosanitary certificates remain valid.

2. Actions Taken with Issued Phytosanitary Certificates

2.1 Certified copies of phytosanitary certificates

A certified copy is a copy of the original of the phytosanitary certificate that is validated (stamped, dated and countersigned) by the NPPO indicating it is a true representative copy of the original phytosanitary certificate. It may be issued upon request by the exporter. It does not replace the original. Such copies are used primarily for re-export purposes.

2.2 Replacement of phytosanitary certificates

Phytosanitary certificates may be replaced at the request of an exporter for a consignment for which a phytosanitary certificate has already been issued. This should be done only in exceptional circumstances (e.g. damage to the phytosanitary certificates issued; change of addresses, country of destination or points of entry; missing or incorrect information) and should be carried out by the NPPO of the country that issued the phytosanitary certificates being replaced.

In all cases, the issuing NPPO should request exporters to return the original phytosanitary certificates and any certified copies that have already been issued for the consignments.

Other requirements concerning replacement of phytosanitary certificates include:

- Phytosanitary certificates returned for replacement should be retained by the NPPO of the issuing country and be cancelled. The new phytosanitary certificates should not have the same number as the certificate being replaced. The number of the original certificate should not be re-used.
- When previously issued phytosanitary certificates cannot be returned and have left the care and control of the NPPO (for example because they are lost or in another country), the NPPO may decide that it is appropriate to issue a replacement certificate. The new phytosanitary certificate should not have the same number as the phytosanitary certificate being replaced but should refer to it by including an additional declaration stating that "This certificate replaces and cancels phytosanitary certificate no. [*insert number*] issued on [*insert date*]".

2.3 Alterations to phytosanitary certificates

Alterations should be avoided as they may create uncertainty about the validity of phytosanitary certificates. However, if alterations are necessary, they should be made only on the original phytosanitary certificates by the issuing NPPO. Alterations should be minimal and should be stamped, dated and countersigned by the issuing NPPO.

3. Considerations for Importing Countries and NPPOs Issuing Phytosanitary Certificates

NPPOs of importing countries may require phytosanitary certificates for regulated articles only. These are usually plants and plant products but may include articles such as empty containers, vehicles and organisms other than plants where phytosanitary measures are technically justified.

NPPOs of the importing countries should not require phytosanitary certificates for plant products that have been processed to the point where they have no potential for introducing regulated pests, or for other articles that do not require phytosanitary measures (see IPPC Article VI.2 and ISPM 32:2009).

NPPOs should consult bilaterally when there are differences between their views regarding the technical justification for requiring phytosanitary certificates. Requirements for phytosanitary certificates should respect the principles of transparency, non-discrimination, necessity and technical justification (see ISPM 1:2006).

3.1 Unacceptable phytosanitary certificates

NPPOs of importing countries should not accept phytosanitary certificates that they determine to be invalid or fraudulent. The NPPO of the declared country of issuance should be notified as soon as possible regarding unacceptable or suspect phytosanitary certificates as described in ISPM 13:2001. Where the NPPO of the importing country suspects that phytosanitary certificates may be unacceptable, it may require the prompt cooperation of the NPPO of the exporting or re-exporting country in determining the validity or non-validity of the phytosanitary certificates. The NPPO of the exporting or re-exporting country should take corrective action where necessary and review systems

for the issuance of phytosanitary certificates so as to ensure that a high level of confidence is associated with its phytosanitary certificates.

3.1.1 Invalid phytosanitary certificates

Phytosanitary certificates are invalid if, for example, they have or they are:

- incomplete or incorrect information
- false or misleading information
- conflicting or inconsistent information
- wording or information that is inconsistent with the model phytosanitary certificates
- information added by unauthorized persons
- unauthorized (not stamped, dated or countersigned) alterations or deletions
- an expired period of validity unless used as a certified copy for re-export
- illegible (e.g. badly written, damaged)
- non-certified copies
- transmitted through a mode of transfer unauthorized by the NPPO (for electronic phytosanitary certificates)
- phytosanitary certification of plants, plant products and other regulated articles prohibited for import.

These are also reasons for rejecting phytosanitary certificates or for requesting additional information.

3.1.2 Fraudulent phytosanitary certificates

Fraudulent phytosanitary certificates typically include those:

- issued on non-authorized forms
- not dated, stamped, marked or sealed, and signed by the issuing NPPO
- issued by persons who are not authorized public officers.

Fraudulent phytosanitary certificates are invalid. The NPPO issuing phytosanitary certificates should have safeguards against their falsification. In the case of electronic phytosanitary certification, safeguards against falsification are an element of the electronic certification mechanism. The NPPO of the exporting country should take corrective action when notified of a non-compliance.

3.2 Import requirements for the preparation and issuance of phytosanitary certificates

Importing countries frequently specify import requirements that should be observed with respect to the preparation and issuance of phytosanitary certificates. Examples of what an importing country may require include:

- that phytosanitary certificates be completed in a specific language or one of its listed languages (however, countries are encouraged to accept one of the official languages of FAO, preferably English)
- the period of time allowed for issuance after inspection or treatment and the period of time between the issuance of phytosanitary certificates and the dispatch of the consignment from the exporting country
- that phytosanitary certificates be completed by typing or if handwritten, be in legible capital letters (where the language allows it)
- the units of measurement to be used in the description of the consignment and for other declared quantities.

4. Specific Considerations for the Preparation and Issuance of Phytosanitary Certificates

Phytosanitary certificates shall only be issued by public officers who are technically qualified and duly authorized by the NPPO.

Phytosanitary certificates should only be issued if it is confirmed that the phytosanitary import requirements are met.

Phytosanitary certificates should contain the necessary information to clearly identify the consignment to which each relates.

Phytosanitary certificates should only contain information related to phytosanitary matters. They should not include statements related to non-phytosanitary requirements such as animal or human health matters, pesticide residues, radioactivity, commercial information (e.g. letters of credit), or quality.

To facilitate cross-referencing between phytosanitary certificates and documents not related to phytosanitary certification (e.g. letters of credit, bills of lading, CITES certificates), notes may accompany phytosanitary certificates that associate them with the identification code, symbol or numbers of the relevant documents that require cross-referencing. Such notes should be used only when necessary and should not be considered part of phytosanitary certificates.

All sections of the phytosanitary certificates should be completed. Where no entry is made, the term "None" should be entered or the line should be blocked out or a line drawn through the section to prevent unauthorized additions.

For re-export of consignments specific information from the country of origin may be necessary; however, this may not be available on a phytosanitary certificate for export (e.g. lack of the specific information for the additional declaration of a phytosanitary certificate for export, or a phytosanitary certificate for export itself is not required by the country of re-export). In such cases, if the specific phytosanitary import requirements cannot be met within the country of re-export, no phytosanitary certificate for re-export may be issued. However, the following may apply:

- Where the phytosanitary certificate for export is required by the country of re-export, on request by exporters, the NPPO of the country of origin may provide additional phytosanitary information (e.g. the results of a growing season inspection) to that required by the country of re-export. Such information may be necessary for the issuance of phytosanitary certificates for re-export. This information should be placed in the additional declaration section, under the subheading "Additional official phytosanitary information" (see section 5).
- Where a phytosanitary certificate for export is not required by the country of re-export, on request from an exporter, the NPPO of the country of origin may nevertheless issue a phytosanitary certificate for export. This would be for consignments intended for re-export to other countries in order to provide additional phytosanitary information necessary for the issuance of phytosanitary certificates for re-export.

In both cases above, the country of re-export should ensure that the identity of the consignment is maintained and that it has not been subjected to the risk of infestation.

Phytosanitary certificates should be issued before dispatch; however, they may also be issued after dispatch of a consignment provided that:

- the phytosanitary security of the consignment has been assured, and
- the NPPO of the exporting country has undertaken sampling, inspection and treatments necessary to satisfy phytosanitary import requirements before dispatch of the consignment.

If these criteria are not met, phytosanitary certificates should not be issued.

In the case where phytosanitary certificates are issued after dispatch, the inspection date should be indicated in the additional declaration section if required by the importing country.

5. Guidelines and Requirements for Completing Sections of a Phytosanitary Certificate for Export

Information on completing the sections of the phytosanitary certificate for export is provided as follows:

[Headings in bold refer to the sections of the model certificate, see model in Annex 1]

No. _____

Each phytosanitary certificate for export should have a unique identification number, which allows for trace-back of consignments, facilitates audits and serves for record-keeping.

Plant Protection Organization of _____

The name of the country issuing the phytosanitary certificate for export should be listed here along with the name of the NPPO.

TO: Plant Protection Organization(s) of _____

The name of the importing country should be listed here. Where a transit country and the importing country have specific phytosanitary requirements that include the need for a phytosanitary certificate for export, the names of both countries should be listed and the transit country should be indicated. Care should be taken to ensure that the phytosanitary import or transit requirements of each country are met and appropriately indicated. In cases where the consignment is imported and then re-exported to another country, the names of both countries may be inserted, provided the phytosanitary import requirements of both countries have been met.

I. Description of Consignment

Name and address of exporter: _____

This information identifies the source of the consignment to facilitate its trace-back and audit by the NPPO of the exporting country. The address of the exporter should be located in the exporting country. The name and address of an exporter's local agent or shipper should be used where an international company with a foreign address is the exporter.

Declared name and address of consignee: _____

The name and address inserted here should be in sufficient detail to enable the NPPO of the importing country to confirm the identity of the consignee and, where necessary, to be able to conduct trace-back of non-compliant imports. Where the consignee is not known, "To order" may be used if the NPPO of the importing country permits the use of the term and accepts any associated risks. The importing country may require that the address of a consignee be a location in the importing country.

Number and description of packages: _____

The number of packages and their description should be included. Sufficient detail should be included in this section to enable the NPPO of the importing country to link the phytosanitary certificate for export with the corresponding consignment. In some cases (e.g. grain and bulk timber), shipping containers and/or railcars are considered the package and the number may be included (e.g. 10 containers). In cases of bulk shipments, the term "in bulk" may be used.

Distinguishing marks: _____

Distinguishing marks on packages (e.g. lot numbers, serial numbers or brand names) and conveyance identification numbers or names (e.g. container and railcar identification numbers or vessel name in the case of bulk shipments) should be included if necessary for the identification of the consignment.

Place of origin: _____

The place of origin refers to places where the commodity was grown or produced and where it was possibly exposed to infestation or contamination by regulated pests. In all cases, the name of the country or countries of origin should be stated. Normally a consignment gains its phytosanitary status from the place of origin. Countries may require that the name or code of the pest free area, pest free place of production or pest free production site be identified. Further details on the pest free area, pest free place of production or pest free production site may be provided in the additional declaration section.

If a commodity is repacked, stored or moved, its phytosanitary status may change over a period of time as a result of its new location through the possible infestation or contamination by regulated pests. Phytosanitary status may also be changed by processing, disinfecting or treating a commodity that results in removing possible infestation or contamination. Thus a commodity may gain its phytosanitary status from more than one place. In such cases, each country and place, where necessary, should be declared with the initial place of origin in brackets, e.g. declared as "country *X* of export (country *Y* of origin)".

If different lots within a consignment originate in different places or countries, all countries and places where necessary should be indicated. To assist with trace-back in such cases, the most relevant place for undertaking trace-back may be identified, for example the exporting company where records are stored.

If plants were imported to or moved within a country and have been grown for a specific period of time (depending on the commodity concerned, but usually one growing season or more), these plants may be considered to have changed their country or place of origin, provided that the phytosanitary status is determined only by that country or place of further growth.

Declared means of conveyance: _____

This section refers to how the commodity is transported when leaving the certifying country. Terms such as "ocean vessel", "boat", "aircraft", "road", "truck", "rail", "mail" and "carried by hand" may be used. The ship's name and voyage number or the aircraft's flight number may be included if known. The means of conveyance is generally as declared by the exporter. Often this will be only the first means of conveyance used directly after issuance of the phytosanitary certificate for export. Consignments frequently move in such a way that the means of conveyance can change, for example a container that is transferred from a ship to a truck. If the distinguishing marks identify the consignment, it is sufficient to declare only the first means of conveyance. This is then not necessarily the means of conveyance used when arriving in the country of import.

Declared point of entry: _____

This should be the first point of arrival in the country of destination, or if not known, the country name. Where the consignment transits through another country this may need to be recorded if the country of transit has phytosanitary requirements for transiting consignments. The entry point of the country of transit, or if not known the country name, should be noted in brackets.

The point of entry is declared by the exporter at the time of issuance of the phytosanitary certificate for export. This point of entry may change for various reasons, and entry into the country at a place other than the declared point of entry should not normally be considered as non-compliance. However, when the NPPO of the importing country prescribes specified points of entry in its phytosanitary import requirements, then one of the specific points of entry should be declared and the consignment should enter through that point.

Name of produce and quantity declared: _____

This section should be sufficiently descriptive of the commodity and should include the name of the plant, plant product or other regulated article, unit and the quantity as accurately as possible to enable the NPPO of the importing country to verify the contents of the consignment. International codes may be added to facilitate identification (e.g. Customs codes) and internationally recognized units and

terms should be used (e.g. metric system). Because different phytosanitary import requirements may apply to the different intended uses (e.g. consumption as compared with propagation) or degree of processing (e.g. fresh as compared with dried), the intended use or degree of processing should be specified. Entries should not refer to trade names, sizes or other commercial terms.

Botanical name of plants: _____

The information inserted here should identify plants and plant products using accepted scientific names, at least to genus level but preferably to species level.

It may not be feasible to provide botanical names for certain regulated articles and products of complex composition such as stock feeds. In these cases, the NPPOs of the importing and exporting countries may agree on a suitable common name descriptor, or the words "Not applicable" or "N/A" should be entered.

Certifying statement

> This is to certify that the plants, plant products or other regulated articles described herein have been inspected and/or tested according to appropriate official procedures and are considered to be free from the quarantine pests specified by the importing contracting party and to conform with the current phytosanitary requirements of the importing contracting party, including those for regulated non-quarantine pests.
>
> They are deemed to be practically free from other pests.* [*Optional clause]

In most instances specific phytosanitary import requirements exist or regulated pests are specified and the certifying statement on the phytosanitary certificate for export is used to certify conformity with these phytosanitary import requirements.

In instances where phytosanitary import requirements are not specific, the NPPO of the exporting country may certify the general phytosanitary status of the consignment for any pests believed by it to be of phytosanitary concern.

NPPOs of exporting countries may include the optional clause on their phytosanitary certificate for export. NPPOs of importing countries cannot request that the optional clause be added.

"Appropriate official procedures" refers to procedures carried out by the NPPO or persons authorized by the NPPO for purposes of phytosanitary certification. Such procedures should be in conformity with ISPMs where appropriate. The procedures may be specified by the NPPO of the importing country taking into account any relevant ISPMs.

"Considered to be free from quarantine pests" refers to freedom from pests in numbers or quantities that can be detected by the application of phytosanitary procedures. It should not be interpreted to mean absolute freedom in all cases but rather that quarantine pests are believed not to be present based on the procedures used for their detection or elimination. It should be recognized that phytosanitary procedures have inherent uncertainty and variability, and involve some probability that pests will not be detected or eliminated. This uncertainty and probability should be taken into account in the specification of appropriate procedures.

In some cases where irradiation treatments have been applied, live stages of target pests may be present in the consignment. Providing the treatment has been applied in accordance with ISPM 18:2003 and the appropriate treatment has been applied to achieve the required response, the validity of this part of the certifying statement is not compromised because the detection of live stages of the target pest is not considered as non-compliance.

"Phytosanitary requirements", as provided by the importing country, are officially prescribed conditions to be met in order to prevent the introduction and/or spread of pests. Phytosanitary import requirements should be specified in advance by the NPPO of the importing country in legislation, regulations or elsewhere (e.g. import permits and bilateral and other arrangements).

"Importing contracting party" refers to governments that have adhered to the IPPC.

II. Additional Declaration

Additional declarations provide specific additional information on a consignment in relation to regulated pests. Additional declarations should be kept to a minimum and be concise. NPPOs of the importing countries should keep under review the need for additional declarations and they should not require additional declarations with the required wording similar to that already included in the certifying statement on the phytosanitary certificate for export. The text of additional declarations may be specified in phytosanitary regulations, import permits or bilateral agreements. Treatments should not be indicated in this section but in section III of the phytosanitary certificate for export.

Additional declarations should be only those containing specific phytosanitary information required by the NPPO of the importing country or requested by the exporter for future phytosanitary certification purposes and they should not repeat information that is otherwise noted in the certifying statement or in the treatment section. In cases where phytosanitary import requirements allow for several alternative measures, the NPPO of the exporting country should specify in its additional declaration which option has been applied.

Appendix 2 provides examples of text for different types of additional declarations that are often required by NPPOs of importing countries. When NPPOs consider it necessary to require or provide an additional declaration they are encouraged to use the standard wording as provided in Appendix 2.

In the case where an import permit is required by the importing country, the import permit number may be referred to here to assist cross-referencing.

Where a phytosanitary certificate for export is issued after the consignment's dispatch, and if required by the importing country the date of inspection should be added to this section of the phytosanitary certificate for export (see also applicable conditions in section 4).

Where additional official phytosanitary information is included for future phytosanitary certification purposes, such as re-export (see section 4), such information should be presented here. This information should be clearly separated from the additional declaration required by the importing country and should follow the added subheading "Additional official phytosanitary information".

III. Disinfestation and/or Disinfection Treatment

Entries should be as follows:

Date

The date that the treatment was applied to the consignment. Months should be written in full so that the month, day and year are not confused.

Treatment

The type of treatment applied to the consignment (e.g. heat treatment, irradiation).

Chemical (active ingredient)

The active ingredient of the chemical applied in the treatment.

Duration and temperature

The duration of the treatment and temperature in the treatment.

Concentration

The concentration and dosage of the treatment applied.

Additional information

Any relevant additional information.

Treatments indicated should only be those that are acceptable to the importing country and are performed or initiated (in the case of transit) in the exporting country under supervision or authority of the NPPO of the exporting country to meet the phytosanitary import requirements.

For irradiation treatments, the provisions of ISPM 18:2003 should be considered.

Stamp of organization

The official seal, stamp or mark identifying the issuing NPPO should be included on the phytosanitary certificate for export. The NPPO of the exporting country should normally use a uniform stamp, seal or mark within a country. It should be added by the public officer upon completion of the form or may be printed on the phytosanitary certificate for export. Care should be taken to ensure that the stamp, seal or mark does not obscure essential information.

Name of authorized officer, date and signature

The name of the public officer is printed, typed, stamped or handwritten in legible upper case (capital) letters (where the language allows it). The date is also to be printed, typed, stamped or handwritten in legible upper case (capital) letters (where the language allows it). The names of months should be written in full so that the month, day and year are not confused.

Although sections of the phytosanitary certificate for export may be completed in advance, the date stated should be the date of issuance. Upon request of the NPPO of the importing country, the NPPO of the exporting country should be able to verify the authenticity of signatures of authorized public officers. The phytosanitary certificate for export shall be signed only after it is duly completed.

When electronic phytosanitary certificates are issued, the certification data should be authenticated by the issuing NPPO. This authentication process is equivalent to the signature of the authorized public officer and stamp, seal or mark. Authenticated electronic certification data is equivalent to the completed paper document of the phytosanitary certificate for export.

Financial liability statement

The inclusion of a statement of the financial liability of the NPPO on the phytosanitary certificate for export is optional and at the discretion of the NPPO of the exporting country.

6. Considerations for Re-Export Situations and Transit

The phytosanitary certificate for re-export is the same as the phytosanitary certificate for export except for the text covering the certifying statement. In the certifying statement on the phytosanitary certificate for re-export, the NPPO of the country of re-export indicates by inserting ticks in the appropriate boxes whether the phytosanitary certificate for re-export is accompanied by the original phytosanitary certificate or a certified copy, whether the consignment has been repacked or not, whether the containers are original or new, and whether an additional inspection has been done.

If the identity of plants, plant products or other regulated articles in the consignment has not been maintained or the consignment has been subjected to the risk of infestation, or the commodity has been processed to change its nature, no phytosanitary certificate for re-export should be issued. The NPPO of the country of re-export, on request by exporters, may carry out appropriate phytosanitary procedures and if the NPPO is confident that the phytosanitary import requirements are met it should issue a phytosanitary certificate for export. The place of origin should still be indicated in brackets on the phytosanitary certificate for export.

If the NPPO of the country of re-export does not require a phytosanitary certificate for the import of a commodity but the NPPO of the country of destination does, and the phytosanitary import requirements can be fulfilled by visual inspections or laboratory testing of samples, the country of re-

export may issue a phytosanitary certificate for export with the country of origin indicated in brackets in the place of origin section of the phytosanitary certificate for export.

6.1 Considerations for issuing a phytosanitary certificate for re-export

When a consignment is imported into a country, then exported to another, the NPPO of the country of re-export, on request from exporters, may issue a phytosanitary certificate for re-export (see model in Annex 2). The NPPO should issue a phytosanitary certificate for re-export only if it is confident that the phytosanitary import requirements are met. Re-export phytosanitary certification may still be performed if the consignment has been stored, split up, combined with other consignments or repackaged, provided that it has not been exposed to infestation or contamination by pests. Where consignments are combined, all the relevant parts added to these consignments must be available and meet the same phytosanitary import requirements.

Before issuing a phytosanitary certificate for re-export, the NPPO should first examine the original phytosanitary certificate or certified copy that accompanied the consignment upon import and determine whether the requirements of the subsequent country of destination are more stringent, the same or less stringent than those certified by the phytosanitary certificate or its certified copies.

If the consignment is repacked or reloaded with its identity being affected or if a risk of infestation or contamination is identified, additional inspection should be carried out. If the consignment is not repacked and the phytosanitary security of the consignment has been maintained, the NPPO of the re-exporting country has two options regarding inspection of the consignment for re-export:

- If the phytosanitary import requirements are the same or less stringent, the NPPO of the re-exporting country may not need to undertake an additional inspection.
- If the phytosanitary import requirements are different or more stringent, the NPPO of the re-exporting country may undertake an additional inspection to ensure that the consignment conforms to the phytosanitary requirements of the importing country where this requirement can be met through inspection.

The country of destination may have phytosanitary import requirements (e.g. growing season inspection, soil testing) that cannot be fulfilled by the country of re-export. In such cases, the country of re-export may still be able to issue a phytosanitary certificate for export or phytosanitary certificate for re-export if:

- *either* particular information on compliance has been included or declared on the phytosanitary certificate for export by the country of origin
- *or* an alternative phytosanitary measure can be applied (such as laboratory tests on samples or treatments) that is considered equivalent and in accordance with the phytosanitary import requirements of the country of destination.

Additional declarations on phytosanitary certificates for re-export where required should be based on the activities of the NPPO of the country of re-export. Additional declarations from the original phytosanitary certificate or certified copies should not be transferred to phytosanitary certificates for re-export.

When re-exports routinely occur, or are started, suitable procedures for satisfying these requirements may be agreed between the NPPOs of the countries of origin and re-export. This may include an exchange of written correspondence between the respective NPPOs on phytosanitary measures applied at origin (e.g. growing season inspection, soil testing) which provides the assurance required for the country of re-export to certify the consignment as required by the country of destination.

The original phytosanitary certificate or its certified copy should accompany the consignment together with the phytosanitary certificate for re-export.

When a phytosanitary certificate for re-export is issued, the NPPO of the re-exporting country provides assurance related to the handling (e.g. splitting, combining, packing, storage) of the consignment in the country of re-export.

If the consignment is split up and the resulting consignments are re-exported separately, then phytosanitary certificates for re-export and certified copies of the phytosanitary certificate from the country of export will be required to accompany all such consignments.

The phytosanitary certificate for re-export shall be signed only after it is duly completed.

6.2 Transit

If a consignment is in transit through a country, the NPPO of the country of transit is not involved unless risks for the country of transit have been identified (ISPM 25:2006).

If the phytosanitary security of the consignment has been compromised during transit, and the NPPO of the country of transit receives a request to become involved, the NPPO may perform phytosanitary certification for export in accordance with the provisions described in this standard.

A change of means of conveyance during transit or the transport of two or more consignments in one conveyance should not be considered a reason to issue phytosanitary certificates unless the phytosanitary security of the consignment is compromised.

Importing countries may have specific phytosanitary import requirements (e.g. require seals, specific packaging) addressed to the country of export for the import of consignments to be moved in transit through other countries if specific risks have been identified.

This annex is a prescriptive part of the standard.

ANNEX 1: Model phytosanitary certificate for export

[Original annexed to the IPPC]

No. _____

Plant Protection Organization of _____

TO: Plant Protection Organization(s) of _____

I. Description of Consignment

Name and address of exporter: _____

Declared name and address of consignee: _____

Number and description of packages: _____

Distinguishing marks: _____

Place of origin: _____

Declared means of conveyance: _____

Declared point of entry: _____

Name of produce and quantity declared: _____

Botanical name of plants: _____

This is to certify that the plants, plant products or other regulated articles described herein have been inspected and/or tested according to appropriate official procedures and are considered to be free from the quarantine pests specified by the importing contracting party and to conform with the current phytosanitary requirements of the importing contracting party, including those for regulated non-quarantine pests.

They are deemed to be practically free from other pests.*

II. Additional Declaration

[Enter text here]

III. Disinfestation and/or Disinfection Treatment

Date _____ Treatment _____ Chemical (active ingredient) _____

Duration and temperature _____

Concentration _____

Additional information _____

_____

Place of issue _____

(Stamp of Organization) Name of authorized officer _____

Date _____ _____

(Signature)

_____

No financial liability with respect to this certificate shall attach to _____ (name of Plant Protection Organization) or to any of its officers or representatives.*

*Optional clause

This annex is a prescriptive part of the standard.

ANNEX 2: Model phytosanitary certificate for re-export

[Original annexed to the IPPC]

No. _____

Plant Protection Organization of _____ (contracting party of re-export)

TO: Plant Protection Organization(s) of _____ (contracting party(ies) of import)

I. Description of Consignment

Name and address of exporter: _____

Declared name and address of consignee: _____

Number and description of packages: _____

Distinguishing marks: _____

Place of origin: _____

Declared means of conveyance: _____

Declared point of entry: _____

Name of produce and quantity declared: _____

Botanical name of plants: _____

This is to certify that the plants, plant products or other regulated articles described above _____ were imported into (contracting party of re-export) _____ from _____ (contracting party of origin) covered by Phytosanitary certificate No. _____, *original ☐ certified true copy ☐ of which is attached to this certificate; that they are packed ☐ repacked ☐ in original ☐ *new ☐ containers, that based on the original phytosanitary certificate ☐ and additional inspection ☐, they are considered to conform with the current phytosanitary requirements of the importing contracting party, and that during storage in _____ (contracting party of re-export), the consignment has not been subjected to the risk of infestation or infection.

*Insert tick in appropriate ☐ boxes

II. Additional Declaration

[Enter text here]

III. Disinfestation and/or Disinfection Treatment

Date _____ Treatment _____ Chemical (active ingredient) _____

Duration and temperature _____

Concentration _____

Additional information _____

_____

Place of issue _____

(Stamp of Organization) Name of authorized officer_____

Date _____ _____

(Signature)

_____

No financial liability with respect to this certificate shall attach to _____ (name of Plant Protection Organization) or to any of its officers or representatives.**

**Optional clause

This appendix was adopted by the Ninth Session of the Commission on Phytosanitary Measures in April 2014.
This appendix is for reference purposes only and is not a prescriptive part of the standard.

APPENDIX 1: Electronic phytosanitary certificates, information on standard XML schemes and exchange mechanisms (2014)

Introduction

Electronic phytosanitary certificates are the electronic equivalents of phytosanitary certificates in paper form and may be used if they are accepted by the national plant protection organization (NPPO) of the importing country. When electronic phytosanitary certificates are issued by the NPPO of the exporting or re-exporting country, they should be made directly available to the NPPO of the importing country.

All the requirements and procedures in this standard apply to electronic phytosanitary certificates.

When using electronic phytosanitary certificates, NPPOs should develop a system for the issuance, transmission and receipt of electronic phytosanitary certificates that uses Extensible Markup Language (XML), standardized message structure and contents, and standardized exchange protocols.

This appendix provides guidance on these elements and refers to a page on the IPPC website (http://ePhyto.ippc.int) that provides links to further details – both IPPC and external websites and documents – on the information contained in this appendix. These links are referred to in the text as "*Link 1*", "*Link 2*" and so forth.

The system should include the following harmonized components to generate electronic phytosanitary certificates.

1. XML Message Structure

NPPOs should use the World Wide Web Consortium's (WC3) XML (*Link 1*) for exchange of electronic phytosanitary certification data.

The phytosanitary XML message structure is based on the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) Sanitary and Phytosanitary (SPS) XML schema (*Link 2*) and on XML data mapping, which indicates where the phytosanitary certification data should be placed in the XML schema.

The phytosanitary XML data mapping enables the generation of an electronic phytosanitary certificate for export (*Link 3*) and an electronic phytosanitary certificate for re-export (*Link 4*).

2. XML Schema Contents

To facilitate automatic electronic communication and processing of phytosanitary certification data, NPPOs are encouraged to use standardized (harmonized) terms, codes and text for the data elements associated with the XML message for electronic phytosanitary certificates.

The use of free (i.e. non-standardized) text should be limited when appropriate codes are available.

For dates and country names, harmonized text is available and no free text is anticipated to be required.

For scientific names of plants and pests, consignment description, treatments, additional declarations and points of entry, extensive lists of harmonized terms, codes and text are being developed and will be available. Free text may be inserted if the appropriate term, text or value does not appear in the lists.

The process for maintaining and updating the lists of harmonized terms is being developed and will be described on the IPPC website (http://ePhyto.ippc.int). NPPOs will be requested to submit proposals for new harmonized terms using this process.

For data elements other than those above, no harmonization of terms and text is needed and therefore free text may be entered.

Further details on the information to be entered for the data elements in the XML message are provided in the following subsections.

2.1 Country names

For the names of countries (i.e. the country of origin, export, re-export, transit and destination) it is encouraged that the two-letter country codes of the International Organization for Standardization (ISO) (*Link 6*) be used.

2.2 Scientific names of plants and pests

For the scientific names of the plants in the consignment, the plants from which plant products were derived, and the regulated pests, the use of the database of scientific names available on the IPPC website (http://ePhyto.ippc.int) (*Link 7*) is encouraged.

2.3 Description of consignment

The type of commodity and the type of packaging should be included in the description of the consignment. It is encouraged that] the commodity be described using IPPC commodity terminology (*Link 8*). It is also encouraged that the type of packaging be described using the United Nations Economic Commission for Europe (UNECE) Recommendation 21 (*Link 9*).

Other elements of the description of the consignment may include, where possible:

- weight, volume and height (which is encouraged to be described using UNECE Recommendation 20 (Link 10))
- declared means of conveyance (which is encouraged to be described using UNECE Recommendation 19 (*Link 16*))
- declared point of entry (which is encouraged to be described using the United Nations Code for Trade and Transportation Locations (UN/LOCODE) (*Link 15*)) or country name.

2.4 Treatments

It is encouraged that treatment types be specified using the IPPC's harmonized terms for treatment types (*Link 11*). Active ingredients are encouraged to be specified using the pesticide index of the Codex Alimentarius (*Link 12*). Other parameters (e.g. concentration, dosage, temperature, and duration of exposure) are encouraged to be described using UNECE Recommendation 20 (*Link 13*).

2.5 Additional declarations

Recommended standardized wording for additional declarations is provided in Appendix 2 and it is encouraged to be described using IPPC codes for additional declarations (*Link 14*). Free text may be used to supplement the additional declarations indicated on the IPPC website or to describe additional declarations that have not been standardized.

2.6 Name of authorized officer

The name of the authorized officer issuing the electronic phytosanitary certificates should be included in each types of electronic phytosanitary certificate.

3. Secure Data Exchange Mechanisms

NPPOs are responsible for the security of their national information technology (IT) system used for generating electronic phytosanitary certificates.

During transmission, the data should be encrypted to ensure that the electronic exchange of the electronic phytosanitary certification data between NPPOs is secure and authenticated. NPPOs should use a secure protocol with a minimum 128-bit encryption. Before transmission, the electronic phytosanitary certification data may be subjected to additional encryption (*Link 17*) that remains intact after transmission.

Transmission of data over the Internet from the NPPO of the exporting country to the NPPO of the importing country should be performed using secure IT mechanisms (e.g. Simple Object Access Protocol (SOAP), Secure/Multipurpose Internet Mail Extensions (S/MIME), File Transfer Protocol (FTP), Representative State Transfer (REST)) using systems that are mutually compatible.

The NPPO of the exporting country should make available to the exporter the actual electronic phytosanitary certificate number for the consignment.

Communication on the status of the message exchange between NPPOs should follow UN/CEFACT recommended standard messages (*Link 18*).

NPPOs are responsible for developing and maintaining their systems for exchanging electronic phytosanitary certification data. In cases where an exchange mechanism is suspended due to maintenance or unexpected system failure, the NPPO should notify other NPPOs as soon as possible.

4. Electronic Phytosanitary Certificate for Re-export

In paper-only systems, the original phytosanitary certificate for export or its certified copy should be available as an attachment to the phytosanitary certificate for re-export. In the situation where paper and electronic phytosanitary certificates are both in use, the following requirements should be met.

4.1 Electronic phytosanitary certificate for re-export with original phytosanitary certificate for export in electronic form

When both the phytosanitary certificate for export and the phytosanitary certificate for re-export are in electronic form, the electronic phytosanitary certificate for export should be attached electronically to the electronic phytosanitary certificate for re-export.

4.2 Electronic phytosanitary certificate for re-export with original phytosanitary certificate in paper form

When the original phytosanitary certificate for export is in paper form and the phytosanitary certificate for re-export is in electronic form, a scan of the original phytosanitary certificate for export (in PDF or other non-editable format) should be attached to the electronic phytosanitary certificate for re-export.

4.3 Paper phytosanitary certificate for re-export with original phytosanitary certificate in electronic form

When the original phytosanitary certificate for export is in electronic form and the phytosanitary certificate for re-export is in paper form, the electronic phytosanitary certificate for export should be printed and validated by the NPPO of the country of re-export by stamping, dating and countersigning. The printed version of the electronic phytosanitary certificate for export becomes a certified copy and should then, in paper form, be attached to the phytosanitary certificate for re-export.

5. Management of Electronic Phytosanitary Certificates Issued by NPPOs

5.1 Retrieval issues

If the NPPO of the importing country is unable to retrieve the electronic phytosanitary certificates, the NPPO of the exporting country should resubmit the original electronic phytosanitary certificates at the request of the NPPO of the importing country.

5.2 Alteration and replacement

If any of the information in electronic phytosanitary certificates needs to be altered after their issuance, the original electronic phytosanitary certificates should be revoked and replacement electronic phytosanitary certificates (*Link 5*) with alterations should be issued as described in this standard.

5.3 Cancelled dispatch

If the NPPO of the exporting country becomes aware of a consignment that is not dispatched after the issuance of electronic phytosanitary certificates, the NPPO of the exporting country should revoke the associated electronic phytosanitary certificates.

5.4 Certified copy

Certified copies of electronic phytosanitary certificates are printouts of the electronic phytosanitary certification data that are validated (stamped, dated and countersigned) by an NPPO attesting the authenticity of the data.

The printouts should be in the format that follows the standardized wording provided by the IPPC model phytosanitary certificates and recognized as phytosanitary certificates. However, the printouts may be XML data in XML format if accepted by the NPPO of the importing country.

6. Declared Name and Address of Consignee

In the case of paper phytosanitary certificates, for “Declared name and address of consignee” the term “To order” may be used in instances where the consignee is not known and the NPPO of the importing country permits use of the term.

With electronic phytosanitary certificates, the consignment information may arrive in the importing country well before the consignment arrives, which will allow pre-entry verification of the electronic phytosanitary certification data.

Instead of using the “To order” option, NPPOs are encouraged to require the electronic phytosanitary certificates to include the name and address of a contact person in the importing country responsible for the consignment.

This appendix is for reference purposes only and is not a prescriptive part of the standard.

APPENDIX 2: Recommended wording for additional declarations

Phytosanitary import requirements for additional declarations should preferably use the following wording. However, these are examples and are not the only statements that may be used.

1. The consignment* was inspected and found free from _____ (name of pest(s) or soil *[to be specified]*).

2. The consignment* was tested (method may be specified) and found free from _____ (name of pest(s)).

3. The growing media in which the plants were grown was tested prior to planting and found free from _____ (name of pest(s)).

4. _____ (Name of pest(s)) is absent/not known to occur in _____ (name of country/area).

5. The consignment* was produced in a
   pest free area for _____ (name of pest(s))**
   area of low pest prevalence for _____ (name of pest(s))
   pest free place of production for _____ (name of pest(s))**
   pest free production site for _____ (name of pest(s))**.

6. The place of production**/production site/field** was inspected during the growing season(s)*** and found free from _____ (name of pest(s)).

7. The plants/mother plants were inspected during the last growing season(s) *** and found free from _____ (name of pest(s)).

8. The plants were produced *in vitro* (specify the *in vitro* technique) and found free from _____ (name of pest(s)).

9. The plants were derived from mother plants that were tested (method may be specified) and found free from _____ (name of pest(s)).

10. This consignment* was produced and prepared for export in accordance with _____ (name of programme/reference to specific phytosanitary import requirement or a bilateral arrangement).

11. This consignment was produced from plant varieties resistant to _____ (name of pest).

12. Plants for planting are in compliance with _____ (specify the tolerance level(s)) established by phytosanitary import requirements for _____ (specify the regulated non-quarantine pest(s)).

* May be specified if this applies only to parts thereof.

** If applicable add: “including a surrounding buffer zone”.

*** Number of times/growing seasons or specific period may be added as appropriate.

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

ISPM 26

ESTABLISHMENT OF PEST FREE AREAS FOR FRUIT FLIES (TEPHRITIDAE)

(2006)

Produced by the Secretariat of the International Plant Protection Convention

Publication history

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2005-04 SC revised draft and approved for member consultation

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2006-04 CPM-1 added topic *Trapping procedures for fruit flies* (2006-037)

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2011-03 CPM-6 revised and adopted standard

ISPM 26. 2006: **Appendix 1** *Fruit fly trapping* (2011). Rome, IPPC, FAO.

2009-11 SC introduced topic *Establishment and maintenance of regulated areas upon outbreak detection in fruit fly free areas* (2009-007)

2010-03 CPM-5 added topic (2009-007)

2010-11 SC approved draft specification for member consultation

2011-02 Member consultation

2011-05 SC revised and approved Specification 53

2011-08 TPFF developed draft text

2012-04 SC revised and approved draft for member consultation

2012-06 Member consultation

2013-03 TPG reviewed comments

2013-05 SC-7 approved for Substantial concerns commenting period

2013-10 Substantial concerns commenting period

2013-11 SC approved draft to be submitted for adoption

2014-04 CPM-9 adopted Annex 2 to ISPM 26:2006.

ISPM 26. 2006: **Annex 2** *Control measures for an outbreak within a fruit fly-pest free area* (2014). Rome, IPPC, FAO.

2014-07 Secretariat corrected error in table of contents

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CONTENTS

Adoption

This standard was adopted by the First Session of the Commission on Phytosanitary Measures in April 2006. Revision of Appendix 1 on Fruit fly trapping was adopted by the Sixth Session of the Commission on Phytosanitary Measures in March 2011. Annex 2 was adopted by the Ninth Session of the Commission on Phytosanitary Measures in April 2014.

INTRODUCTION

Scope

This standard provides guidelines for the establishment of pest free areas for fruit flies (Tephritidae) of economic importance, and for the maintenance of their pest free status.

References

IPPC. 1997. *International Plant Protection Convention*. Rome, IPPC, FAO.

ISPM 4. 1995. *Requirements for the establishment of pest free areas*. Rome, IPPC, FAO. [published 1996]

ISPM 5. *Glossary of phytosanitary terms*. Rome, IPPC, FAO.

ISPM 6. 1997. *Guidelines for surveillance*. Rome, IPPC, FAO.

ISPM 8. 1998. *Determination of pest status in an area*. Rome, IPPC, FAO.

ISPM 9. 1998. *Guidelines for pest eradication programmes*. Rome, IPPC, FAO.

ISPM 10. 1999. *Requirements for the establishment of pest free places of production and pest free production sites*. Rome, IPPC, FAO.

ISPM 17. 2002. *Pest reporting*. Rome, IPPC, FAO.

Definitions

Definitions of phytosanitary terms used in the present standard can be found in ISPM 5 (*Glossary of phytosanitary terms*).

Outline of Requirements

The general requirements for establishing a fruit fly-pest free area (FF-PFA) include:

- the preparation of a public awareness programme
- the management elements of the system (documentation and review systems, record-keeping)
- supervision activities.

The major elements of the FF-PFA are:

- the characterization of the FF-PFA
- the establishment and maintenance of the FF-PFA.

These elements include the surveillance activities of trapping and fruit sampling, and official control on the movement of regulated articles. Guidance on surveillance and fruit sampling activities is provided in Appendixes 1 and 2.

Additional elements include: corrective action planning, suspension, loss of pest free status and reinstatement (if possible) of the FF-PFA. Corrective action planning is described in Annex 1.

BACKGROUND

Fruit flies are a very important group of pests for many countries due to their potential to cause damage in fruits and to their potential to restrict access to international markets for plant products that can host fruit flies. The high probability of introduction of fruit flies associated with a wide range of hosts results in restrictions imposed by many importing countries to accept fruits from areas in which these pests are established. For these reasons, there is a need for an ISPM that provides specific guidance for the establishment and maintenance of pest free areas for fruit flies.

A pest free area is "an area in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained" (ISPM 5). Areas initially free from fruit flies may remain naturally free from fruit flies due to the presence of barriers or climate conditions, and/or maintained free through movement restrictions and related measures (though fruit flies have the potential to establish there) or may be made free by an eradication programme (ISPM 9:1998). ISPM 4:1995 describes different types of pest free areas and provides general guidance on the establishment of pest free areas. However, a need for additional guidance on establishment and maintenance of pest free areas specifically for fruit flies (fruit fly-pest free areas, FF-PFA) was recognized. This standard describes additional requirements for establishment and maintenance of FF-PFAs. The target pests for which this standard was developed include insects of the order Diptera, family Tephritidae, of the genera *Anastrepha*, *Bactrocera*, *Ceratitis*, *Dacus*, *Rhagoletis* and *Toxotrypana*.

The establishment and maintenance of an FF-PFA implies that no other phytosanitary measures specific for the target species are required for host commodities within the PFA.

REQUIREMENTS

1. General Requirements

The concepts and provisions of ISPM 4:1995 apply to the establishment and maintenance of pest free areas for all pests including fruit flies and therefore ISPM 4 should be referred to in conjunction with this standard.

Phytosanitary measures and specific procedures as further described in this standard may be required for the establishment and maintenance of FF-PFA. The decision to establish a formal FF-PFA may be made based on the technical factors provided in this standard. They include components such as pest biology, size of the area, pest population levels and dispersal pathway, ecological conditions, geographical isolation and availability of methods for pest eradication.

FF-PFAs may be established in accordance with this ISPM under a variety of different situations. Some of them require the application of the full range of elements provided by this standard; others require only the application of some of these elements.

In areas where the fruit flies concerned are not capable of establishment because of climatic, geographical or other reasons, absence should be recognized according to the first paragraph of section 3.1.2 of ISPM 8:1998. If, however, the fruit flies are detected and can cause economic damage during a season (Article VII.3 of the IPPC), corrective actions should be applied in order to allow the maintenance of a FF-PFA.

In areas where the fruit flies are capable of establishment and known to be absent, general surveillance in accordance with section 3.1.2 of ISPM 8:1998 is normally sufficient for the purpose of delimiting and establishing a pest free area. Where appropriate, import requirements and/or domestic movement restrictions against the introduction of the relevant fruit fly species into the area may be required to maintain the area free from the pest.

1.1 Public awareness

A public awareness programme is most important in areas where the risk of introduction is higher. An important factor in the establishment and maintenance of FF-PFAs is the support and participation of the public (especially the local community) close to the FF-PFA and individuals that travel to or through the area, including parties with direct and indirect interests. The public and stakeholders should be informed through different forms of media (written, radio, TV) of the importance of establishing and maintaining the pest free status of the area, and of avoiding the introduction or re-introduction of potentially infested host material. This may contribute to and improve compliance with the phytosanitary measures for the FF-PFA. The public awareness and phytosanitary education programme should be ongoing and may include information on:

- permanent or random checkpoints
- posting signs at entry points and transit corridors
- disposal bins for host material
- leaflets or brochures with information on the pest and the pest free area
- publications (e.g. print, electronic media)
- systems to regulate fruit movement
- non-commercial hosts
- security of the traps
- penalties for non-compliance, where applicable.

1.2 Documentation and record-keeping

The phytosanitary measures used for the establishment and maintenance of FF-PFA should be adequately documented as part of phytosanitary procedures. They should be reviewed and updated regularly, including corrective actions, if required (see also ISPM 4:1995).

The records of surveys, detections, occurrences or outbreaks and results of other operational procedures should be retained for at least 24 months. Such records should be made available to the NPPO of the importing country on request.

1.3 Supervision activities

The FF-PFA programme, including regulatory control, surveillance procedures (for example trapping, fruit sampling) and corrective action planning should comply with officially approved procedures.

Such procedures should include official delegation of responsibility assigned to key personnel, for example:

- a person with defined authority and responsibility to ensure that the systems/procedures are implemented and maintained appropriately
- entomologist(s) with responsibility for the authoritative identification of fruit flies to species level.

The effectiveness of the programme should be monitored periodically by the NPPO of the exporting country, through review of documentation and procedures.

2. Specific Requirements

2.1 Characterization of the FF-PFA

The determining characteristics of the FF-PFA include:

- the target fruit fly species and its distribution within or adjacent to the area
- commercial and non-commercial host species

- delimitation of the area (detailed maps or global positioning system (GPS) coordinates showing the boundaries, natural barriers, entry points and host area locations, and, where necessary, buffer zones)
- climate, for example rainfall, relative humidity, temperature, prevailing wind speed and direction.

Further guidance on establishing and describing a PFA is provided in ISPM 4:1995.

2.2 Establishment of the FF-PFA

The following should be developed and implemented:

- surveillance activities for establishment of the FF-PFA
- delimitation of the FF-PFA
- phytosanitary measures related to movement of host material or regulated articles
- pest suppression and eradication techniques as appropriate.

The establishment of buffer zones may also be necessary (as described in section 2.2.1) and it may be useful to collect additional technical information during the establishment of the FF-PFA.

2.2.1 Buffer zone

In areas where geographic isolation is not considered adequate to prevent introduction to or reinfestation of a PFA or where there are no other means of preventing fruit fly movement to the PFA, a buffer zone should be established. Factors that should be considered in the establishment and effectiveness of a buffer zone include:

- pest suppression techniques which may be used to reduce the fruit fly population, including:
  - use of selective insecticide-bait
  - spraying
  - sterile insect technique
  - male annihilation technique
  - biological control
  - mechanical control, etc.
- host availability, cropping systems, natural vegetation
- climatic conditions
- the geography of the area
- capacity for natural spread through identified pathways
- the ability to implement a system to monitor the effectiveness of buffer zone establishment (e.g. trapping network).

2.2.2 Surveillance activities prior to establishment

A regular survey programme should be established and implemented. Trapping is the preferred option to determine fruit fly absence or presence in an area for lure/bait responsive species. However, fruit sampling activities may sometimes be required to complement the trapping programme in cases where trapping is less effective, for example when species are less responsive to specific lures.

Prior to the establishment of a FF-PFA, surveillance should be undertaken for a period determined by the climatic characteristics of the area, and as technically appropriate for at least 12 consecutive months in the FF-PFA in all relevant areas of commercial and non-commercial host plants to demonstrate that the pest is not present in the area. There should be no populations detected during the surveillance activities prior to establishment. A single adult detection, depending on its status (in accordance with ISPM 8:1998), may not disqualify an area from subsequent designation as an FF-PFA. For qualifying the area as a pest free area, there should be no detection of an immature

specimen, two or more fertile adults, or an inseminated female of the target species during the survey period. There are different trapping and fruit sampling regimes for different fruit fly species. Surveys should be conducted using the guidelines in Appendixes 1 and 2. These guidelines may be revised as trap, lure and fruit sampling efficiencies improve.

2.2.2.1 Trapping procedures

This section contains general information on trapping procedures for target fruit fly species. Trapping conditions may vary depending on, for example, the target fruit fly and environmental conditions. More information is provided in Appendix 1. When planning for trapping, the following should be considered.

Trap type and lures

Several types of traps and lures have been developed over decades to survey fruit fly populations. Fly catches differ depending on the types of lure used. The type of trap chosen for a survey depends on the target fruit fly species and the nature of the attractant. The most widely used traps include Jackson, McPhail, Steiner, open bottom dry trap (OBDT), yellow panel traps, which may use specific attractants (para-pheromone or pheromone lures that are male specific), or food or host odours (liquid protein or dry synthetic). Liquid protein is used to catch a wide range of different fruit fly species and capture both females and males, with a slightly higher percentage of females captured. However identification of the fruit flies can be difficult due to decomposition within the liquid bait. In traps such as McPhail, ethylene glycol may be added to delay decomposition. Dry synthetic protein baits are female biased, capture less non-target organisms and, when used in dry traps, may prevent premature decomposition of captured specimens.

Trap density

Trap density (number of traps per unit area) is a critical factor for effective fruit fly surveys and it should be designed based on target fruit fly species, trap efficiency, cultivation practices, and other biotic and abiotic factors. Density may change depending on the programme phase, with different densities required during the establishment of FF-PFA and the maintenance phase. Trap density also depends on the risk associated with potential pathways for entry into the designated PFA.

Trap deployment (determination of the specific location of the traps)

In a FF-PFA programme, an extensive trapping network should be deployed over the entire area. The trapping network layout will depend on the characteristics of the area, host distribution and the biology of the fruit fly of concern. One of the most important features of trap placement is the selection of a proper location and trap site within the host plant. The application of GPS and geographic information systems (GIS) are useful tools for management of a trapping network.

Trap location should take into consideration the presence of the preferred hosts (primary, secondary and occasional hosts) of the target species. Because the pest is associated with maturing fruit, the location including rotation of traps should follow the sequence of fruit maturity in host plants. Consideration should be given to commercial management practices in the area where host trees are selected. For example, the regular application of insecticides (and/or other chemicals) to selected host trees may have a false-negative effect on the trapping programme.

Trap servicing

The frequency of trap servicing (maintaining and refreshing the traps) during the period of trapping should depend on the:

- longevity of baits (attractant persistency)
- retention capacity
- rate of catch
- season of fruit fly activity
- placement of the traps

- biology of the species
- environmental conditions.

Trap inspection (checking the traps for fruit flies)

The frequency of regular inspection during the period of trapping should depend on:

- expected fruit fly activity (biology of the species)
- response of the target fruit fly in relation to host status at different times of the year
- relative number of target and non-target fruit flies expected to be caught in a trap
- type of trap used
- physical condition of the flies in the trap (and whether they can be identified).

In certain traps, specimens may degrade quickly making identification difficult or impossible unless the traps are checked frequently.

Identification capability

NPPOs should have in place, or have ready access to, adequate infrastructure and trained personnel to identify detected specimens of the target species in an expeditious manner, preferably within 48 hours. Continuous access to expertise may be necessary during the establishment phase or when implementing corrective actions.

2.2.2.2 Fruit sampling procedures

Fruit sampling may be used as a surveillance method in combination with trapping where trapping is less effective. It should be noted that fruit sampling is particularly effective in small-scale delimiting surveys in an outbreak area. However, it is labour-intensive, time consuming and expensive due to the destruction of fruit. It is important that fruit samples should be held in suitable condition to maintain the viability of all immature stages of fruit fly in infested fruit for identification purpose.

Host preference

Fruit sampling should take into consideration the presence of primary, secondary and occasional hosts of the target species. Fruit sampling should also take into account the maturity of fruit, apparent signs of infestation in fruit, and commercial practices (e.g. application of insecticides) in the area.

Focusing on high-risk areas

Fruit sampling should be targeted on areas likely to have presence of infested fruits such as:

- urban areas
- abandoned orchards
- rejected fruit at packing facilities
- fruit markets
- sites with a high concentration of primary hosts
- entrance points into the FF-PFA, where appropriate.

The sequence of hosts that are likely to be infested by the target fruit fly species in the area should be used as fruit sampling areas.

Sample size and selection

Factors to be considered include:

- the required level of confidence
- the availability of primary host material in the field
- fruits with symptoms on trees, fallen or rejected fruit (for example at packing facilities), where appropriate.

Procedures for processing sampled fruit for inspection

Fruit samples collected in the field should be brought to a facility for holding, fruit dissection, pest recovery and identification. Fruit should be labelled, transported and held in a secure manner to avoid mixing fruits from different samples.

Identification capability

NPPOs should have in place, or have ready access to, adequate infrastructure and trained personnel to identify fruit fly immature stages and emerged adults of the target species in an expeditious manner.

2.2.3 Controls on the movement of regulated articles

Movement controls of regulated articles should be implemented to prevent the entry of target pests into the FF-PFA. These controls depend on the assessed risks (after identification of likely pathways and regulated articles) and may include:

- listing of the target fruit fly species on a quarantine pest list
- regulation of the pathways and articles that require control to maintain the FF-PFA
- domestic restrictions to control the movement of regulated articles into the FF-PFA
- inspection of regulated articles, examination of relevant documentation as appropriate and, where necessary for cases of non-compliance, the application of appropriate phytosanitary measures (e.g. treatment, refusal or destruction).

2.2.4 Additional technical information for establishment of a FF-PFA

Additional information may be useful during the establishment phase of FF-PFAs. This includes:

- historical records of detection, biology and population dynamics of the target pest(s), and survey activities for the designated target pest(s) in the FF-PFA
- the results of phytosanitary measures taken as part of actions following detections of fruit flies in the FF-PFA
- records of the commercial production of host crops in the area, an estimate of non-commercial production and the presence of wild host material
- lists of the other fruit fly species of economic importance that may be present in the FF-PFA.

2.2.5 Domestic declaration of pest freedom

The NPPO should verify the fruit fly free status of the area (in accordance with ISPM 8:1998) specifically by confirming compliance with the procedures set up in accordance with this standard (surveillance and controls). The NPPO should declare and notify the establishment of the FF-PFA, as appropriate.

In order to be able to verify the fruit fly free status in the area and for purposes of internal management, the continuing FF-PFA status should be checked after the PFA has been established and any phytosanitary measures for the maintenance of the FF-PFA have been put in place.

2.3 Maintenance of the FF-PFA

In order to maintain the FF-PFA status, the NPPO should continue to monitor the operation of the surveillance and control activities, continuously verifying the pest free status.

2.3.1 Surveillance for maintenance of the FF-PFA

After verifying and declaring the FF-PFA, the official surveillance programme should be continued at a level assessed as being necessary for maintenance of the FF-PFA. Regular technical reports of the survey activities should be generated (for example monthly). Requirements for this are essentially the same as for establishment of the FF-PFA (see section 2.2) but with differences in density and trap locations dependent upon the assessed level of risk of introduction of the target species.

2.3.2 Controls on the movement of regulated articles

These are the same as for establishment of the FF-PFA (provided in section 2.2.3).

2.3.3 Corrective actions (including response to an outbreak)

The NPPO should have prepared plans for corrective actions that may be implemented if the target pest(s) is detected in the FF-PFA or in host material from that area (detailed guidelines are provided in Annex 1), or if faulty procedures are found. This plan should include components or systems to cover:

- outbreak declaration according to criteria in ISPM 8:1998 and notification
- delimiting surveillance (trapping and fruit sampling) to determine the infested area under corrective actions
- implementation of control measures
- further surveillance
- criteria for the reinstatement of freedom of the area affected by the outbreak
- responses to interceptions.

A corrective action plan should be initiated as soon as possible and in any case within 72 hours of the detection (of an adult or immature stage of the target pest).

2.4 Suspension, reinstatement or loss of a FF-PFA status

2.4.1 Suspension

The status of the FF-PFA or the affected part within the FF-PFA should be suspended when an outbreak of the target fruit fly occurs or based on one of the following triggers: detection of an immature specimen of the target fruit fly, two or more fertile adults as demonstrated by scientific evidence, or an inseminated female within a defined period and distance. Suspension may also be applied if procedures are found to be faulty (for example inadequate trapping, host movement controls or treatments).

If the criteria for an outbreak are met, this should result in the implementation of the corrective action plan as specified in this standard and immediate notification to interested importing countries' NPPOs (see ISPM 17:2002). The whole or part of the FF-PFA may be suspended or revoked. In most cases a suspension radius will delimit the affected part of the FF-PFA. The radius will depend on the biology and ecology of the target fruit fly. The same radius will generally apply for all FF-PFAs for a given target species unless scientific evidence supports any proposed deviation. Where a suspension is put in place, the criteria for lifting the suspension should be made clear. Interested importing countries' NPPOs should be informed of any change in FF-PFA status.

2.4.2 Reinstatement

Reinstatement should be based on requirements for establishment with the following conditions:

- no further detection of the target pest species for a period determined by the biology of the species and the prevailing environmental conditions[1], as confirmed by surveillance, or
- in the case of a fault in the procedures, only when the fault has been corrected.

2.4.3 Loss of FF-PFA status

If the control measures are not effective and the pest becomes established in the whole area (the area recognized as pest free), the status of the FF-PFA should be lost. In order to achieve again the FF-PFA, the procedures of establishment and maintenance outlined in this standard should be followed.

[1] The period starts from the last detection. For some species, no further detection should occur for at least three life cycles; however the required period should be based on scientific information including that provided by the surveillance systems in place.

This annex is a prescriptive part of the standard.

ANNEX 1: Guidelines on corrective action plans

The detection of a single fruit fly (adult or immature) of the target species in the FF-PFA should trigger enforcement of a corrective action plan.

In case of an outbreak, the objective of the corrective action plan is to ensure eradication of the pest to enable reinstatement of pest status in the affected area into the FF-PFA.

The corrective action plan should be prepared taking into account the biology of the target fruit fly species, the geography of the FF-PFA area, climatic conditions and host distribution within the area.

The elements required for implementation of a corrective action plan include:

- legal framework under which the corrective action plan can be applied
- criteria for the declaration of an outbreak
- time scales for the initial response
- technical criteria for delimiting trapping, fruit sampling, application of the eradication actions and establishment of regulatory measures
- availability of sufficient operational resources
- identification capability
- effective communication within the NPPO and with the NPPO(s) of the importing country(ies), including provision of contact details of all parties involved.

Actions to apply the corrective action plan

(1) *Determination of the phytosanitary status of the detection (actionable or non-actionable)*

(1.1) If the detection is a transient non-actionable occurrence (ISPM 8:1998), no further action is required.

(1.2) If the detection of a target pest may be actionable, a delimiting survey, which includes additional traps, and usually fruit sampling as well as an increased trap inspection rate, should be implemented immediately after the detection to assess whether the detection represents an outbreak, which will determine necessary responsive actions. If a population is present, this action is also used to determine the size of the affected area.

(2) *Suspension of FF-PFA status*

If after detection it is determined that an outbreak has occurred or any of the triggers specified in section 2.4.1 is reached, the FF-PFA status in the affected area should be suspended. The affected area may be limited to parts of the FF-PFA or may be the whole FF-PFA.

(3) *Implementation of control measures in the affected area*

As per ISPM 9:1998, specific corrective or eradication actions should be implemented immediately in the affected area(s) and adequately communicated to the community. Eradication actions may include:

- selective insecticide-bait treatments
- sterile fly release
- total harvest of fruit in the trees
- male annihilation technique
- destruction of infested fruit
- soil treatment (chemical or physical)
- insecticide application.

Phytosanitary measures should be immediately enforced for control of movement of regulated articles that can host fruit flies. These measures may include cancellation of shipments of fruit commodities

from the affected area and as appropriate, fruit disinfestation and the operation of road blocks to prevent the movement of infested fruit from the affected area to the rest of the pest free area. Other measures could be adopted if agreed by the importing country, for example treatment, increased surveys, supplementary trapping.

(4) *Criteria for reinstatement of a FF-PFA after an outbreak and actions to be taken*

The criteria for determining that eradication has been successful are specified in section 2.4.2 and should be included in the corrective action plan for the target fruit fly. The time period will depend on the biology of the species and the prevailing environmental conditions. Once the criteria have been fulfilled the following actions should be taken:

- notification of NPPOs of importing countries
- reinstatement of normal surveillance levels
- reinstatement of the FF-PFA.

(5) *Notification of relevant agencies*

Relevant NPPOs and other agencies should be kept informed of any change in FF-PFA status as appropriate, and IPPC pest reporting obligations observed (ISPM 17:2002).

This annex was adopted by the Ninth Session of the Commission on Phytosanitary Measures in April 2014.
This annex is a prescriptive part of the standard.

ANNEX 2: Control measures for an outbreak within a fruit fly-pest free area (2014)

BACKGROUND

A fruit fly (Tephritidae) outbreak detected in a fruit fly-pest free area (FF-PFA) may pose a risk for those importing countries where the fruit fly species is considered a quarantine pest. This annex describes control measures to be taken in a fruit fly eradication area established within an FF-PFA in the event of an outbreak.

Corrective actions and other phytosanitary measures that may be used in an eradication area within an FF-PFA are covered by this standard.

The eradication area and the related control measures are established with the intent to eradicate the target fruit fly species and restore FF-PFA status, to protect the surrounding FF-PFA, and to meet the phytosanitary import requirements of the importing country, where applicable. In particular, control measures are needed because movements of regulated articles from and through an eradication area pose a potential risk of spreading the target fruit fly species.

1. Establishment of an Eradication Area

The national plant protection organization (NPPO) of the exporting country should declare an outbreak in accordance with this and other relevant international standards for phytosanitary measures. When a target fruit fly species outbreak is detected within an FF-PFA, an eradication area should be established based on a technical evaluation. The free status of the eradication area should be suspended. If control measures cannot be applied to establish an eradication area, then the status of the FF-PFA should be revoked in accordance with this standard.

The eradication area should cover the infested area. In addition, a buffer zone should be established in accordance with this standard, and as determined by delimiting surveys, taking into account the natural dispersal capability of the target fruit fly species, its relevant biological characteristics, and other geographic and environmental factors.

A circle delimiting the minimum size of the eradication area should be drawn, centred on the actual target fruit fly species detection and with a radius large enough to comply with the above considerations, as determined by the NPPO of the exporting country. In the case of several pest detections, several (possibly overlapping) circles should be drawn accordingly, as illustrated in Figure 1.

If necessary for the practical implementation of the eradication area, the NPPO of the exporting country may decide to adjust the eradication area to correspond to administrative boundaries or topography, or to approximate the circle with a polygon.

A georeferencing device (e.g. global positioning system (GPS)) or map with geographical coordinates may be used for delimiting and enabling recognition of the eradication area. Signposts may be placed along boundaries and on roads to alert the public, and notices may be published to facilitate public awareness.

The NPPO of the exporting country should inform the NPPO of the importing country when a fruit fly outbreak is confirmed and an eradication area is established within an FF-PFA.

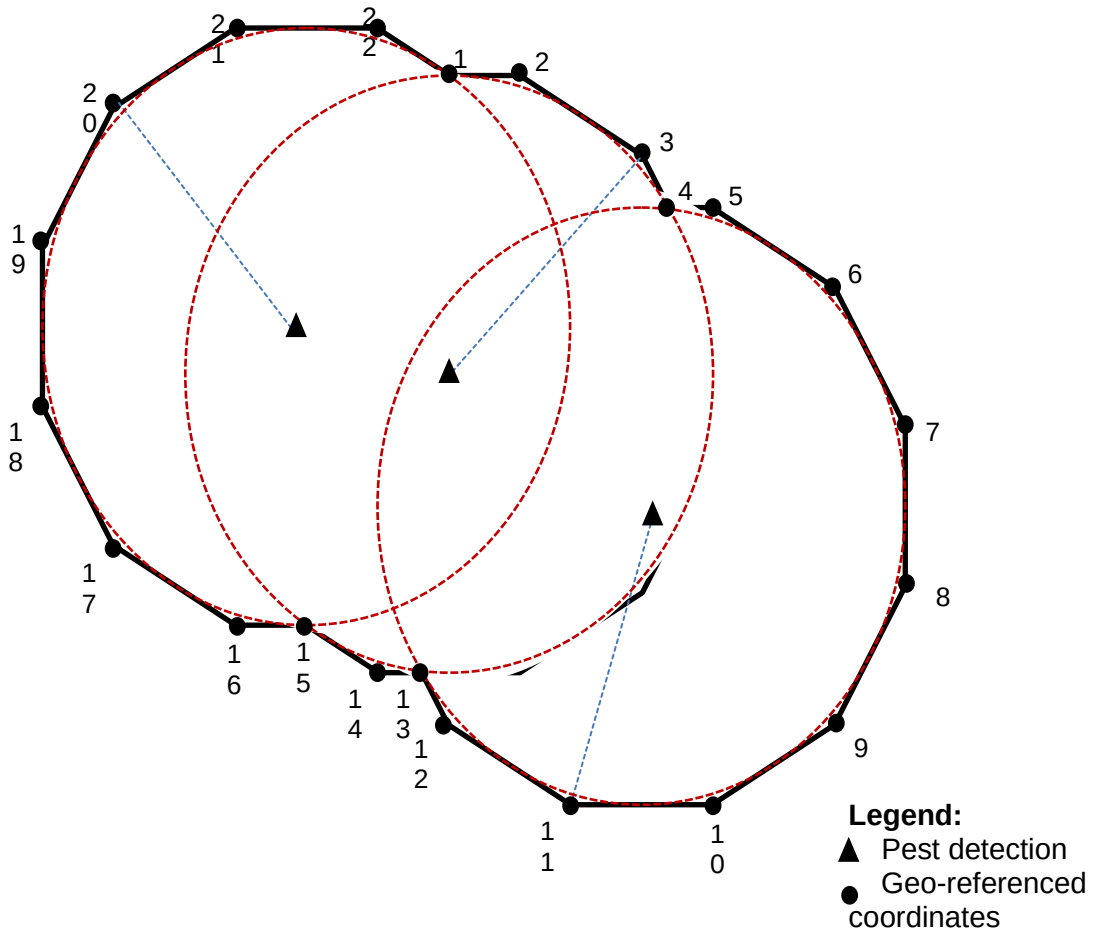

Figure 1: Example of delimiting circles and approximating polygons to determine the eradication area around three pest detections.

2. Control Measures

Each stage of the production chain (e.g. growing, sorting, packing, transporting, dispatching) may lead to spread of the target fruit fly species from the eradication area into the FF-PFA. This statement does not apply to any facilities located in the FF-PFA and handling only host fruit from the FF-PFA. Appropriate control measures should be applied to manage the pest risk for the surrounding FF-PFA and the importing country.

Control measures in use in other fruit fly-infested areas may be implemented in the eradication area.

Control measures may be audited by the NPPO of the importing country, in accordance with the NPPO of the exporting country's requirements.

Control measures applied at each stage of the production chain are described in the following sections.

2.1 Production

During the production period, within the eradication area, the NPPO of the exporting country may require control measures to avoid infestation, such as fruit bagging, fruit stripping (i.e. removal of unwanted fruits from trees), protein bait sprays, sterile insect technique, parasitoid releases, field sanitation, male annihilation technique, bait stations or netting.

2.2 Movement of regulated articles

Movement of regulated articles (e.g. soil, host plants, host fruit) into, from, through or within the eradication area should comply with control measures to prevent the spread of the target fruit fly species and should be accompanied by the necessary documentation to indicate the articles' origin and destination. This also pertains to moving regulated articles for phytosanitary certification.

2.3 Packing and packing facilities

Fruit packing facilities may be located within or outside the eradication area and may pack host fruit grown in or outside the eradication area. Control measures preventing spread of the target fruit fly species should be taken into account in each case.

The NPPO of the exporting country should:

- register the facility
- require control measures to prevent the target fruit fly species from entering or escaping the facility, as appropriate
- require and approve methods of physical separation of different host fruit lots (e.g. by using insect-proof packaging) to avoid cross-contamination
- require appropriate measures to maintain segregation of host fruits originating from areas of different pest status (e.g. separate locations for reception, processing, storage and dispatch)
- require appropriate measures regarding the handling and movement of host fruit through the facility to prevent mixing of fruit from areas of different pest status (e.g. flowcharts, signs and staff training)
- require and approve methods of disposal of rejected host fruit from the eradication area
- monitor the target fruit fly species at the facility and, if relevant, in the adjacent FF-PFA
- verify the packing material is insect proof and clean
- require appropriate control measures to eradicate target fruit fly species from the facility when they are detected
- audit the facility.

2.4 Storage and storage facilities

Fruit storage facilities may be located within or outside the eradication area. Such facilities should be registered with the NPPO of the exporting country and comply with the control measures to prevent the spread of the target fruit fly species; for example, they should:

- maintain distinction and separation between host fruit originating from the eradication area and from the FF-PFA
- use an approved method of disposal of host fruit from the eradication area that has been rejected as a result of inspection or quality control activities
- monitor for the target fruit fly species at the facility and if relevant, in the adjacent FF-PFA
- take appropriate control measures to eradicate the target fruit fly species from the facility when detected.

2.5 Processing and processing facilities

If the processing facility is located within the eradication area, host fruit destined for processing (such as juicing, canning and puréeing) does not pose additional fruit fly risk to the area.

If the facility is located outside the eradication area, the NPPO of the exporting country should require measures within the facility to prevent the escape of the target fruit fly species, through insect-proof reception, storage and processing areas.

Monitoring for the target fruit fly species may be conducted at the facility and, if relevant, in the adjacent FF-PFA. Appropriate control measures should be taken to eradicate target fruit fly species from the facility when they are detected.

Approved disposal of rejected host fruit and plant waste from the eradication area should be required by the NPPO of the exporting country. Rejected host fruit should be disposed of in such a way that the target fruit fly species are rendered non-viable.

2.6 Treatment and treatment facilities

Treatment facilities should be registered by the NPPO of the exporting country.

Post-harvest treatment (e.g. cold treatment, heat treatment, fumigation, irradiation), or in some cases pre-harvest treatment (e.g. bait spray, fruit bagging), may be required for host fruit moving into an FF-PFA or being exported to countries where the target fruit fly species is regulated as quarantine pest.

Control measures preventing the escape of the target fruit fly species may be required for treatment facilities located within the FF-PFA, if treating regulated articles from the eradication area. The NPPO of the exporting country may require physical isolation within the facility.
The NPPO of the exporting country should approve the method of disposal of rejected host fruit from the eradication area to reduce the risk of spread of the target fruit fly species. Disposal methods may include double bagging followed by deep burial or incineration.

2.7 Sale inside the eradication area

Host fruit sold within the eradication area may be at risk of infestation if exposed before being sold (e.g. placed on display in an open air market) and may therefore need to be physically protected, when feasible, to avoid spread of the target fruit fly species while on display and being stored.

3. Documentation and Record-Keeping

The control measures, including corrective actions, used in the eradication area should be adequately documented, reviewed and updated (see also ISPM 4:1995). Such documents should be made available to the NPPO of the importing country on request.

4. Termination of Control Measures in the Eradication Area

Eradication of the target fruit fly species in the eradication area should meet the requirements for reinstatement of an FF-PFA status after an outbreak, according to this standard. The declaration of eradication should be based on no further detections of the target fruit fly species for a period determined by its biology and prevailing environmental conditions, as confirmed by surveillance referred to in this standard.[2]

The control measures should remain in force until eradication is declared. If eradication is successful, the particular control measures in the eradication area may be terminated and the FF-PFA status should be reinstated. If eradication is unsuccessful, the FF-PFA delimitation should be modified accordingly. The NPPO of the importing country should be notified as appropriate.

[2] The period starts from the last detection. For some species, no further detection should occur for at least three life cycles; however, the required period should be based on scientific information, including that provided by the surveillance systems in place.

This appendix was adopted by the Sixth Session of the Commission on Phytosanitary Measures in March 2011.
This appendix is for reference purposes only and is not a prescriptive part of the standard.

APPENDIX 1: Fruit fly trapping (2011)

This appendix provides detailed information for trapping procedures for fruit fly species (Tephritidae) of economic importance under different pest statuses. Specific traps, in combination with attractants, and killing and preserving agents, should be used depending on the technical feasibility, the species of fruit fly and the pest status of the areas, which can be either an infested area, an area of low pest prevalence (FF-ALPP), or a pest free area (FF-PFA). It describes the most widely used traps, including materials such as trapping devices and attractants, and trapping densities, as well as procedures including evaluation, data recording and analysis.

1. Pest status and survey types

There are five pest statuses where surveys may be applied:

A. Pest present without control. The pest is present but not subject to any control measures.

B. Pest present under suppression. The pest is present and subject to control measures. Includes FF-ALPP.

C. Pest present under eradication. The pest is present and subject to control measures. Includes FF-ALPP.

D. Pest absent and FF-PFA being maintained. The pest is absent (e.g. eradicated, no pest records, no longer present) and measures to maintain pest absence are applied.

E. Pest transient. Pest under surveillance and actionable, under eradication.

The three types of surveys and corresponding objectives are:

- **monitoring surveys**, applied to verify the characteristics of the pest population
- **delimiting surveys**, applied to establish the boundaries of an area considered to be infested by or free from the pest
- **detection surveys**, applied to determine if the pest is present in an area.

Monitoring surveys are necessary to verify the characteristics of the pest population before the initiation or during the application of suppression and eradication measures to verify the population levels and to evaluate the efficacy of the control measures. These are necessary for situations A, B and C. Delimiting surveys are applied to determine the boundaries of an area considered to be infested by or free from the pest such as boundaries of an established FF-ALPP (situation B) (ISPM 30:2008) and as part of a corrective action plan when the pest exceeds the established low prevalence levels or in an FF-PFA (situation E) (ISPM 26:2006) as part of a corrective action plan when a detection occurs. Detection surveys are to determine if the pest is present in an area, that is to demonstrate pest absence (situation D) and to detect a possible entry of the pest into the FF-PFA (pest transient actionable) (ISPM 8:1998).

Additional information on how or when specific types of surveys should be applied can be found in other standards dealing with specific topics such as pest status, eradication, pest free areas or areas of low pest prevalence.

2. Trapping scenarios

As the pest status may change over time, the type of survey needed may also change:

- Pest present. Starting from an established population with no control (situation A), phytosanitary measures may be applied, and potentially lead toward an FF-ALPP (situation B and C) or an FF-PFA (situation D).
- Pest absent. Starting from an FF-PFA (situation D), the pest status is either maintained or a detection occurs (situation E), where measures would be applied aimed at restoring the FF-PFA.

3. Trapping materials

The effective use of traps relies on the proper combination of trap, attractant and killing agent to attract, capture, kill and preserve the target fruit fly species for effective identification, counting data collection and analysis. Traps for fruit fly surveys use the following materials as appropriate:

- a trapping device
- attractants (pheromones, parapheromones and food attractants)
- killing agents in wet and dry traps (with physical or chemical action)
- preservation agents (wet or dry).

3.1 Attractants

Some fruit fly species of economic importance and the attractants commonly used to capture them are presented in Table 1. Presence or absence of a species from this table does not indicate that pest risk analysis has been performed and in no way is it indicative of the regulatory status of a fruit fly species.

Table 1. A number of fruit fly species of economic importance and commonly used attractants

Scientific name	Attractant
Anastrepha fraterculus (Wiedemann)[4]	Protein attractant (PA)
Anastrepha grandis (Macquart)	PA
Anastrepha ludens (Loew)	PA, 2C-1[1]
Anastrepha obliqua (Macquart)	PA, 2C-1[1]
Anastrepha serpentina (Wiedemann)	PA
Anastrepha striata (Schiner)	PA
Anastrepha suspensa (Loew)	PA, 2C-1[1]
Bactrocera carambolae (Drew & Hancock)	Methyl eugenol (ME)
Bactrocera caryeae (Kapoor)	ME
Bactrocera correcta (Bezzi)	ME
Bactrocera dorsalis (Hendel)[4]	ME
Bactrocera invadens (Drew, Tsuruta, & White)	ME, 3C[2]
Bactrocera kandiensis (Drew & Hancock)	ME
Bactrocera musae (Tryon)	ME
Bactrocera occipitalis (Bezzi)	ME
Bactrocera papayae (Drew & Hancock)	ME
Bactrocera philippinensis (Drew & Hancock)	ME
Bactrocera umbrosa (Fabricius)	ME
Bactrocera zonata (Saunders)	ME, 3C[2], ammonium acetate (AA)
Bactrocera cucurbitae (Coquillett)	Cuelure (CUE), 3C[2], AA
Bactrocera neohumeralis (Hardy)	CUE
Bactrocera tau (Walker)	CUE
Bactrocera tryoni (Froggatt)	CUE
Bactrocera citri (Chen) (*B. minax*, Enderlein)	PA
Bactrocera cucumis (French)	PA
Bactrocera jarvisi (Tryon)	PA
Bactrocera latifrons (Hendel)	PA
Bactrocera oleae (Gmelin)	PA, ammonium bicarbonate (AC), spiroketal (SK)
Bactrocera tsuneonis (Miyake)	PA

Scientific name	Attractant
Ceratitis capitata (Wiedemann)	Trimedlure (TML), Capilure (CE), PA, 3C[2], 2C-2[3]
Ceratitis cosyra (Walker)	PA, 3C[2], 2C-2[3]
Ceratitis rosa (Karsch)	TML, PA, 3C[2], 2C-2[3]
Dacus ciliatus (Loew)	PA, 3C[2], AA
Myiopardalis pardalina (Bigot)	PA
Rhagoletis cerasi (Linnaeus)	Ammonium salts (AS), AA, AC
Rhagoletis cingulata (Loew)	AS, AA, AC
Rhagoletis indifferens (Curran)	AA, AC
Rhagoletis pomonella (Walsh)	butyl hexanoate (BuH), AS
Toxotrypana curvicauda (Gerstaecker)	2-methyl-vinylpyrazine (MVP)

[1] Two-component (2C-1) synthetic food attractant of ammonium acetate and putrescine, mainly for female captures.

[2] Three-component (3C) synthetic food attractant, mainly for female captures (ammonium acetate, putrescine, trimethylamine).

[3] Two-component (2C-2) synthetic food attractant of ammonium acetate and trimethylamine, mainly for female captures.

[4] Taxonomic status of some listed members of the *Bactrocera dorsalis* complex and of *Anastrepha fraterculus* is uncertain.

3.1.1 Male-specific attractants

The most widely used attractants are pheromone or parapheromones that are male specific. The parapheromone trimedlure (TML) captures species of the genus *Ceratitis* (including *C. capitata* and *C. rosa*). The parapheromone methyl eugenol (ME) captures a large number of species of the genus *Bactrocera* (including *B. carambolae, B. dorsalis, B. invadens, B. musae, B. philippinensis* and *B. zonata*). The pheromone spiroketal captures *B. oleae*. The parapheromone cuelure (CUE) captures a large number of other *Bactrocera* species, including *B. cucurbitae* and *B. tryoni*. Parapheromones are generally highly volatile and can be used with a variety of traps (examples are listed in Table 2a). Controlled-release formulations exist for TML, CUE and ME, providing a longer-lasting attractant for field use. It is important to be aware that some inherent environmental conditions may affect the longevity of pheromone and parapheromone attractants.

3.1.2 Female-biased attractants

Female-specific pheromones/parapheromones are not usually commercially available (except, for example, 2-methyl-vinylpyrazine). Therefore, the female-biased attractants (natural, synthetic, liquid or dry) that are commonly used are based on food or host odours (Table 2b). Historically, liquid protein attractants (PA) have been used to capture a wide range of different fruit fly species. Liquid protein attractants capture both females and males. These liquid attractants are generally less sensitive than the parapheromones. In addition, liquid attractants capture high numbers of non-target insects and require more frequent servicing.

Several food-based synthetic attractants have been developed using ammonia and its derivatives. This may reduce the number of non-target insects captured. For example, for capturing *C. capitata* a synthetic food attractant consisting of three components (ammonium acetate, putrescine and trimethylamine) is used. For capturing of *Anastrepha* species the trimethylamine component may be removed. A synthetic attractant lasts approximately 4–10 weeks depending on climatic conditions. It captures few non-target insects and significantly fewer male fruit flies, making this attractant suited for use in sterile fruit fly release programmes. New synthetic food attractant technologies are available for use, including the long-lasting three-component and two-component mixtures contained in the same patch, as well as the three components incorporated in a single cone-shaped plug (Tables 1 and 3).

In addition, because food-foraging female and male fruit flies respond to synthetic food attractants at the sexually immature adult stage, these attractant types are capable of detecting female fruit flies earlier and at lower population levels than liquid protein attractants.

Table 2a. Attractants and traps for male fruit fly surveys

Fruit fly species	**Attractant and trap** (see below for abbreviations)																									
	TML/CE											**ME**								**CUE**								
	CC	CH	ET	JT	LT	MM	ST	SE	TP	YP	VARs+	CH	ET	JT	LT	MM	ST	TP	YP	CH	ET	JT	LT	MM	ST	TP	YP
Anastrepha fraterculus																											
Anastrepha ludens																											
Anastrepha obliqua																											
Anastrepha striata																											
Anastrepha suspensa																											
Bactrocera carambolae												x	x	x	x	x	x	x	x								
Bactrocera caryeae												x	x	x	x	x	x	x	x								
Bactrocera citri (B. minax)																											
Bactrocera correcta												x	x	x	x	x	x	x	x								
Bactrocera cucumis																											
Bactrocera cucurbitae																				x	x	x	x	x	x	x	x
Bactrocera dorsalis												x	x	x	x	x	x	x	x								
Bactrocera invadens												x	x	x	x	x	x	x	x								
Bactrocera kandiensis												x	x	x	x	x	x	x	x								
Bactrocera latifrons																											
Bactrocera occipitalis												x	x	x	x	x	x	x	x								
Bactrocera oleae																											
Bactrocera papayae												x	x	x	x	x	x	x	x								
Bactrocera philippinensis												x	x	x	x	x	x	x	x								
Bactrocera tau																				x	x	x	x	x	x	x	x
Bactrocera tryoni																				x	x	x	x	x	x	x	x
Bactrocera tsuneonis																											
Bactrocera umbrosa												x	x	x	x	x	x	x	x								
Bactrocera zonata												x	x	x	x	x	x	x	x								
Ceratitis capitata		x	x	x	x	x	x	x	x	x	x																
Ceratitis cosyra																											
Ceratitis rosa		x	x	x	x	x	x	x	x	x	x																
Dacus ciliatus																											
Myiopardalis pardalina																											
Rhagoletis cerasi																											

Fruit fly species	Attractant and trap (see below for abbreviations)																									
	TML/CE											ME								CUE							
	CC	CH	ET	JT	LT	MM	ST	SE	TP	YP	VARs+	CH	ET	JT	LT	MM	ST	TP	YP	CH	ET	JT	LT	MM	ST	TP	YP
Rhagoletis cingulata																											
Rhagoletis indifferens																											
Rhagoletis pomonella																											
Toxotrypana curvicauda																											

Attractant abbreviations

TML	Trimedlure
CE	Capilure
ME	Methyl eugenol
CUE	Cuelure

Trap abbreviations

CC	Cook and Cunningham (C&C) trap
CH	ChamP trap
ET	Easy trap
JT	Jackson trap
LT	Lynfield trap
MM	Maghreb-Med or Morocco trap
ST	Steiner trap
SE	Sensus trap
TP	Tephri trap
VARs+	Modified funnel trap
YP	Yellow panel trap

Table 2b. Attractants and traps for female-biased fruit fly surveys

Fruit fly species	Attractant and trap (see below for abbreviations)																									
	3C							2C-2					2C-1	PA			SK+AC		AS (AA, AC)				BuH			MVP
	ET	SE	MLT	OBDT	LT	MM	TP	ET	MLT	LT	MM	TP	MLT	ET	McP	MLT	CH	YP	RB	RS	YP	PALz	RS	YP	PALz	GS
Anastrepha fraterculus															x	x										
Anastrepha grandis															x	x										
Anastrepha ludens													x		x	x										
Anastrepha obliqua													x		x	x										
Anastrepha striata															x	x										
Anastrepha suspensa													x		x	x										
Bactrocera carambolae															x	x										
Bactrocera caryeae															x	x										
Bactrocera citri (B. minax)															x	x										
Bactrocera correcta															x	x										
Bactrocera cucumis															x	x										
Bactrocera cucurbitae			x												x	x										

Fruit fly species	Attractant and trap (see below for abbreviations)																								
	3C							2C-2					2C-1	PA			SK+AC		AS (AA, AC)				BuH			MVP
	ET	SE	MLT	OBDT	LT	MM	TP	ET	MLT	LT	MM	TP	MLT	ET	McP	MLT	CH	YP	RB	RS	YP	PALz	RS	YP	PALz	GS
Bactrocera dorsalis															x	x										
Bactrocera invadens			x												x	x										
Bactrocera kandiensis															x	x										
Bactrocera latifrons															x	x										
Bactrocera occipitalis															x	x										
Bactrocera oleae														x	x	x	x	x			x	x				
Bactrocera papayae															x	x										
Bactrocera philippinensis															x	x										
Bactrocera tau															x	x										
Bactrocera tryoni															x	x										
Bactrocera tsuneonis															x	x										
Bactrocera umbrosa															x	x										
Bactrocera zonata			x												x	x										
Ceratitis capitata	x	x	x		x	x	x	x	x	x	x	x		x	x	x										
Ceratitis cosyra			x						x						x	x										
Ceratitis rosa		x	x						x						x	x										
Dacus ciliatus			x												x	x										
Myiopardalis pardalina															x	x										
Rhagoletis cerasi																			x	x	x	x	x	x	x	
Rhagoletis cingulata																					x	x		x	x	
Rhagoletis indifferens																				x	x					
Rhagoletis pomonella																			x		x	x	x			
Toxotrypana curvicauda																										x

Attractant abbreviations

3C	(AA+Pt+TMA)	AS	ammonium salts
2C-2	(AA+TMA)	AA	ammonium acetate
2C-1	(AA+Pt)	BuH	butyl hexanoate
PA	protein attractant	MVP	papaya fruit fly pheromone

Trap abbreviations

CH	ChamP trap	McP	McPhail trap	RS	Red sphere trap
ET	Easy trap	MLT	Multilure trap	SE	Sensus trap
GS	Green sphere	OBDT	Open bottom dry trap	TP	Tephri trap
LT	Lynfield trap	PALz	Fluorescent yellow sticky “cloak” trap	YP	Yellow panel trap

			(2-methyl vinylpyrazine)	MM	Maghreb-Med or Morocco trap	RB	Rebell trap
SK	spiroketal	Pt	putrescine				
AC	ammonium (bi)carbonate	TMA	trimethylamine				

Table 3. List of attractants and field longevity

Common name	Attractant abbreviations	Formulation	Field longevity[1] (weeks)
Parapheromones			
Trimedlure	TML	Polymeric plug	4–10
		Laminate	3–6
		Liquid	1–4
		PE bag	4-5
Methyl eugenol	ME	Polymeric plug	4–10
		Liquid	4–8
Cuelure	CUE	Polymeric plug	4–10
		Liquid	4–8
Capilure (TML plus extenders)	CE	Liquid	12–36
Pheromones			
Papaya fruit fly (*T. curvicauda*) (2-methyl-6-vinylpyrazine)	MVP	Patches	4–6
Olive Fly (spiroketal)	SK	Polymer	4–6
Food-based attractants			
Torula yeast/borax	PA	Pellet	1–2
Protein derivatives	PA	Liquid	1–2
Ammonium acetate	AA	Patches	4–6
		Liquid	1
		Polymer	2–4
Ammonium (bi)carbonate	AC	Patches	4–6
		Liquid	1
		Polymer	1–4
Ammonium salts	AS	Salt	1
Putrescine	Pt	Patches	6–10
Trimethylamine	TMA	Patches	6–10
Butyl hexanoate	BuH	Vial	2
Ammonium acetate + Putrescine + Trimethylamine	3C (AA+Pt+TMA)	Cone/patches	6–10
Ammonium acetate + Putrescine + Trimethylamine	3C (AA+Pt+TMA)	Long-lasting patches	18–26
Ammonium acetate + Trimethylamine	2C-2 (AA+TMA)	Patches	6–10
Ammonium acetate + Putrescine	2C-1 (AA+Pt)	Patches	6–10
Ammonium acetate / Ammonium carbonate	AA/AC	PE bag w. alufoil cover	3–4

[1] Based on half-life. Attractant longevity is indicative only. Actual timing should be supported by field testing and validation.

3.2 Killing and preserving agents

Traps retain attracted fruit flies through the use of killing and preserving agents. In some dry traps, killing agents are a sticky material or a toxicant. Some organophosphates may act as a repellent at higher doses. The use of insecticides in traps is subject to the registration and approval of the product in the respective national legislation.

In other traps, liquid is the killing agent. When liquid protein attractants are used, mix borax 3% concentration to preserve the captured fruit flies. There are protein attractants that are formulated with borax, and thus no additional borax is required. When water is used in hot climates, 10% propylene glycol is added to prevent evaporation of the attractant and to preserve captured flies.

3.3 Commonly used fruit fly traps

This section describes commonly used fruit fly traps. The list of traps is not comprehensive; other types of traps may achieve equivalent results and may be used for fruit fly trapping.

Based on the killing agent, there are three types of traps commonly used:

- **Dry traps.** The fly is caught on a sticky material board or killed by a chemical agent. Some of the most widely used dry traps are Cook and Cunningham (C&C), ChamP, Jackson/Delta, Lynfield, open bottom dry trap (OBDT) or Phase IV, red sphere, Steiner and yellow panel/Rebell traps.
- **Wet traps.** The fly is captured and drowns in the attractant solution or in water with surfactant. One of the most widely used wet traps is the McPhail trap. The Harris trap is also a wet trap with a more limited use.
- **Dry or wet traps**. These traps can be used either dry or wet. Some of the most widely used are Easy trap, Multilure trap and Tephri trap.

Cook and Cunningham (C&C) trap

General description

The C&C trap consists of three removable creamy white panels, spaced approximately 2.5 cm apart. The two outer panels are made of rectangular paperboard measuring 22.8 cm × 14.0 cm. One or both panels are coated with sticky material (Figure 1). The adhesive panel has one or more holes which allow air to circulate through. The trap is used with a polymeric panel containing an olfactory attractant (usually trimedlure), which is placed between the two outer panels. The polymeric panels come in two sizes – standard and half panel. The standard panel (15.2 cm × 15.2 cm) contains 20 g of TML, while the half size (7.6 cm × 15.2 cm) contains 10 g. The entire unit is held together with clips, and suspended in the tree canopy with a wire hanger.

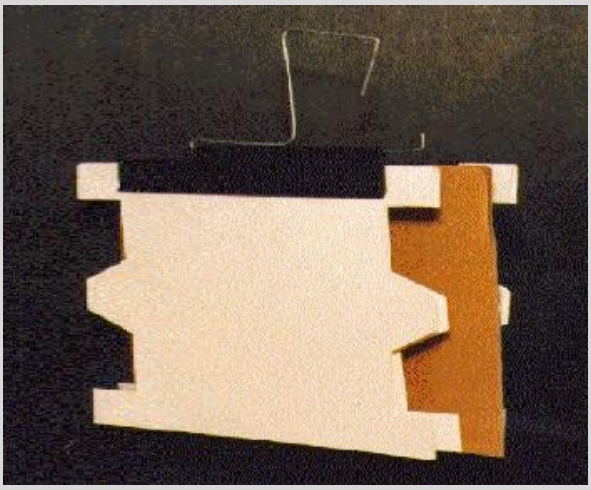

Figure 1. Cook and Cunningham (C&C) trap.

Use

As a result of the need for economic highly sensitive delimiting trapping of *C. capitata*, polymeric panels were developed for the controlled release of greater amounts of TML. This keeps the release rate constant for a longer period of time reducing hand labour and increasing sensitivity. The C&C trap with its multipanel construction has significant adhesive surface area for fly capture.

- For the species for which the trap and attractant is used, see Table 2a.

- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Table 4d.

ChamP trap (CH)

General description

The ChamP trap is a hollow, yellow panel-type trap with two perforated sticky side panels. When the two panels are folded, the trap is rectangular in shape (18 cm × 15 cm), and a central chamber is created to place the attractant (Figure 2). A wire hanger placed at the top of the trap is used to place it on branches.

Figure 2. ChamP trap.

Use

The ChamP trap can accommodate patches, polymeric panels, and plugs. It is equivalent to a Yellow panel/Rebell trap in sensitivity.

- For the species for which the trap and attractant is used, see Table 2 (a and b).
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Tables 4b and 4c.

Easy trap (ET)

General description

The Easy trap is a two-part rectangular plastic container with an inbuilt hanger. It is 14.5 cm high, 9.5 cm wide, 5 cm deep and can hold 400 ml of liquid (Figure 3). The front part is transparent and the rear part is yellow. The transparent front of the trap contrasts with the yellow rear enhancing the trap's ability to catch fruit flies. It combines visual effects with parapheromone and food-based attractants.

Figure 3. Easy trap.

Use

The trap is multipurpose. It can be used dry baited with parapheromones (e.g. TML, CUE, ME) or synthetic food attractants (e.g. 3C and both combinations of 2C attractants) and a retention system such as dichlorvos. It can also be used wet baited with liquid protein attractants holding up to 400 ml of mixture. When synthetic food attractants are used, one of the dispensers (the one containing putrescine) is attached inside to the yellow part of the trap and the other dispensers are left free.

The Easy trap is one of the most economic traps commercially available. It is easy to carry, handle and service, providing the opportunity to service a greater number of traps per man-hour than some other traps.

- For the species for which the trap and attractant is used, see Table 2 (a and b).
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Table 4d.

Fluorescent yellow sticky "cloak" trap (PALz)

General description

The PALz trap is prepared from fluorescent yellow plastic sheets (36 cm × 23 cm). One side is covered with sticky material. When setting up, the sticky sheet is placed around a vertical branch or a pole in a "cloaklike" manner (Figure 4), with the sticky side facing outward, and the back corners are fastened together with clips.

Figure 4. Fluorescent yellow sticky cloak trap.

Use

The trap uses the optimal combination of visual (fluorescent yellow) and chemical (cherry fruit fly synthetic bait) attractant cues. The trap is kept in place by a piece of wire, attached to the branch or pole. The bait dispenser is fastened to the front top edge of the trap, with the bait hanging in front of the sticky surface. The sticky surface of the trap has a capture capacity of about 500 to 600 fruit flies. Insects attracted by the combined action of these two stimuli are caught on the sticky surface.

- For the species for which the trap and attractant is used, see Table 2b.
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Table 4e.

Jackson trap (JT) or Delta trap

General description

The Jackson trap is hollow, delta shaped and made of a white waxed cardboard. It is 8 cm high, 12.5 cm long and 9 cm wide (Figure 5). Additional parts include a white or yellow rectangular insert of waxed cardboard which is covered with a thin layer of adhesive used to trap fruit flies once they land inside the trap body; a polymeric plug or cotton wick in a plastic basket or wire holder; and a wire hanger placed at the top of the trap body.

Use

This trap is mainly used with parapheromone attractants to capture male fruit flies. The attractants used with JT/Delta traps are TML, ME and CUE. When ME and CUE are used a toxicant must be added.

Figure 5. Jackson trap or Delta trap.

For many years this trap has been used in exclusion, suppression or eradication programmes for multiple purposes, including population ecology studies (seasonal abundance, distribution, host sequence, etc.); detection and delimiting trapping; and surveying sterile fruit fly populations in areas subjected to sterile fly mass releases. JT/Delta traps may not be suitable for some environmental conditions (e.g. rain or dust).

The JT/Delta traps are some of the most economic traps commercially available. They are easy to carry, handle and service, providing the opportunity of servicing a greater number of traps per man-hour than some other traps.

- For the species for which the trap and attractant is used, see Table 2a.
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Tables 4b and 4d.

Lynfield trap (LT)

General description

The conventional Lynfield trap consists of a disposable, clear plastic, cylindrical container measuring 11.5 cm high with a 10 cm diameter base and 9 cm diameter screw-top lid. There are four entry holes evenly spaced around the wall of the trap (Figure 6). Another version of the Lynfield trap is the Maghreb-Med trap also known as Morocco trap (Figure 7).

Figure 6. Lynfield trap.

Figure 7. Maghreb-Med trap or Morocco trap.

Use

The trap uses an attractant and insecticide system to attract and kill target fruit flies. The screw-top lid is usually colour-coded to the type of attractant being used (red, CE/TML; white, ME; yellow, CUE). To hold the attractant a 2.5 cm screw-tip cup hook (opening squeezed closed) screwed through the lid from above is used. The trap uses the male-specific parapheromone attractants CUE, Capilure (CE), TML and ME.

CUE and ME attractants, which are ingested by the male fruit fly, are mixed with malathion. However, because CE and TML are not ingested by either *C. capitata* or *C. rosa*, a dichlorvos-impregnated matrix is placed inside the trap to kill fruit flies that enter.

- For the species for which the trap and attractant is used, see Table 2 (a and b).
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Tables 4b and 4d.

McPhail (McP) trap type

General description

The conventional McPhail (McP) trap is a transparent glass or plastic, pear-shaped invaginated container. The trap is 17.2 cm high and 16.5 cm wide at the base and holds up to 500 ml of solution (Figure 8). The trap parts include a rubber cork or plastic lid that seals the upper part of the trap and a wire hook to hang traps on tree branches. A plastic version of the McPhail trap is 18 cm high and 16 cm wide at the base and holds up to 500 ml of solution (Figure 9). The top part is transparent and the base is yellow.

Figure 8. McPhail trap.

Use

For this trap to function properly it is essential that the body stays clean. Some designs have two parts

in which the upper part and base of the trap can be separated allowing for easy service (rebaiting) and inspection of fruit fly captures.

This trap uses a liquid food attractant, based on hydrolysed protein or torula yeast/borax tablets. Torula tablets are more effective than hydrolysed proteins over time because the pH is stable at 9.2. The level of pH in the mixture plays an important role in attracting fruit flies. Fewer fruit flies are attracted to the mixture as the pH becomes more acidic.

Figure 9. Plastic McPhail trap.

To bait with yeast tablets, mix three to five torula tablets in 500 ml of water or follow the manufacturer's recommendation. Stir to dissolve tablets. To bait with protein hydrolysate, mix protein hydrolysate and borax (if not already added to the protein) in water to reach 5–9% hydrolysed protein concentration and 3% of borax.

The nature of its attractant means this trap is more effective at catching females. Food attractants are generic by nature, and so McP traps tend to also catch a wide range of other non-target tephritid and non-tephritid fruit flies in addition to the target species.

McP-type traps are used in fruit fly management programmes in combination with other traps. In areas subjected to suppression and eradication actions, these traps are used mainly to monitor female populations. Female catches are crucial in assessing the amount of sterility induced to a wild population in a sterile insect technique (SIT) programme. In programmes releasing only sterile males or in a male annihilation technique (MAT) programme, McP traps are used as a population detection tool by targeting feral females, whereas other traps (e.g. Jackson traps), used with male-specific attractants, catch the released sterile males, and their use should be limited to programmes with an SIT component. Furthermore, in fruit fly-free areas, McP traps are an important part of the non-indigenous fruit fly trapping network because of their capacity to capture fruit fly species of quarantine importance for which no specific attractants exist.

McP traps with liquid protein attractant are labour intensive. Servicing and rebaiting take time, and the number of traps that can be serviced in a normal working day is half that of some other traps described in this appendix.

- For the species for which the trap and attractant is used, see Table 2b.
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Tables 4a, 4b, 4d and 4e.

Modified funnel trap (VARs+)

General description

The modified funnel trap consists of a plastic funnel and a lower catch container (Figure 10). The top roof has a large (5 cm diameter) hole, over which an upper catch container (transparent plastic) is placed.

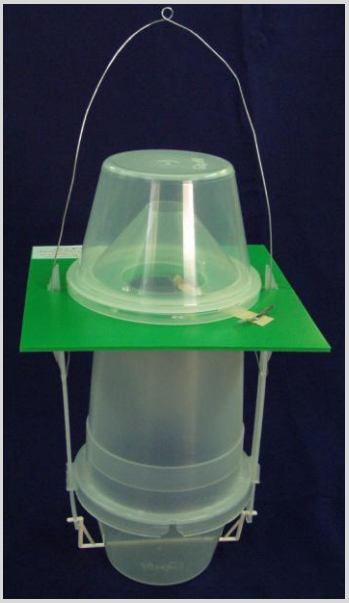

Figure 10. Modified funnel trap.

Use

Since it is a non-sticky trap design, it has a virtually unlimited catch capacity and very long field life. The bait is attached to the roof, so that the bait dispenser is positioned into the middle of the large hole on the roof. A small piece of matrix impregnated with a killing agent is placed inside both the upper and lower catch containers to kill fruit flies that enter.

- For the species for which the trap and attractant is used, see Table 2a.
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Table 4d.

Multilure trap (MLT)

General description

The Multilure trap (MLT) is a version of the McPhail trap described previously. The trap is 18 cm high and 15 cm wide at the base and can hold up to 750 ml of liquid (Figure 11). It consists of a two-piece plastic invaginated cylinder-shaped container. The top part is transparent and the base is yellow. The upper part and base of the trap separate, allowing the trap to be serviced and rebaited. The transparent upper part of the trap contrasts with the yellow base enhancing the trap's ability to catch fruit flies. A wire hanger, placed on top of the trap body, is used to hang the trap from tree branches.

Use

This trap follows the same principles as those of the McP trap. However, an MLT used with dry synthetic attractant is more efficient and selective than an MLT or McP trap used with liquid protein attractant. Another important difference is that an MLT with a dry synthetic attractant allows for a cleaner servicing and is much less labour intensive than a McP trap. When synthetic food attractants are used, dispensers are attached to the inside walls of the upper cylindrical part of the trap or hung from a clip at the top. For this trap to function properly it is essential that the upper part stays transparent.

Figure 11. Multilure trap.

When the MLT is used as a wet trap a surfactant should be added to the water. In hot climates 10% propylene glycol can be used to decrease water evaporation and decomposition of captured fruit flies.

When the MLT is used as a dry trap, a suitable (non-repellent at the concentration used) insecticide such as dichlorvos or a deltamethrin (DM) strip is placed inside the trap to kill the fruit flies. DM is applied to a polyethylene strip placed on the upper plastic platform inside the trap. Alternatively, DM may be used

in a circle of impregnated mosquito net and will retain its killing effect for at least six months under field conditions. The net must be fixed on the ceiling inside the trap using adhesive material.

- For the species for which the trap and attractant is used, see Table 2b.
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Tables 4a, 4b, 4c and 4d.

Open bottom dry trap (OBDT) or (Phase IV) trap

General description

This trap is an open-bottom cylindrical dry trap that can be made from opaque green plastic or wax-coated green cardboard. The cylinder is 15.2 cm high and 9 cm in diameter at the top and 10 cm in diameter at the bottom (Figure 12). It has a transparent top, three holes (each of 2.5 cm diameter) equally spaced around the wall of the cylinder midway between the ends, and an open bottom, and is used with a sticky insert. A wire hanger, placed on top of the trap body, is used to hang the trap from tree branches.

Figure 12. Open bottom dry trap (Phase IV).

Use

A food-based synthetic chemical female biased attractant can be used to capture *C. capitata*. However, it also serves to capture males. Synthetic attractants are attached to the inside walls of the cylinder. Servicing is easy because the sticky insert permits easy removal and replacement, similar to the inserts used in the JT. This trap is less expensive than the plastic or glass McP-type traps.

- For the species for which the trap and attractant is used, see Table 2b.
- For attractants used and rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Table 4d.

Red sphere trap (RS)

General description

The trap is a red sphere 8 cm in diameter (Figure 13). The trap mimics the size and shape of a ripe apple. A green version of this trap is also used. The trap is covered with a sticky material and baited with the synthetic fruit odour butyl hexanoate, which has a fragrance like a ripe fruit. Attached to the top of the sphere is a wire hanger used to hang it from tree branches.

Figure 13. Red sphere trap.

Use

The red or green traps can be used unbaited, but they are much more efficient in capturing fruit flies when baited. Fruit flies that are sexually mature and ready to lay eggs are attracted to this trap.

Many types of insects will be caught by these traps. It will be necessary to positively identify the target fruit fly from the non-target insects likely to be present on the traps.

- For the species for which the trap and attractant is used, see Table 2b.
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Table 4e.

Sensus trap (SE)

General description

The Sensus trap consists of a vertical plastic bucket 12.5 cm in high and 11.5 cm in diameter (Figure 14). It has a transparent body and a blue overhanging lid, which has a hole just underneath it. A wire hanger placed on top of the trap body is used to hang the trap from tree branches.

Figure 14. Sensus trap.

Use

The trap is dry and uses male-specific parapheromones or, for female-biased captures, dry synthetic food attractants. A dichlorvos block is placed in the comb on the lid to kill the flies.

- For the species for which the trap and attractant is used, see Table 2 (a and b).
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Table 4d.

Steiner trap (ST)

General description

The Steiner trap is a horizontal, clear plastic cylinder with openings at each end. The conventional Steiner trap is 14.5 cm long and 11 cm in diameter (Figure 15). There are a number of versions of Steiner traps. These include the Steiner trap of 12 cm long and 10 cm in diameter (Figure 16) and 14 cm long and 8.5 cm in diameter (Figure 17). A wire hanger, placed on top of the trap body, is used to hang the trap from tree branches.

Figure 15. Conventional Steiner trap.

Figure 16. Steiner trap version.

Figure 17. Steiner trap version.

Use

This trap uses the male-specific parapheromone attractants TML, ME and CUE. The attractant is suspended from the centre of the inside of the trap. The attractant may be a cotton wick soaked in 2–3 ml of a mixture of parapheromone or a dispenser with the attractant and an insecticide (usually malathion, dibrom or deltamethrin) as a killing agent.

- For the species for which the trap and attractant is used, see Table 2a.
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Tables 4b and 4d.

Tephri trap (TP)

General description

The Tephri trap is similar to a McP trap. It is a vertical cylinder 15 cm high and 12 cm in diameter at the base and can hold up to 450 ml of liquid (Figure 18). It has a yellow base and a clear top, which can be separated to facilitate servicing. There are entrance holes around the top of the

periphery of the yellow base, and an invaginated opening in the bottom. Inside the top is a platform to hold attractants. A wire hanger, placed on top of the trap body, is used to hang the trap from tree branches.

Use

The trap is baited with hydrolysed protein at 9% concentration; however, it can also be used with other liquid protein attractants as described for the conventional glass McP trap or with the female dry synthetic food attractant and with TML in a plug or liquid as described for the JT/Delta and Yellow panel traps. If the trap is used with liquid protein attractants or with dry synthetic attractants combined with a liquid retention system and without the side holes, the insecticide will not be necessary. However, when used as a dry trap and with side holes, an insecticide solution (e.g. malathion) soaked into a cotton wick or other killing agent is needed to avoid escape of captured insects. Other suitable insecticides are dichlorvos or deltamethrin (DM) strips placed inside the trap to kill the fruit flies. DM is applied in a polyethylene strip, placed on the plastic platform inside the top of the trap. Alternatively, DM may be used in a circle of impregnated mosquito net and will retain its killing effect for at least six months under field conditions. The net must be fixed on the ceiling of the inside of the trap using adhesive material.

Figure 18. Tephri trap.

- For the species for which the trap and attractant is used, see Table 2 (a and b).
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Tables 4b and 4d.

Yellow panel trap (YP)/Rebell trap (RB)

General description

The Yellow panel trap (YP) consists of a yellow rectangular cardboard plate (23 cm × 14 cm) coated with plastic (Figure 19). The rectangle is covered on both sides with a thin layer of sticky material. The Rebell trap is a three-dimensional YP-type trap with two crossed yellow rectangular plates (15 cm × 20 cm) made of plastic (polypropylene) making them extremely durable (Figure 20). The trap is also coated with a thin layer of sticky material on both sides of both plates. A wire hanger, placed on top of the trap body, is used to hang it from tree branches.

Figure 19. Yellow panel trap.

Use

Figure 20. Rebell trap.

These traps can be used as visual traps alone and baited with TML, spiroketal or ammonium salts (ammonium acetate). The attractants may be contained in controlled-release dispensers such as a polymeric plug. The attractants are attached to the face of the trap. The attractants can also be mixed into the cardboard's coating. The two-dimensional design and greater contact surface make these traps more efficient, in terms of fly captures, than the JT and McPhail-type traps. It is important to consider that these traps require special procedures for transportation, submission and fruit fly screening methods because they are so sticky that specimens can be destroyed in handling. Although these traps can be used in most types of control programme applications, their use is recommended for the post-eradication phase and for fly-free areas, where highly sensitive traps are required. These traps should not be used in areas subjected to mass release of sterile fruit flies because of the large number of released fruit flies that would be caught. It is important to note that their yellow colour and open design allow them to catch other non-target insects including natural enemies of fruit flies and pollinators.

- For the species for which the trap and attractant is used, see Table 2 (a and b).
- For rebaiting (field longevity), see Table 3.
- For use under different scenarios and recommended densities, see Tables 4b, 4c, 4d and 4e.

4. Trapping procedures

4.1 Spatial distribution of traps

The spatial distribution of traps will be guided by the purpose of the survey, the intrinsic characteristics of the area, the biological characteristics of the fruit fly and its interactions with its hosts, as well as the efficacy of the attractant and trap. In areas where continuous compact blocks of commercial orchards are present and in urban and suburban areas where hosts exist, traps are usually deployed in a grid system, which may have a uniform distribution.

In areas with scattered commercial orchards, rural areas with hosts and in marginal areas where hosts exist, trap networks are normally distributed along roads that provide access to host material.

In suppression and eradication programmes, an extensive trapping network should be deployed over the entire area that is subject to surveillance and control actions.

Trapping networks are also placed as part of early detection programmes for target fruit fly species. In this case traps are placed in high-risk areas such as points of entry, fruit markets, urban areas garbage dumps, as appropriate. This can be further supplemented by traps placed along roadsides to form transects and at production areas close to or adjacent to land borders, port of entries and national roads.

4.2 Trap deployment (placement)

Trap deployment involves the actual placement of the traps in the field. One of the most important factors of trap deployment is selecting an appropriate trap site. It is important to have a list of the primary, secondary and occasional fruit fly hosts, their phenology, distribution and abundance. With this basic information, it is possible to properly place and distribute the traps in the field, and it also allows for effective planning of a programme of trap relocation.

When possible, pheromone traps should be placed in mating areas. Fruit flies normally mate in the crown of host plants or close by, selecting semi-shaded spots and usually on the upwind side of the crown. Other suitable trap sites are the eastern side of the tree which gets the sunlight in the early

hours of the day, resting and feeding areas in plants that provide shelter and protect fruit flies from strong winds and predators. In specific situations trap hangers may need to be coated with an appropriate insecticide to prevent ants from eating captured fruit flies.

Protein traps should be deployed in shaded areas in host plants. In this case traps should be deployed in primary host plants during their fruit maturation period. In the absence of primary host plants, secondary host plants should be used. In areas with no host plants identified, traps should be deployed in plants that can provide shelter, protection and food to adult fruit flies.

Traps should be deployed in the middle to the top part of the host plant canopy, depending on the height of the host plant, and oriented towards the upwind side. Traps should not be exposed to direct sunlight, strong winds or dust. It is of vital importance to have the trap entrance clear from twigs, leaves and other obstructions such as spider webs to allow proper airflow and easy access for the fruit flies.

Placement of traps in the same tree baited with different attractants should be avoided because it may cause interference among attractants and a reduction of trap efficiency. For example, placing a *C. capitata* male-specific TML trap and a protein attractant trap in the same tree will cause a reduction of female capture in the protein traps because TML acts as a female repellent.

Traps should be relocated following the maturation phenology of the fruit hosts present in the area and biology of the fruit fly species. By relocating the traps it is possible to follow the fruit fly population throughout the year and increase the number of sites being checked for fruit flies.

4.3 Trap mapping

Once traps are deployed at carefully selected sites at the correct density and distributed in an appropriate pattern, the location of the traps must be recorded. It is recommended that the location of traps should be geo-referenced with the use of global positioning system (GPS) equipment where available. A map or sketch of the trap location and the area around the traps should be prepared.

The application of GPS and geographic information systems (GIS) in the management of trapping network has proved to be a very powerful tool. GPS allows each trap to be geo-referenced through geographical coordinates, which are then used as input information in a GIS.

In addition to GPS location data or in the event that GPS data is not available for trap locations, reference for the trap location should include visible landmarks. In the case of traps placed in host plants located in suburban and urban areas, references should include the full address of the property where the trap was placed. Trap reference should be clear enough to allow control teams and supervisors who service the traps to find the trap easily.

A database or trapping book of all traps with their corresponding coordinates should be kept, together with the records of trap services, date of collection, collector, rebaiting, trap captures, and if possible notes on the collection site such as ecological characteristics. GIS provides high-resolution maps showing the exact location of each trap and other valuable information such as exact location of fruit fly detections, historical profiles of the geographical distribution patterns of the fruit flies, relative size of the populations in given areas and spread of the fruit fly population in case of an outbreak. This information is extremely useful in planning control activities, ensuring that bait sprays and sterile fruit fly releases are accurately placed and cost-effective in their application.

4.4 Trap servicing and inspection

Trap servicing intervals are specific to each trapping system and are based on the half-life of the attractant noting that actual timings should be supported by field testing and validation (see Table 3). Capturing fruit flies will depend, in part, on how well the trap is serviced. Trap servicing includes rebaiting and maintaining the trap in a clean and appropriate operating condition. Traps should be in a condition to consistently kill and retain in good condition any target flies that have been captured.

Attractants have to be used in the appropriate volumes and concentrations and replaced at the recommended intervals, as indicated by the manufacturer. The release rate of attractants varies considerably with environmental conditions. The release rate is generally high in hot and dry areas, and low in cool and humid areas. Thus, in cool climates traps may have to be rebaited less often than in hot conditions.

Inspection intervals (i.e. checking for fruit fly captures) should be adjusted according to the prevailing environmental conditions, pest situations and biology of fruit flies, on a case-by-case basis. The interval can range from one day up to 30 days, e.g. seven days in areas where fruit fly populations are present and 14 days in fruit fly free areas. In the case of delimiting surveys inspection intervals may be more frequent, with two to three days being the most common interval.

Avoid handling more than one lure type at a time if more than one lure type is being used at a single locality. Cross-contamination between traps of different attractant types (e.g. Cue and ME) reduces trap efficacy and makes laboratory identification unduly difficult. When changing attractants, it is important to avoid spillage or contamination of the external surface of the trap body or the ground. Attractant spillage or trap contamination would reduce the chances of fruit flies entering the trap. For traps that use a sticky insert to capture fruit flies, it is important to avoid contaminating areas in the trap that are not meant for capturing fruit flies with the sticky material. This also applies to leaves and twigs that surround the trap. Attractants, by their nature, are highly volatile and care should be taken when storing, packaging, handling and disposing of lures to avoid compromising the attractant and operator safety.

The number of traps serviced per day per person will vary depending on type of trap, trap density, environmental and topographic conditions and experience of the operators. Where a large trap network is in place, it may need to be serviced over a number of days. In this case, the network may be serviced through a number of “routes” or “runs” which systematically ensure all traps within the network are inspected and serviced, and none are missed.

4.5 Trapping records

The following information should be included in order to keep proper trapping records as they provide confidence in the survey results: trap location, plant where the trap is placed, trap and attractant type, servicing and inspection dates, and target fruit fly capture. Any other information considered necessary can be added to the trapping records. Retaining results over a number of seasons can provide useful information on spatial changes in fruit fly population.

4.6 Flies per trap per day

Flies per trap per day (FTD) is a population index that indicates the average number of flies of the target species captured per trap per day during a specified period in which the trap was exposed in the field.

The function of this population index is to have a comparative measure of the size of the adult pest population in a given space and time.

It is used as baseline information to compare the size of the population before, during and after the application of a fruit fly control programme. The FTD should be used in all reports of trapping.

The FTD is comparable within a programme; however, for meaningful comparisons between programmes, it should be based on the same fruit fly species, trapping system and trap density.

In areas where sterile fruit fly release programmes are in operation FTD is used to measure the relative abundance of the sterile and wild fruit flies.

FTD is the result of dividing the total number of fruit flies captured (F) by the product obtained from multiplying the total number of inspected traps (T) by the average number of days between trap inspections (D). The formula is as follows:

$$FTD = \frac{F}{T \times D}$$

5. Trap densities

Establishing a trapping density appropriate to the purpose of the survey is critical and underpins confidence in the survey results. The trap densities need to be adjusted based on many factors including type of survey, trap efficiency, location (type and presence of host, climate and topography), pest situation and lure type. In terms of type and presence of hosts, as well as the risk involved, the following types of location may be of concern:

- production areas
- marginal areas
- urban areas
- points of entry (and other high-risk areas such as fruit markets).

Trap densities may also vary as a gradient from production areas to marginal areas, urban areas and points of entry. For example, in a pest free area, a higher density of traps is required at high-risk points of entry and a lower density in commercial orchards. Or, in an area where suppression is applied, such as in an area of low pest prevalence or an area under a systems approach where the target species is present, the reverse occurs, and trapping densities for that pest should be higher in the production field and decrease toward points of entry. Other situations such as high-risk urban areas should be taken into consideration when assessing trapping densities.

Tables 4a–4f show suggested trap densities for various fruit fly species based on common practice. These densities have been determined taking into consideration research results, feasibility and cost effectiveness. Trap densities are also dependent on associated surveillance activities, such as the type and intensity of fruit sampling to detect immature stages of fruit flies. In those cases where trapping surveillance programmes are complemented with fruit sampling activities, trap densities could be lower than the suggested densities shown in Tables 4a–4f.

The suggested densities presented in Tables 4a–4f have been made also taking into account the following technical factors:

- various survey objectives and pest status
- target fruit fly species (Table 1)
- pest risk associated with working areas (production and other areas).

Within the delimited area, the suggested trap density should be applied in areas with a significant likelihood of capturing fruit flies such as areas with primary hosts and possible pathways (e.g. production areas versus industrial areas).

Table 4a. Trap densities suggested for *Anastrepha* spp.

Trapping	Trap type[1]	Attractant	Trap density/km² (2)			
			Production area	Marginal	Urban	Points of entry[3]
Monitoring survey, no control	MLT/McP	2C-1/PA	0.25–1	0.25–0.5	0.25–0.5	0.25–0.5
Monitoring survey for suppression	MLT/McP	2C-1/PA	2–4	1–2	0.25–0.5	0.25–0.5
Delimiting survey in an FF-ALPP after an unexpected increase in population	MLT/McP	2C-1/PA	3–5	3–5	3–5	3–5
Monitoring survey for eradication	MLT/McP	2C-1/PA	3–5	3–5	3–5	3–5
Detection survey in an FF-PFA to verify pest absence and for exclusion	MLT/McP	2C-1/PA	1–2	2–3	3–5	5–12
Delimitation survey in an FF-PFA after a detection in addition to detection survey[4]	MLT/McP	2C-1/PA	20–50	20–50	20–50	20–50

1 Different traps can be combined to reach the total number.

(2) Refers to the total number of traps.

3 Also other high-risk sites.

4 This range includes high-density trapping in the immediate area of the detection (core area). However, it may decrease towards the surrounding trapping zones.

Trap type		Attractant	
McP	McPhail trap	2C-1	AA+Pt
		AA	Ammonium acetate
		Pt	Putrescine
MLT	Multilure trap	PA	Protein attractant

Table 4b. Trap densities suggested for *Bactrocera* spp. responding to methyl eugenol (ME), cuelure (CUE) and food attractants (PA = protein attractants)

Trapping	Trap type[1]	Attractant	Trap density/km² (2)			
			Production area	Marginal	Urban	Points of entry[3]
Monitoring survey, no control	JT/ST/TP/LT/MM/ MLT/McP/ET	ME/CUE/PA	0.25–1.0	0.2–0.5	0.2–0.5	0.2–0.5
Monitoring survey for suppression	JT/ST/TP/LT/MM/ MLT/McP/ET	ME/CUE/PA	2–4	1–2	0.25–0.5	0.25–0.5
Delimiting survey in an FF-ALPP after an unexpected increase in population	JT/ST/TP/MLT/LT/ MM/McP/YP/ET	ME/CUE/PA	3–5	3–5	3–5	3–5
Monitoring survey for eradication	JT/ST/TP/MLT/LT/ MM/McP/ET	ME/CUE/PA	3–5	3–5	3–5	3–5
Detection survey in an FF-PFA to verify pest absence and for exclusion	CH/ST/LT/MM/ML T/McP/TP/YP/ET	ME/CUE/PA	1	1	1–5	3–12
Delimitation survey in a PFA after a detection in addition to detection survey[4]	JT/ST/TP/MLT/LT/ MM/McP/YP/ET	ME/CUE/PA	20–50	20–50	20–50	20–50

1 Different traps can be combined to reach the total number.

(2) Refers to the total number of traps.

3 Also other high-risk sites.

4 This range includes high-density trapping in the immediate area of the detection (core area). However, it may decrease towards the surrounding trapping zones.

Trap type		Attractant	
CH	ChamP trap	ME	Methyleugenol
ET	Easy trap	CUE	Cuelure
JT	Jackson trap	PA	Protein attractant
LT	Lynfield trap		
McP	McPhail trap		
MLT	Multilure trap		
MM	Maghreb-Med or Morocco		
ST	Steiner trap		
TP	Tephri trap		

YP Yellow panel trap

Table 4c. Trap densities suggested for *Bactrocera oleae*

Trapping	Trap type[1]	Attractant	Trap density/km² (2)			
			Production area	Marginal	Urban	Points of entry[3]
Monitoring survey, no control	MLT/CH/YP/ET/McP	AC+SK/PA	0.5–1.0	0.25–0.5	0.25–0.5	0.25–0.5
Monitoring survey for suppression	MLT/CH/YP/ET/McP	AC+SK/PA	2–4	1–2	0.25–0.5	0.25–0.5
Delimiting survey in an FF-ALPP after an unexpected increase in population	MLT/CH/YP/ET/McP	AC+SK/PA	3–5	3–5	3–5	3–5
Monitoring survey for eradication	MLT/CH/YP/ET/McP	AC+SK/PA	3–5	3–5	3–5	3–5
Detection survey in an FF-PFA to verify pest absence and for exclusion	MLT/CH/YP/ET/McP	AC+SK/PA	1	1	2–5	3–12
Delimitation survey in a PFA after a detection in addition to detection survey[4]	MLT/CH/YP/ET/McP	AC+SK/PA	20–50	20–50	20–50	20–50

1 Different traps can be combined to reach the total number.

(2) Refers to the total number of traps.

3 Also other high-risk sites.

4 This range includes high-density trapping in the immediate area of the detection (core area). However, it may decrease towards the surrounding trapping zones.

Trap type		Attractant	
CH	ChamP trap	AC	Ammonium bicarbonate
ET	Easy trap	PA	Protein attractant
McP	McPhail trap	SK	Spiroketal
MLT	Multilure trap		
YP	Yellow panel trap		

Table 4d. Trap densities suggested for *Ceratitis* spp.

Trapping	Trap type[1]	Attractant	Trap density/km² (2)			
			Production area	Marginal	Urban	Points of entry[3]
Monitoring survey, no control[4]	JT/MLT/McP/ OBDT/ST/SE/ET/ LT/TP/VARs+/CH	TML/CE/3C/ 2C-2/PA	0.5–1.0	0.25–0.5	0.25–0.5	0.25–0.5
Monitoring survey for suppression	JT/MLT/McP/ OBDT/ST/SE/ET/ LT/MMTP/VARs+/ CH	TML/CE/3C/ 2C-2/PA	2–4	1–2	0.25–0.5	0.25–0.5
Delimiting survey in an FF-ALPP after an unexpected increase in population	JT/YP/MLT/McP/ OBDT/ST/ET/LT/ MM/TP/VARs+/CH	TML/CE/3C/ PA	3–5	3–5	3–5	3–5
Monitoring survey for eradication[5]	JT/MLT/McP/ OBDT/ST/ET/LT/ MM/TP/VARs+/CH	TML/CE/3C/ 2C-2/PA	3–5	3–5	3–5	3–5
Detection survey in an FF-PFA to verify pest absence and for exclusion[5]	JT/MLT/McP/ST/ ET/LT/MM/CC/ VARs+/CH	TML/CE/3C/ PA	1	1–2	1–5	3–12
Delimitation survey in a PFA after a detection in addition to detection survey[6]	JT/YP/MLT/McP/ OBDT/ST//ET/LT/ MM/TP/VARs+/CH	TML/CE/3C/ PA	20–50	20–50	20–50	20–50

1 Different traps can be combined to reach the total number.

(2) Refers to the total number of traps.

[3] Also other high-risk sites.

[4] 1:1 ratio (1 female trap per male trap).

[5] 3:1 ratio (3 female traps per male trap).

[6] This range includes high-density trapping in the immediate area of the detection (core area). However, it may decrease towards the surrounding trapping zones (ratio 5:1, 5 female traps per male trap).

Trap type		Attractant	
CC	Cook and Cunningham (C&C) Trap (with TML for male capture)	2C-2	(AA+TMA)
CH	ChamP trap	3C	(AA+Pt+TMA)
ET	Easy trap (with 2C and 3C attractants for female-biased captures)	CE	Capilure
JT	Jackson trap (with TML for male capture)	AA	Ammonium acetate
LT	Lynfield trap (with TML for male capture)	PA	Protein attractant
McP	McPhail trap	Pt	Putrescine
MLT	Multilure trap (with 2C and 3C attractants for female-biased captures)	TMA	Trimethylamine
MM	Maghreb-Med or Morocco	TML	Trimedlure
OBDT	Open Bottom Dry Trap (with 2C and 3C attractants for female-biased captures)		
SE	Sensus trap (with CE for male captures and with 3C for female-biased captures)		
ST	Steiner trap (with TML for male capture)		
TP	Tephri trap (with 2C and 3C attractants for female-biased captures)		
VARs+	Modified funnel trap		
YP	Yellow panel trap		

Table 4e. Trap densities suggested for *Rhagoletis* spp.

Trapping	Trap type[1]	Attractant	Trap density/km^2 (2)			
			Production area	Marginal	Urban	Points of entry[3]
Monitoring survey, no control	RB/RS/PALz/YP	BuH/AS	0.5–1.0	0.25–0.5	0.25–0.5	0.25–0.5
Monitoring survey for suppression	RB/RS/PALz/YP	BuH/AS	2–4	1–2	0.25–0.5	0.25–0.5
Delimiting survey in an FF-ALPP after an unexpected increase in population	RB/RS/PALz/YP	BuH/AS	3–5	3–5	3–5	3–5
Monitoring survey for eradication	RB/RS/PALz/YP	BuH/AS	3–5	3–5	3–5	3–5
Detection survey in an FF-PFA to verify pest absence and for exclusion	RB/RS/PALz/YP	BuH/AS	1	0.4–3	3–5	4–12
Delimitation survey in a PFA after a detection in addition to detection survey[4]	RB/RS/PALz/YP	BuH/AS	20–50	20–50	20–50	20–50

[1] Different traps can be combined to reach the total number.

(2) Refers to the total number of traps.

[3] Also other high-risk sites.

[4] This range includes high-density trapping in the immediate area of the detection (core area). However, it may decrease towards the surrounding trapping zones.

Trap type		Attractant	
		AS	Ammonium salt
RB	Rebell trap	BuH	Butyl hexanoate
RS	Red sphere trap		
PALz	Fluorescent yellow sticky trap		
YP	Yellow panel trap		

Table 4f. Trap densities suggested for *Toxotrypana curvicauda*

Trapping	Trap type[1]	Attractant	Trap density/km^2 (2)			
			Production area	Marginal	Urban	Points of entry[3]
Monitoring survey, no control	GS	MVP	0.25–0.5	0.25–0.5	0.25–0.5	0.25–0.5

Monitoring survey for suppression	GS	MVP	2–4	1	0.25–0.5	0.25–0.5
Delimiting survey in an FF-ALPP after an unexpected increase in population	GS	MVP	3–5	3–5	3–5	3–5
Monitoring survey for eradication	GS	MVP	3–5	3–5	3–5	3–5
Detection survey in an FF-PFA to verify pest absence and for exclusion	GS	MVP	2	2–3	3–6	5–12
Delimitation survey in a PFA after a detection in addition to detection survey[4]	GS	MVP	20–50	20–50	20–50	20–50

[1] Different traps can be combined to reach the total number.

[(2)] Refers to the total number of traps.

[3] Also other high-risk sites.

[4] This range includes high-density trapping in the immediate area of the detection (core area). However, it may decrease towards the surrounding trapping zones.

Trap type		Attractant	
GS	Green sphere	MVP	Papaya fruit fly pheromone (2-methyl-vinylpyrazine)

6. Supervision activities

Supervision of trapping activities includes assessing the quality of the materials used and reviewing the effectiveness of the use of these materials and trapping procedures.

The materials used should perform effectively and reliably at an acceptable level for a prescribed period of time. The traps themselves should maintain their integrity for the entire duration that they are anticipated to remain in the field. The attractants should be certified or bioassayed by the manufacturer for an acceptable level of performance based on their anticipated use.

The effectiveness of trapping should be officially reviewed periodically by individuals not directly involved in conducting trapping activities. The timing of review will vary by programme, but it is recommended to occur at least twice a year in programmes that run for six months or longer. The review should address all aspects related to the ability of trapping to detect targeted fruit flies within the timeframe required to meet programme outcomes e.g. Early detection of a fruit fly entry. Aspects of a review include quality of trapping materials, record-keeping, layout of the trapping network, trap mapping, trap placement, trap condition, trap servicing, trap inspection frequency and capability for fruit fly identification.

The trap deployment should be evaluated to ensure that the prescribed types and densities of traps are in place. Field confirmation is achieved through inspection of individual routes.

Trap placement should be evaluated for appropriate host selection, trap relocation schedule, height, light penetration, fruit fly access to trap, and proximity to other traps. Host selection, trap relocation and proximity to other traps can be evaluated from the records for each trap route. Host selection, placement and proximity can be further evaluated by field examination.

Traps should be evaluated for their overall condition, correct attractant, appropriate trap servicing and inspection intervals, correct identifying markings (such as trap identification and date placed), evidence of contamination and proper warning labels. This is performed in the field at each site where a trap is placed.

Evaluation of identification capability can occur via target fruit flies that have been marked in some manner in order to distinguish them from wild trapped fruit flies. These marked fruit flies are placed in traps in order to evaluate the operator's diligence in servicing the traps, competence in recognizing the targeted fruit fly species, and knowledge of the proper reporting procedures once a fruit fly is found. Commonly used marking systems are fluorescent dyes or wing clipping.

In some programmes that survey for eradication or to maintain FF-PFAs, the fruit flies may also be marked by using sterile irradiated fruit flies in order to further reduce the chances of the marked fruit

fly being falsely identified as a wild fruit fly and resulting in unnecessary actions by the programme. A slightly different method is necessary under a sterile fruit fly release programme in order to evaluate personnel on their ability to accurately distinguish target wild fruit flies from the released sterile fruit flies. The marked fruit flies used are sterile and lack the fluorescent dye, but are marked physically by wing clipping or some other method. These fruit flies are placed into the trap samples after they have been collected in the field but before they are inspected by the operators.

The review should be summarized in a report detailing how many inspected traps on each route were found to be in compliance with the accepted standards in categories such as trap mapping, placement, condition, and servicing and inspection interval. Aspects that were found to be deficient should be identified, and specific recommendations should be made to correct these deficiencies.

Proper record-keeping is crucial to the appropriate functioning of trapping. The records for each trap route should be inspected to ensure that they are complete and up to date. Field confirmation can then be used to validate the accuracy of the records. Maintenance of voucher specimens of collected species of regulated fruit fly species is recommended.

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This appendix is for reference purposes only and is not a prescriptive part of the standard.

APPENDIX 2: Guidelines for fruit sampling

Information about sampling is available in the references listed below. The list is not exhaustive.

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This phytosanitary treatment was adopted by the Ninth Session of the Commission on Phytosanitary Measures in 2014.
The annex is a prescriptive part of ISPM 28:2007.

ISPM 28
Annex 15

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

ISPM 28 PHYTOSANITARY TREATMENTS

PT 15: Vapour heat treatment for *Bactocera cucurbitae* on *Cucumis melo* var. *reticulatus*

(2014)

Scope of the treatment

This treatment comprises the vapour heat treatment of *Cucumis melo* var. *reticulatus* (netted melon) fruit to result in the mortality of eggs and larvae of melon fly (*Bactrocera cucurbitae*) at the stated efficacy[1].

Treatment description

Name of treatment	Vapour heat treatment for *Bactrocera cucurbitae* on *Cucumis melo* var. *reticulatus*
Active ingredient	N/A
Treatment type	Physical (vapour heat)
Target pest	*Bactrocera cucurbitae* (Coquillett) (Diptera: Tephritidae)
Target regulated articles	Fruit of netted melon (*Cucumis melo* var. *reticulatus*).

Treatment schedule

Exposure in a vapour heat chamber:

- at a minimum of 95% relative humidity
- to air temperature increasing from room temperature to more than 46 °C
- for between three to five hours, until fruit core temperature reaches 45 °C

[1]The scope of phytosanitary treatments does not include issues related to pesticide registration or other domestic requirements for contracting parties' approval of treatments. IPPC adopted treatments may not provide information on specific effects on human health or food safety, which should be addressed using domestic procedures prior to contracting parties approving a treatment. In addition, potential effects of treatments on product quality are considered for some host commodities before their international adoption. However, evaluation of any effects of a treatment on the quality of commodities may require additional consideration. There is no obligation for a contracting party to approve, register or adopt the treatments for use in its territory.

- followed by 30 minutes at a minimum of 95% relative humidity in an air temperature of 46 °C and with fruit pulp temperature at a minimum of 45 °C.

Once the treatment is complete, the melons should be cooled at ambient air temperature to allow their core temperature to drop below 30 °C.

The efficacy and confidence level of the treatment is effective dose (ED)99.9889 at the 95% confidence level.

The commodity temperature and relative humidity should be monitored continuously at <1 minute intervals during treatment and should not fall below the stated level.

Other relevant information

In evaluating this treatment the Technical Panel on Phytosanitary Treatments (TPPT) considered issues associated with temperature regimes and thermal conditioning, taking into account the work of Hallman and Mangan (1997).

This schedule was based on the work of Iwata *et al*. (1990) and developed using the "Earl's Favourite" cultivar of *Cucumis melo* var. *reticulatus*.

The fruit may be damaged if the core temperature exceeds 47 °C.

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Publication history

This is not an official part of the standard

2006 Treatment submitted to TPPT

2010-07 Draft revised

2011-05 Approved by SC e-decision to go for member consultation

2011-07 Member consultation

2011-12 TPPT response to comments to SC

2012-05 SC e-decision returned draft to TPPT

2012-12 TPPT reviewed draft

2013-02 Letter to submitter

2013-07 TPPT reviewed submitter response and recommended to the SC for CPM adoption

2013-10 SC e-decision approved draft for CPM adoption

2014-04 CPM-9 adopted Annex 15 to ISPM 28:2007

ISPM 28. 2007: **Annex 15** *Vapour heat treatment* for Bactrocera cucurbitae *on* Cucumis melo *var.* reticulatus (2014). Rome, IPPC, FAO.

Publication history: Last modified 2014-04

This diagnostic protocol was adopted by the Standards Committee on behalf of the Commission on Phytosanitary Measures in January 2014.

The annex is a prescriptive part of ISPM 27:2006.

ISPM 27
Annex 4

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

ISPM 27 DIAGNOSTIC PROTOCOLS

DP 4: *Tilletia indica* Mitra

(2014)

CONTENTS

1. Pest Information

Tilletia indica Mitra causes the disease Karnal bunt, also known as partial bunt, of wheat (*Triticum* spp.). Karnal bunt was first described in Karnal, India, in 1931. The pathogen is widespread in parts of South Asia and Southwest Asia (USDA, 2007; Wiese, 1987). It has also been detected in certain areas of the United States and Mexico, and in South Africa (Crous *et al.*, 2001; Fuentes-Davila, 1996).

Hosts include *Triticum aestivum*, *Triticum durum* and *Triticum aestivum* × *Secale cereale*. Records on *Triticum aestivum* × *Secale cereale* are rare; however, *Secale* spp. have been shown to have the potential to be a host (Sansford *et al.*, 2008). *T. indica* has been shown to infect other grass species under glasshouse conditions but has never been detected in the field in these alternative hosts (Inman *et al.*, 2003).

T. indica is a floret-infecting smut pathogen. Seeds are infected through the germinal end of the kernel and the fungus develops within the pericarp where it produces a powdery, brownish black mass of teliospores. When fresh, the spore masses produce a foetid, decaying fish-like smell (trimethylamine). Unlike systemic smuts, it is not usual for all the seeds on an ear of the host to be infected with *T. indica*, and heads with infected seeds do not differ in appearance from healthy heads (Figure 1). Seeds are usually only partially colonized, showing varying degrees of infestation (Figure 2). Therefore it is very difficult to detect the disease in the field. The symptoms are not usually seen until after harvest, unless infestation levels are high.

T. indica reduces grain quality by discolouring and imparting an objectionable odour to the grain and products made from it. It also causes a small reduction in yield. Generally, *Triticum aestivum* containing more than 3% bunted kernels is considered unsatisfactory for human consumption (Fuentes-Davila, 1996).

There are other *Tilletia* species that can be confused with *T. indica* and are commonly found in harvested grain or seeds. These include *Tilletia walkeri* (a pathogen of *Lolium perenne* and *Lolium multiflorum*), *T. horrida* (a pathogen of *Oryza* spp.) and *T. ehrhartae* (a pathogen of *Ehrharta calycina*). In Australia, *T. walkeri* and *T. ehrhartae* are found to contaminate harvested seed of *Triticum aestivum. T. walkeri* and *T. horrida* are present in the United States and are detected in harvested seed of *Triticum aestivum*, especially where *Oryza* spp. and *Lolium* spp. are grown in rotation with *Triticum aestivum* (Castlebury, 1998; Castlebury and Carris, 1999; Pascoe *et al.*, 2005). Because of the morphological similarity of these pathogens, accurate identification is important.

2. Taxonomic Information

Name:	*Tilletia indica* Mitra, 1931
Synonyms:	*Neovossia indica* (Mitra) Mundkur, 1941
Taxonomic position:	Eukaryota, Fungi, Basidiomycota, Ustilaginomycotina, Exobasidiomycetes, Exobasidiomycetidae, Tilletiales, Tilletiaceae
Common name:	Karnal bunt or partial bunt
Reference:	MycoBank 267835

3. Detection

The diagnostic scheme for *T. indica*, as presented in Figure 3, describes procedures for the detection of teliospores in seeds or grain of host plants. Seeds or grain samples are visually examined for the presence of bunted kernels (section 3.1). If a bunted kernel is detected, teliospores can be removed and *T. indica* can be identified by morphology (section 4.1).

If no bunted kernels are detected in the sample, the sample may be tested for the presence of teliospores by using a size-selective sieve wash test on three subsamples (section 3.2). However, such testing may not distinguish between infested grain and grain contaminated with teliospores on the seed surface. If no teliospores are detected after the size-selective sieve wash test, the diagnostic result of

the sample is negative. If teliospores are detected, the number of teliospores detected will determine which method can be used for identification:

- If 10 or more teliospores are detected, the first step is identification of the species of the teliospores (section 4.1) by morphology. If further confirmation is required, the next step is *either* isolation of the teliospores and germination (section 4.2.1) followed by the molecular protocols described in sections 4.3.1–4.3.3 *or* removal of individual teliospores (section 4.2.3) followed by a direct real-time polymerase chain reaction (PCR) on the individual teliospores (section 4.3.4). (Refer to A, B and C in Figure 3.)
- If fewer than 10 teliospores are detected, for reliable discrimination between *T. indica* and similar species it is highly recommended that the size-selective sieve wash test is repeated on new subsamples. The detection limit may or may not be the same as the regulatory limit.

In this diagnostic protocol, methods (including reference to brand names) are described as published, as these defined the original level of sensitivity, specificity and/or reproducibility achieved.

3.1 Examination of seeds/grain

Direct visual examination either for bunted kernels or for teliospores contaminating seed or grain surfaces is not considered a reliable method for phytosanitary purposes. However, bunted kernels may be detected by visual examination with the naked eye in conjunction with low power microscopy (10–40× magnification). This protocol is based on the examination of a 1 kg sample of seeds or grain; the whole sample needs to be examined for bunted kernels (Figure 2) or other Poaceae seeds (for example *Lolium* spp.). The symptoms observed and the presence of the other Poaceae seeds is recorded.

If bunted kernels are present, a positive diagnosis can be made based on the morphology of the teliospores. Microscope slides of the teliospores must be made and the morphology of these teliospores described. If the morphology of the teliospores is consistent with that of *T. indica* (refer to section 4.1 and Figures 4–8) a positive diagnosis can be made.

To help visualize symptoms, kernels can be soaked in 0.2% NaOH for 24 h at 20 °C, which mildly bleaches the endosperm and makes the blackened infection stand out in stark contrast. This process is especially useful for chemically treated seed lots where coloured dyes may obscure symptoms (Agarwal and Mathur, 1992; Mathur and Cunfer, 1993). With severe infestation and contamination, teliospores may be seen on the surface of seeds (Mathur and Cunfer, 1993).

In the absence of bunted kernels the size-selective sieve wash test (section 3.2) may be used to determine whether *T. indica* is present or not present in the sample. Alternatively, in the absence of bunted kernels *T. indica* may be considered not to be present. If seed of *Lolium* spp. is found contaminating the sample there is a high probability that *T. walkeri* will be detected in the sample.

3.2 Extraction of teliospores from seeds/grain, size-selective sieve wash test

The size-selective sieve wash test is a reliable method for detecting *T. indica* teliospores in an untreated sample of *Triticum aestivum*, *Triticum durum* or *Triticum aestivum* × *Secale cereale*. It is important that a minimum of three replicate subsamples of 50 g each is tested to ensure detection of teliospores if they are present in the sample (refer to Table 1 for the number of samples required to detect different numbers of teliospores). This method has, on average, an 82% efficiency of recovery, and microscopic examination typically requires only a few slides per 50 g sample. The method is described below and further details are available from Inman *et al.* (2003), Peterson *et al.* (2000) and Wright *et al.* (2003). The detection limit may or may not be the same as the regulatory limit.

It is important that all equipment is soaked before use for 15 min in a bleach solution (1.6% sodium hypochlorite (NaOCl) active ingredient) to eliminate the risk of false positives by cross-contamination from previous samples. Bleach kills teliospores and makes them appear hyaline compared with their normally dark, pigmented appearance. All equipment is rinsed with tap water after soaking.

The 50 g sample of untreated seed is placed in an Erlenmeyer flask (250 ml) with 100 ml 0.01% Tween 20 aqueous solution. The sample is placed on a shaker for 3 min at 200 r.p.m. to release the teliospores, then it is poured onto a 53 µm sieve sitting on top of a 20 µm sieve, which is sitting inside a funnel on top of another flask (500 ml). The flask that contained the sample is then rinsed twice with approximately 50 ml sterile tap water each time: the rinsing water is poured over the sample sitting in the sieve. The sample is further washed with sterile tap water (200–300 ml) using an aspirator bottle to ensure good removal of the teliospores from the seed. The sample and the 53 µm sieve are removed. The 20 µm sieve is tilted to a 45° angle and, using an aspirator bottle filled with sterile tap water, the debris is washed on the sieve from the top to the bottom with a sidewards sweeping motion, going backwards and forwards. This process washes all teliospores recovered from the sample into the lower part of the sieve. The teliospores and debris are then washed into a 15 ml conical centrifuge tube. It is important that polypropylene tubes are used as the teliospores will stick to the sides of polycarbonate tubes, giving false results. These steps are repeated until the 20 µm sieve appears clean. The final volume in the tube will be approximately 8 ml. If necessary, the 20 µm sieve can be examined under a low power microscope to check for residual teliospores.

The collected suspension is centrifuged at 1000 *g* for 3 min to collect the teliospores, as they are denser than most of the debris collected during the wash test. The equation for calculating the relative centrifugal force (RCF (*g*)) from r.p.m. is $RCF = 1.12\ r_{max}\ (r.p.m./100)^2$, where r_{max} is the maximum radius (mm) from the centre of rotation to the bottom of the centrifuge tube. The supernatant is carefully removed, without disturbing the pellet, using a new disposable Pasteur pipette. The pellet can then be examined under the microscope. If the pellet is too thick, water can be added to dilute the suspension, and the pellet stirred with a pipette tip to ensure an even suspension is obtained, before examination under the microscope.

The whole pellet suspension is placed in 20 µl lots onto a microscope slide and covered with a coverslip. The slides are examined using bright field microscopy at 20–40× magnification. It is important to examine every square millimetre of the suspension on the slide for the presence of teliospores. If teliospores are found, the morphological characteristics (e.g. size, colour and ornamentation) and the number of teliospores found on each slide are recorded.

Table 1. Number of replicate 50 g subsamples required to detect different levels of contamination with specified confidences, assuming an equal distribution of teliospores (Peterson *et al.*, 2000)

	No. replicate samples required for detection according to level of confidence (%)		
Contamination level (no. teliospores per 50 g sample)	99%	99.9%	99.99%
1	3	5	6
2	2	3	4
5	1	1	1

4. Identification

Identification of *T. indica* is based on either (a) symptoms on kernels and morphology of teliospores, or (b) morphology of teliospores and detection of the unique DNA sequence by one of the PCR techniques (see Figure 3).

4.1 Morphology of teliospores

When suspect teliospores are found in a sieve wash test, the kernels in both the washed subsample(s) and the parent sample could be re-examined for symptoms. If symptoms are found, they should be

confirmed by microscopic examination of the teliospores. Any grass seeds found in the sample should also be examined for signs of bunt infestation and, if found, the associated teliospores should be examined microscopically. If the teliospores found in the sieve wash test are the same as those found on bunted kernels a diagnosis can be made. If, however, no bunted kernels are found in the larger sample, testing with one of the molecular tests (sections 4.3.1–4.3.4) is recommended for identification.

Table 2 lists the morphological characteristics of *T. indica* teliospores as well as teliospores of the common *Tilletia* species that can be found in seeds or grain shipments and confused with *T. indica.*

4.1.1 Morphological identification

T. indica teliospores are globose to subglobose, sometimes with a small hyphal fragment (more common on immature teliospores, but occasionally found on mature teliospores); mostly 22–47 µm in diameter, occasionally larger, up to 64 µm (mean 35–41 µm); pale orange-brown to dark, reddish brown; mature teliospores black and opaque (Figures 4 and 5); densely ornamented with sharply pointed to truncate spines, occasionally with curved tips, 1.4–5.0 (–7.0) µm high, which in surface view appear as either individual spines (densely echinulate) or closely spaced, narrow ridges (finely cerebriform) (Figures 4 and 5); the spines are covered by a thin hyaline membrane (Carris *et al.*, 2006; CMI, 1983).

Sterile cells of *T. indica* are globose, subglobose to lachrymiform (tear-shaped), yellowish brown, 10–28 µm × 48 µm, with or without an apiculus (short stalk), with smooth walls up to 7 µm thick and laminated. Sterile cells are likely to be uncommon in sieved washings (Carris *et al.*, 2006; CMI, 1983).

If 10 or more teliospores are present in a sieve wash test, then the morphological identification can be confirmed. If fewer than 10 teliospores are detected, morphological characteristics are not considered completely reliable for confident identification (EPPO, 2007). In this case it is recommended that the sample is resampled by preparing new subsamples from the original 1 kg and tested.

4.1.2 Morphological comparison with other *Tilletia* species

The most important morphological characteristics that discriminate *T. indica*, *T. walkeri*, *T. horrida* and *T. ehrhartae* are teliospore size (range and mean), ornamentation and colour (Table 2; Figures 4–8). Published reports often vary on spore size. The spore size is affected by the mounting medium and by heating treatments. Pascoe *et al.* (2005) showed that in Australia, *T. walkeri* and *T. ehrhartae* are common contaminants of harvested *Triticum aestivum.* In the United States, the morphologically and genetically similar fungus *T. walkeri* and also *T. horrida* are known contaminants of harvested *Triticum aestivum* (Castlebury and Carris, 1999; Cunfer and Castlebury, 1999; Smith *et al.*, 1996). In addition to the *Tilletia* species mentioned in Table 2, other tuberculate-spored *Tilletia* species may be confused with *T. indica* (Durán, 1987; Durán and Fischer, 1961; Pimentel *et al.*, 1998). These species are less likely to be found as contaminants of *Triticum aestivum.* They include *Tilletia barclayana sensu lato* (smut of various Poaceae, e.g. *Panicum* and *Paspalum*), *Tilletia eragrostidis* (on *Eragrostis*), *Tilletia inolens* (on *Lachnagrostis filiformis*), *Tilletia rugispora* (on *Paspalum*) and *Tilletia boutelouae* (on *Bouteloua gracilis*). None of these morphologically similar species has been found to naturally infest *Triticum aestivum.*

The median teliospore spin profiles can be enhanced by bleaching the teliospores in 10% NaOCl for 15–20 min. If necessary, teliospores can then be rinsed twice in water and stained, for example with trypan blue or cotton blue in lactoglycerol (Figure 8).

4.2 Isolation and germination of teliospores

There are now two methods available to confirm the identification of teliospores detected in the sieve wash test (section 3.2). There is the standard procedure of recovering the teliospores from the slide and inducing their germination (section 4.2.1) and a new procedure developed by Tan *et al.* (2009) that enables PCR to be done directly on a single teliospore recovered from the slide (section 4.2.3).

4.2.1 Germination of teliospores

T. indica is a facultative biotroph. To produce cultures, teliospores are soaked in water, quickly surface-sterilized and then germinated on water agar plates.

The teliospores can be recovered from the slides and coverslips by washing them with distilled water over the 20 µm sieve and then into a clean sterile conical centrifuge tube (as in section 3.2). The volume should be approximately 3–5 ml. The tubes are incubated overnight at 21 °C to hydrate the teliospores and make fungal and bacterial contaminants more susceptible to subsequent surface sterilization. After overnight incubation, the teliospores are pelleted by centrifugation at 1200 *g* for 3 min.

The supernatant is removed and the teliospores are sterilized by suspending the pellet in 5 ml bleach (0.3–0.5% NaOCl active ingredient), inverting the tube quickly three times and centrifuging at 1200 *g* for 1 min. Some teliospores can be killed if the total time in the bleach exceeds 2 min. As an alternative to bleach treatment, teliospores can be surface-sterilized for 30 min in 5–10 ml acidified electrolyzed water (AEW). AEW effectively surface-sterilizes teliospores but, compared with a 1–2 min bleach treatment, stimulates rather than reduces teliospore germination (Bonde *et al.*, 1999). The teliospores are then washed twice by removing the supernatant, resuspending the pellet in 1 ml sterile distilled water (SDW) and centrifuging at 1200 *g* for 5 min.

The pellet is resuspended in 1 ml SDW and 200 µl of the teliospore suspension is placed aseptically onto 2% water agar with antibiotics (WA+A) plates and spread with a sterile spreader. The antibiotics used are 60 mg penicillin-G (Na salt) and 200 mg streptomycin sulphate per litre of agar (EPPO, 2007). The WA+A plates are incubated at 21 °C with a 12 h light cycle. The plates are left for about 5 days before being sealed or placed inside clear polyethylene bags.

After 7–14 days, non-dormant teliospores produce a promycelium bearing 32–128 or more basidiospores (primary sporidia) at its tip. These colonies produce secondary sporidia typically of two types: filiform and allantoid. These can then be cultured directly on solid media (Figure 9) or liquid nutrient media such as potato dextrose broth. Small blocks of agar (1 cm × 1 cm) bearing germinated teliospores or colonies are cut out and then stuck to the underside of a Petri dish lid so that the germinated teliospore is facing the surface of the broth. This allows the sporidia to be released onto the broth surface. The dishes are incubated at 21 °C with a 12 h light cycle. After 2–3 days, basidiospores deposited onto the broth surface produce small mats of mycelia of approximately 0.5–1.0 cm diameter. Each mycelial mat is removed with a sterile dissecting needle, and touched onto sterile filter paper to remove excessive broth. The mycelium is placed in suitable vials (e.g. 1.5–2.0 ml microcentrifuge tubes) for immediate DNA extraction, or stored at −80 °C for later DNA extraction.

Germination of teliospores for molecular analysis may not always be possible; for example, if seeds are treated with NaOH as in the case of fungicide-treated grain. Increasing the number of sieved replicates may increase the number of teliospores recovered and hence the number of teliospores that can be germinated. Teliospores can have a period of dormancy, which can effect germination (Carris *et al.*, 2006). This can be resolved by carrying out direct real-time PCR on individual teliospores (see section 4.3.4).

Table 2. Morphological characteristics of teliospores of *Tilletia indica*, *Tilletia walkeri*, *Tilletia horrida* and *Tilletia ehrhartae*, and hosts associated with these four species

Species	Teliospore size (µm)	Teliospore size (mean) (µm)	Teliospore colour	Teliospore shape	Teliospore sheath	Teliospore spines	Host
T. indica[a]	22–64	35–41	Pale orange-brown to dark reddish brown, mature spores black to opaque	Globose to subglobose	Present	1.4–5(–7) µm In surface view, densely echinulate or as closely spaced, narrow ridges (finely cerebriform). In median view, smoother more complete outline due to spines being densely arranged occasionally with curved tips.	*Triticum* spp.
T. walkeri[b]	28–35	30–31	Pale yellow to dark reddish brown (never black or opaque)	Globose	Present, extending to tips of projections, hyaline to yellowish brown	3–6 µm Coarse +/– cerebriform. Wide incompletely cerebriform ridges in surface view. In median view, profile is irregular with gaps between spines.	*Lolium perenne* and *Lolium multiflorum*
T. horrida[c]	14–36 (mature <25)	24–28	Light to dark chestnut brown, can be semi-opaque	Globose to subglobose	Present, extending to the ends of the spines, hyaline to tinted	1.5–4 µm Frequently curved, and appear as polygonal scales in surface view.	*Oryza* spp.
T. ehrhartae[d]	17–25	no data	Very dark olivaceous brown when mature. Can be opaque because of melanization of the scales.	Globose to subglobose	Present, extending to the apex of the spines or slightly beyond	1–2.5 µm Cylindrical or slightly tapered spines. In surface view, rarely cerebriform. Larger, acute polygonal scales. In median view, broadly truncated to slightly rounded at apex.	*Ehrharta calycina*

Notes: [a]Based on Inman *et al.* (2003). [b]Based on Castlebury, 1998; Milbrath *et al.,* 1998; Castlebury and Carris, 1999; Cunfer and Castlebury, 1999. [c]As *T. barclayana*: Durán and Fischer, 1961; CMI, 1965; Durán, 1987; Castlebury and Carris, 1999. As *T. horrida*: Khanna and Payak, 1968; Aggarwal *et al.,* 1990; Castlebury, 1998. [d]Pascoe *et al.,* 2005.

4.2.2 Germination of similar *Tilletia* species

In culture, *T. walkeri* and *T. indica* produce very similar colonies. On potato dextrose agar (PDA) after 14 days at 19 °C with a 12 h light cycle, both species typically produce white to cream-coloured slow-growing irregular crustose colonies, approximately 4–6 mm in diameter (Figure 9). In contrast, comparable cultures of *T. horrida* grow significantly more slowly (colonies only 2–3 mm in diameter) because of their higher optimal temperature. *T. horrida* isolates may also produce a reddish purple pigment (Figure 9), both on PDA and potato dextrose broth.

4.2.3 Recovery of single teliospores

After the teliospores are examined and their morphology is recorded, the slide is allowed to dry out, either with or without the coverslip on. When the coverslip is removed, it is placed on the slide upside down so it can be checked for teliospores adhering to it.

On another slide a single piece of a coverslip obtained by cutting into tiny pieces (1×1 mm^2) is placed that has been sterilized (autoclaved at 121 °C for 15 min or baked at 170 °C for 2 h). A 1 µl drop of Tris-ethylenediaminetetraacetic acid (EDTA) (TE) buffer is placed onto this piece of coverslip. Under either a compound or a dissecting microscope, a single teliospore is picked off with a very fine needle and placed into the droplet of TE buffer. The teliospore will transfer to the droplet. Using forceps another sterilized small piece of coverslip is placed on top to make a sandwich. The teliospore is crushed by using the forceps to press down on the coverslip, and then the glass sandwich is transferred into a 0.2 ml PCR tube. The coverslip is crushed further with a pipette tip (Tan *et al.*, 2009).

The procedure then followed is as described in section 4.3.4.1.

4.3 Molecular identification

There are a number of molecular methods available for the identification of *T. indica*. Any of the methods described below may be used, however, it is essential that reference material (positive controls) has been obtained from experts in this area (refer to section 6).

The first three protocols described below work well but rely upon germination of the teliospores so that sufficient DNA can be extracted from the mycelial mat produced. Germination of the teliospores can take up to three weeks. Peterson *et al.* (2000) found the average teliospore germination rate to be 55%, which severely reduces the chances of identifying the teliospores by these three molecular methods. A fourth molecular protocol is then described that does not rely upon germination of the teliospores.

Diagnostically significant differences exist between *T. indica*, *T. walkeri* and *T. horrida* in their nuclear and mitochondrial (mt) DNA. Interspecific polymorphisms have been identified using various PCR methods, including random amplification of polymorphic DNA (RAPD), restriction fragment length polymorphism (RFLP) and amplified fragment length polymorphism (AFLP) (Laroche *et al.*, 1998; Pimentel *et al.*, 1998). In the nuclear ribosomal (r) DNA internal transcribed spacer (ITS) 1 and 2 regions, there is a >98% similarity between *T. walkeri* and *T. indica* sequences (Levy *et al.*, 2001). However, within the ITS1 region, *T. walkeri* has a diagnostically important restriction enzyme site (*Sca*1) that is not present in *T. indica*, *T. horrida* or other closely related species (Levy *et al.*, 2001; Pimentel *et al.*, 1998). mtDNA sequence differences have enabled species-specific primers to be designed for *T. indica* and *T. walkeri* (Frederick *et al.*, 2000). These primers can be used in conventional PCR assays, in a TaqMan® system in conjunction with a probe (Frederick *et al.*, 2000) or real-time multiplex assay with five probes (Tan *et al.* 2009).

4.3.1 Restriction enzyme analysis of the ITS1 region

The target gene region is the ITS region of the nuclear rRNA gene (Pimentel *et al*., 1998). The PCR amplicon produced includes both ITS1 and ITS2 and the conserved fragment 5.8S. This amplicon is approximately 670 base pairs (bp) including primer sequences. Oligonucleotides used for *T. indica*:

Forward primer ITS1 (5′-TCC GTA GGT GAA CCT GCG G-3′)

Reverse primer ITS4 (5′-TCC TCC GCT TAT TGA TAT GC-3′) (White *et al*., 1990).

DNA is extracted from mycelium. This is done either by grinding up the mycelium using a mortar and pestle or by placing approximately 0.1 g mycelium in a sterile 2 ml microcentrifuge tube one-third full with sterile 0.5 mm glass beads and 1 ml molecular grade water (MGW). The tube is sealed with a screw lid containing an o-ring and oscillated in a beadbeater or in a tissue lyser on quarter power for 5 min. The ground sample is allowed to stand for 30 s, then its DNA is extracted using a proprietary DNA extraction kit for fungi. No DNA cleanup is required. The extracted DNA is used immediately, kept overnight at 4 °C or stored at −20 °C for longer periods.

PCR to produce the restriction amplicon uses the following mastermix (concentration per 50 µl single reaction): 1× PCR buffer (containing 1.5 mM $MgCl_2$ (Applied Biosystems))[1], 0.2 mM of each dNTP, 1.25 µl AmpliTaq (5 U/µl) (Applied Biosystems)[1], 0.5 µM each primer and 1 µl extracted DNA. PCR cycling parameters are: 94 °C denaturation for 2 min; 30 cycles of 94 °C for 1 min, 54 °C for 1 min and 72 °C for 1 min; and a 72 °C extension step for 10 min.

Restriction of the PCR amplicon is done as follows. Restriction mix (concentration per 20 µl single reaction): 7.3 µl MGW, 2.0 µl restriction buffer (Promega)[2], 0.2 µl bovine serum albumin (10 µg/µl), 0.5 µl restriction enzyme (either *Taq*1 or *Sca*1 at 10 U/µl (Promega))[2] and 10.0 µl neat DNA amplicon solution as produced above (>50 ng/µl DNA). This mix is incubated for 3 h at 37 °C, and the reaction is gently mixed by inversion during incubation. Restricted products are stored at 4 °C before visualizing on a gel. When required, 10 µl reaction product is loaded with a suitable marker and run on a 2% gel.

The assay is positive for *T. indica* if amplified test samples are cut with restriction enzyme *Taq*1 to give five products (occurring at 60, 70, 110, 170 and 260 bp) and there is no cut with *Sca*1. A positive result for *T. walkeri* is obtained if amplified test samples are restricted with *Taq1* to give the same five fragments as with *T. indica*, but *Sca*1 restricts amplified products to give two fragments: at 140 bp and 520 bp. If the amplified product comes from *T. horrida*, *Taq*1 produces four DNA fragments (60, 110, 150 and 335 bp) and *Sca*1 produces no cuts. Other *Tilletia* species give different restriction patterns with these and other enzymes (Pimentel *et al*., 1998).

[1] The use of products of the brand Applied Biosystems in this diagnostic protocol implies no approval of them to the exclusion of others that may also be suitable. This information is given for the convenience of users of this protocol and does not constitute an endorsement by the CPM of the chemical, reagent and/or equipment named. Equivalent products may be used if they can be shown to lead to the same results.

[2] The use of products of the brand Promega in this diagnostic protocol implies no approval of them to the exclusion of others that may also be suitable. This information is given for the convenience of users of this protocol and does not constitute an endorsement by the CPM of the chemical, reagent and/or equipment named. Equivalent products may be used if they can be shown to lead to the same results.

4.3.2 Conventional PCR assay using species-specific primers

This assay was designed by Frederick *et al*. (2000) using mtDNA[3], producing an amplicon of 414 bp. Oligonucleotides used for *T. indica*:

Forward primer Tin 3 (5′-CAA TGT TGG CGT GGC GC-3′)

Reverse primer Tin 4 (5′-CAA CTC CAG TGA TGG CTC CG-3′).

DNA is extracted from mycelium. This is done by grinding 0.5–1.0 g mycelium in a 1.5 ml microcentrifuge tube with 75 µl lysis buffer and then grinding further with a sterile pestle attached to a power drill. An additional 75 µl lysis buffer is added before extracting DNA using a proprietary DNA extraction kit for fungi. No DNA cleanup is required. Extracted DNA is used immediately, kept overnight at 4 °C or stored at −20°C for longer periods.

PCR for this assay uses the following mastermix (concentration per 25 µl single reaction): 1x PCR buffer (containing 10 mM Tris-HCl, 50 mM KCl (pH 8.3), 1.5 mM $MgCl_2$ and 0.001% (w/v) gelatin); dATP, dGTP, dCTP and dTTP, each at a concentration of 0.1 µM; each primer at a concentration of 0.1 µM; 0.5 U of *AmpliTaq* DNA polymerase; and 1.0 µl extracted DNA obtained as described above.

PCR cycling parameters are: 94 °C denaturation for 1 min; 25 cycles of 94 °C for 15 s, 65 °C for 15 s and 72 °C for 15 s; and a 72 °C extension step for 6 min.

As required, 10 µl reaction product is loaded with a suitable marker and run on a 2% agarose gel.

When testing for *T. walkeri*, the Tin 3 primer is replaced with 0.1 µl forward primer Tin 11 (5′-TAA TGT TGG CGT GGC AT-3′) (25 µM). This produces an amplicon of 414 bp.

Positive reactions produce a single amplicon of 414 bp for both *T. indica* (primers Tin 3/Tin 4) and *T. walkeri* (primers Tin 11/Tin 4). If the *T. walkeri*- and *T. indica*-specific primers do not produce positive results for the test samples (but positive control DNA samples *are* positive), then the sample extractions belong to another *Tilletia* species, such as *T. horrida*. Restriction enzyme analysis may enable further species identification of these samples if required (section 4.3.1).

Alternatively, no amplification can result from poor quality DNA. This can be checked by testing extracts with the universal primers (ITS1 and ITS4) described in section 4.3.1. If the samples contain good quality DNA and hence test samples are not *T. indica* or *T. walkeri* but another *Tilletia* species, then a single band (approximately 670 bp) will be produced when PCR amplicons are run on an agarose gel. If amplification is still not produced, fresh DNA should be extracted and retested.

4.3.3 PCR assay using species-specific primers and a fluorescent probe

This assay was designed by Frederick *et al.* (2000) using genomic DNA, producing an amplicon of 212 bp. Oligonucleotides used for *T. indica*:

Forward primer Tin 3 (5′-CAA TGT TGG CGT GGC GC-3′)

Reverse primer Tin 10 (5′-AGCTCCGCCTCAAGTTCCTC-3′)

RT probe: TaqMan® probe (10 µM) (Applied Biosystems[1]): 5′-(FAM label)-ATT CCC GGC TTC GGC GTC ACT-(TAMRA quencher)-3′.

DNA is extracted from mycelial tissue as described in section 4.3.2.

[3] Ferreira and colleagues submitted the GenBank accession numbers AF218058, AF218059 and AF218060. This mitochondrial sequence shares low homology with a *T. indica* mitochondrial DNA sequence with accession number DQ993184: BLAST results show only approximately 30% homology. The base composition of the AT content in mitochondrial DNA is higher than the GC content, which is generally 30–40% (Kurtzman, 1985), however, the AT content of the three sequences in GenBank submitted by Ferreira and colleagues is 43.5%, which is lower than the GC content (56.55%). (C) The primers TIN3/Tin4 cannot amplify mitochondrial DNA to give the desired amplicon when the primers are derived from the extracted and purified *T. indica* mitochondrial DNA; therefore, the three submitted sequences refer to genomic DNA.

PCR for this assay uses the following mastermix (concentration per 25 µl single reaction): 1× TaqMan® Universal Master Mix, 0.4 µM of either Tin3/Tin10 or Tin11/Tin10 primers and 4 µM of the probe, 12.5 ng genomic DNA for both *T. indica*- and *T. walker*-specific assays (obtained as in section 4.3.2). PCR cycling parameters are: 50 °C for 2 min, 95 °C for 10 min, and 34 cycles of 95 °C for 15 s and 60 °C for 1 min.

Optical-grade reaction tubes and caps should be used to allow real-time amplification to be monitored.

When testing for *T. walkeri*, Tin 3 is replaced with 1.0 µl forward primer Tin 11 (5′-TAA TGT TGG CGT GGC AT-3′) (25 µM), which produces an amplicon of 212 bp.

T. indica produces amplification with primers Tin 3/Tin 10 and *T. walkeri* with primers Tin 11/Tin 10. If neither primer set produces amplification but control samples react as expected, then the sample extractions belong to another *Tilletia* species, such as *T. horrida*. When testing for *T. indica* and the threshold cycle (Ct) of the sample is >33, the result indicates that it is negative for *T. indica* and is highly likely to be another species of *Tilletia*. Likewise, when testing for *T. walkeri* and the Ct is >33, the result indicates that it is negative for *T. walkeri* and is highly likely to be another species of *Tilletia*. Restriction enzyme analysis may enable further species identification of these samples if required (section 4.3.1).

No amplification can result from poor quality DNA. This can be checked by testing extracts with the universal primers (ITS1 and ITS4) described in section 4.3.1. If the samples contain good quality DNA and hence test samples are not *T. indica* or *T. walkeri* but another *Tilletia* species, then a single band (approximately 670 bp) will be produced when PCR amplicons are run on an agarose gel. If amplification is still not produced, fresh DNA should be extracted and retested.

The sensitivity limits of both the *T. indica* and *T. walkeri* assays were found to be 5 pg total DNA. This concentration produced detectable levels of fluorescence (Frederick *et al*., 2000). The species specificity of the assays was tested against DNA extracted from *T. barclayana, Tilletia tritici, Tilletia laevis, Tilletia controversa* and *Tilletia fusca.* None of these isolates amplified in either the *T. indica*- or the *T. walkeri*-specific assays (Frederick *et al*., 2000).

4.3.4 Direct real-time PCR on teliospores

This assay was designed by Tan *et al*. (2009) to use the ITS region that occurs between the nuclear small and large subunit rDNA. It was found that *Tilletia* species have two variable regions (ITS1 and ITS2) separated by the conserved 5.8S rRNA gene (Levy *et al.,* 2001; Tan and Murray, 2006). The protocol is designed to initially amplify *Tilletia*-specific DNA and then use real-time PCR and fluorescent probes to identify the species of *Tilletia*. The ITS1 region in rDNA was targeted in this study for the design of the multiplex assay; a five-plex fluorescent PCR assay to identify closely related *Tilletia* species detected in grain.

An aliquot of the reaction mix is added to the PCR tube (from section 4.2.3) and using the same pipette tip the glass sandwich is crushed into pieces to release the spore material. It is important to ensure the PCR tube is not cut during the crushing.

4.3.4.1 Amplification of *Tilletia* DNA before proceeding to real-time PCR

Amplification of *Tilletia*-specific DNA of various *Tilletia* species is performed with primers MK56 (5'-GTA GGT GAA CCT GCG GAA GGA TCA TT-3′) (Tan *et al.*, 1996) and Tilletia-R (5'-CAA GAG ATC CGT TGT CAA AAG TTG-3′) (Tan and Murray, 2006). Each PCR is performed in 20 µl (single reaction) containing 1.5 mM $MgCl_2$, 200 µM each of the four deoxynucleotides dATP, dTTP, dCTP and dGTP, 0.5 µM each of the primer pair and 0.5 U Taq DNA polymerase (Invitrogen[4]) in 1× buffer (50 mM Tris (pH 9.0), 20 mM NaCl, 1% Triton X-100 and 0.1% gelatin).

[4] The use of products of the brand Invitrogen in this diagnostic protocol implies no approval of them to the exclusion of others that may also be suitable. This information is given for the convenience of users of this

The thermal cycling parameters are: an initial cycle of 95 °C for 3 min; 20 cycles of 94 °C for 20 s, 63 °C for 30 s and 72 °C for 30 s, with the annealing temperature decreased by 1 °C per cycle for 5 cycles to 59 °C; and finally a 10 min and 1 min incubation at 72 °C and 4 °C, respectively.

The restricted products may be stored at 4 °C. If visualizing on a gel, 10 µl reaction product is loaded with a suitable marker and run on a 2% agarose gel. The expected fragment size is 260 bp. However, this fragment will not be visible if the PCR is done on a single teliospore, as there will not be enough DNA present.

4.3.4.2 Real-time five-plex fluorescent PCR assay for species identification

Real-time PCR assays with the dual-labelled probes and oligonucleotide primers (Table 3) in 20 µl reactions in 0.1 ml microfuge tubes are performed in the Rotor-Gene 6000 instrument (Qiagen[5]). The five-plex reaction mixture consists of 1× ImmoBuffer (Bioline[6], 5 mM $MgCl_2$, 200 µM of each of the four deoxynucleotides dATP, dTTP, dCTP and dGTP, 1 U Immolase™ DNA Polymerase (Bioline[6]) and 0.2 µM, 0.4 µM and 0.9 µM of each of the dual-labelled probes, the four forward primers and the four reverse primers, respectively (Table 3). The template DNA is 1 µl PCR product from the PCR amplification of *Tilletia*-specific DNA (section 4.3.4.1).

The thermal cycling parameters are an initial cycle of 95 °C for 10 min followed by 40 cycles of 94 °C for 15 s and 65 °C for 60 s, with the annealing temperature decreased by 1 °C per cycle for 6 cycles to 60 °C. The dynamic tube normalization option is used to determine the average background of each individual sample before amplification commences. Fluorescence data are recorded to five channels: green, yellow, orange, red and crimson.

The sensitivity of the test for single spores was 10–40% (i.e. out of known positive *T. indica* spores only 10–40% gave positive PCR results) (Tan and Wright, 2009). This sensitivity arises from of a number of reasons, including the fact that all *T. indica* spores and bunted grain had to be autoclaved twice so there may have been a ldeterioration of genetic material. The specificity of the probe for *T. indica* was investigated in a DNA mixture of *T. indica*:*T. walkeri* or *T. ehrhartae* or *T. caries,* in ratios of 1:0.1 pg and 0.1:1 pg (appropriate concentration range indicated from single-spore analysis). The specificity of the primers was tested and they were found not to react with other *Tilletia* species.

Standard curves for each detection of each species should be generated as described in Tan *et al*. (2009) using known concentrations of *Tilletia* spp. DNA. The Ct value (the value of the cycle where the amplification curve crosses the threshold line) obtained is used to set the threshold for that *Tilletia* species being tested. In general, a Ct value greater than that set in this step is considered a negative result.

protocol and does not constitute an endorsement by the CPM of the chemical, reagent and/or equipment named. Equivalent products may be used if they can be shown to lead to the same results.

[5] The use of products of the brand Qiagen in this diagnostic protocol implies no approval of them to the exclusion of others that may also be suitable. This information is given for the convenience of users of this protocol and does not constitute an endorsement by the CPM of the chemical, reagent and/or equipment named. Equivalent products may be used if they can be shown to lead to the same results.

[6] The use of products of the brand Bioline in this diagnostic protocol implies no approval of them to the exclusion of others that may also be suitable. This information is given for the convenience of users of this protocol and does not constitute an endorsement by the CPM of the chemical, reagent and/or equipment named. Equivalent products may be used if they can be shown to lead to the same results.

Table 3. Sequences and modifications of the primers and probes used in the five-plex fluorescent PCR diagnostic assay for *T. indica* and other related *Tilletia* spp.

Primer pairs (sequence 5′-3′)	Probes (modifications 5′, 3′)	Channel	Target
KB-DL-For: CTTCGGAAGAGTCTCCTT (nt. 64–81[a]) KB-DL- Rev: CCGGACAGGTACTCAG (nt. 127–142)	ACGGAAGGAACGAGGC (nt. 105–120) (6-FAM, BHQ1)	Green	*T. indica*
	ACGGAAGGAACAAGGC (nt. 67–82[b]) (JOE, BHQ1)	Yellow	*T. walkeri*
Hor-DL-For: GGCCAATCTTCTCTACTATC (nt. 40–59[c]) Hor-DL-Rev: CCGGACAGGATCACTA (nt. 87–102)	CAACCCAGACTACGGAGGGTGA (nt. 60–81) (CAL Fluor Red 610, BHQ2)	Orange	*T. horrida* (some strains are not detected)
Tri-DL-For: ATTGCCGTACTTCTCTTC (nt. 56–73[d]) Tri-DL-Rev: GTAGTCTTGTGTTTGGATAATAG (nt. 99–112)	AGAGGTCGGCTCTAATCCCATC A (nt. 75–97) (Quasar 670, BHQ2)	Red	Broad range*
Ehr-DL-For: CGCATTCTTATGCTTCTTG (nt. 72–90[e]) Ehr-DL-Rev: GTTAGGAACCAAAGCCATC (nt. 128–146)	CAGAGTCATTGGTTCTTCGGAG C (nt. 104–126) (Quasar 705, BHQ2)	Crimson	*T. ehrhartae*

Notes: GenBank accession numbers are [a]AF398434, [b]AF310180, [c]AF310171, [d]AF398447 and [e]AY770433. The list of the reference material used and place of origin is in Tan *et al.* (2009), and material is held at Elizabeth Macarthur Agricultural Institute (EMAI), NSW Dept. of Primary Industries in Australia (See section 6, contact points. nt., nucleotide.

*Includes *T. caries, T. laevis, T. controversa, T. fusca, T. bromi, T. goloskokovii.*

5. Records

Refer to section 2.5 in ISPM 27:2006 for the list of information that needs to be recorded and retained.

The report on the diagnosis should include the number of positive subsamples and the estimated number of teliospores detected in each positive subsample. If cultures were obtained for molecular analysis, the colony morphology, especially any pigmentation, and growth rate under defined conditions should be described. Cultures should be kept (mycelium from broths or mycelial plugs from agar plates can be stored frozen at −80 °C).

6. Contact Points for Further Information

Further information on this organism can be obtained from:

Department of Agriculture and Food, Government of Western Australia, South Perth, WA 6151, Australia (Ms Dominie Wright; e-mail: dominie.wright@agric.wa.gov.au; tel: +61 8 9368 3875; fax: + 61 8 474 2658).

Elizabeth Macarthur Agricultural Institute (EMAI), New South Wales Department of Primary Industries, Camden, NSW 2570, Australia (Dr Mui-Keng; email: mui-keng.tan@idpi.nsw.gov.au).

Laboratory of Plant Inspection and Quarantine, Shenzhen Entry-Exit Inspection and Quarantine Bureau, Shenzhen, 518045 Guangdong Province, China (Dr Guiming Zhang; email: zgm2001cn@yahoo.com.cn; tel: +86 755 8211 1148; fax: +86 755 2558 8630).

United States Department of Agriculture (USDA) Agricultural Research Service (ARS), North Atlantic Area (NAA), Fort Detrick, MD 21702, USA (Mr Gary Peterson; email: gary.peterson@ars.usda.gov).

USDA Animal and Plant Health Inspection Service (APHIS), Riverdale, MD, USA (Dr Mary Palm; email: Mary.E.Palm@aphis.usda.gov).

USDA APHIS, Beltsville, MD, USA (Dr John McKemy; email: John.M.McKemy@aphis.usda.gov)

Food and Environment Research Agency, York YO41 1LZ, United Kingdom (Dr Kelvin Hughes; email: Kelvin.Hughes@fera.gsi.gov.uk).

7. Acknowledgements

The basis of this protocol was originally drafted by A.J. Inman, K.J.D. Hughes and R.J. Bowyer, Food and Environment Agency, York, United Kingdom, in 2003. That protocol was ring-tested in European laboratories[7] (Riccioni *et al*., 2002) and has formed the basis of the EPPO protocol PM 7/29(2) (EPPO, 2007).

The protocol has been enhanced by D.G. Wright, Department of Agriculture and Food, Government of Western Australia, Perth, Australia; K.J.D Hughes, Food and Environment Agency, York, United Kingdom; and G. Zhang, Laboratory of Plant Inspection and Quarantine, Shenzhen, China. V. Cockerell, Science and Advice for Scottish Agriculture, Edinburgh, United Kingdom, reviewed the protocol.

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[7] A. Radova, State Phytosanitary Administration, Olomouc, Czech Republic; I. Vloutoglou, Benaki Phytopathological Institute, Athens, Greece; A. Porta-Puglia, Istituto Sperimentale per la Patologia Vegetale, Rome, Italy; C. Montuschi, Servizio Fitosanitario Regionale, Bologna, Italy; I. van Brouwershaven, NPPO, Wageningen, The Netherlands; M. de Jesus Gomes, E. Diogo and M.R. Malheiros, Direcção-Geral de Protecção das Culturas, Lisbon, Portugal; V. Cockerell, Science and Advice for Scottish Agriculture, Edinburgh, United Kingdom; A. Barnes, Food and Environment Research Agency (FERA), York, United Kingdom.

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9. Figures

Figure 1. An infected head of wheat showing the symptoms of Karnal bunt.

Photo courtesy Department of Agriculture and Food, Government of Western Australia.

Figure 2. Infected grains of wheat showing the symptoms of Karnal bunt.

Photo courtesy Department of Agriculture and Food, Government of Western Australia.

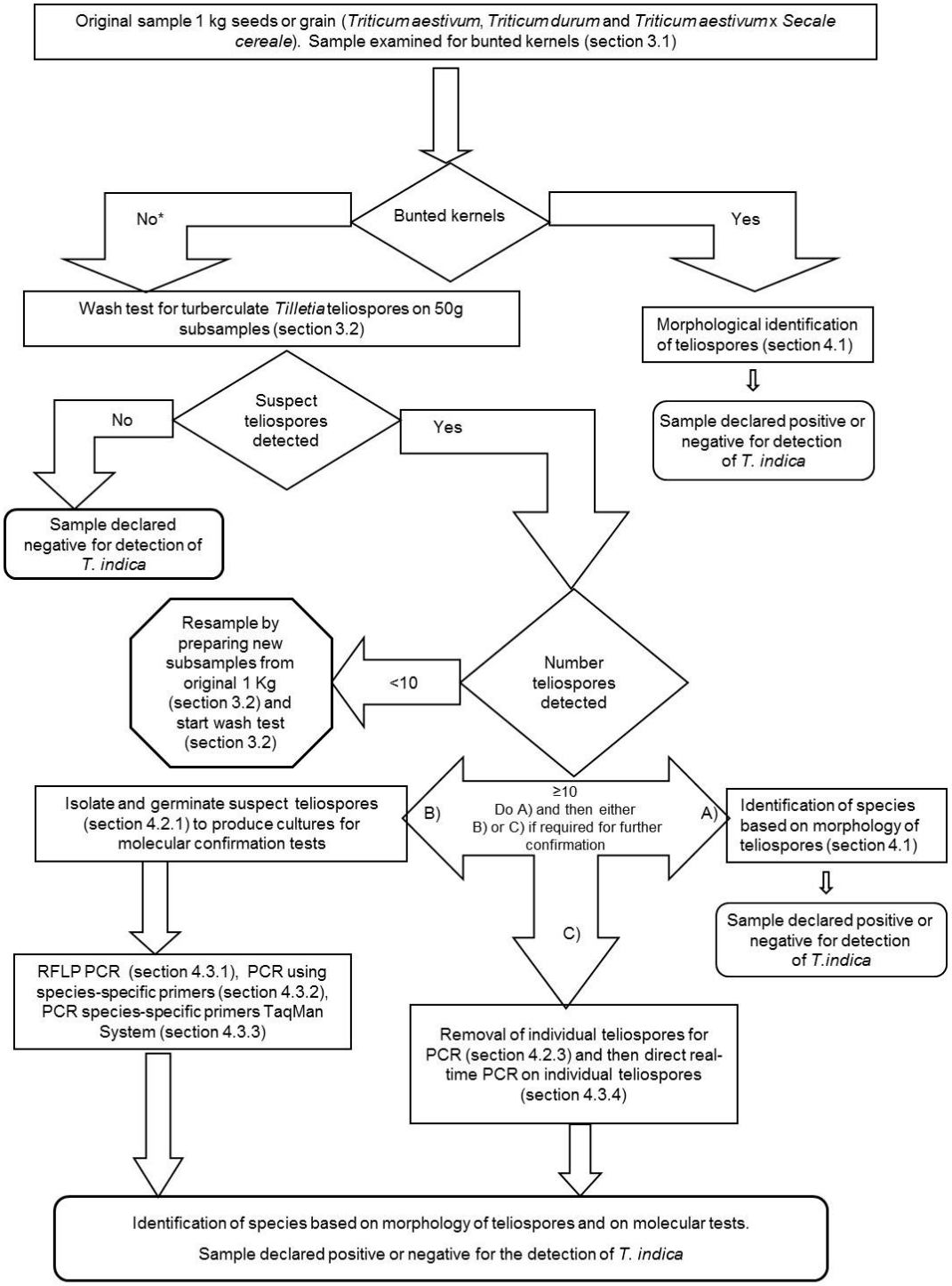


Figure 3. Flow diagram showing the process to be used for the detection and identification of *Tilletia indica* in seed and grain samples.

PCR, polymerase chain reaction; RFLP, restriction fragment length polymorphism.

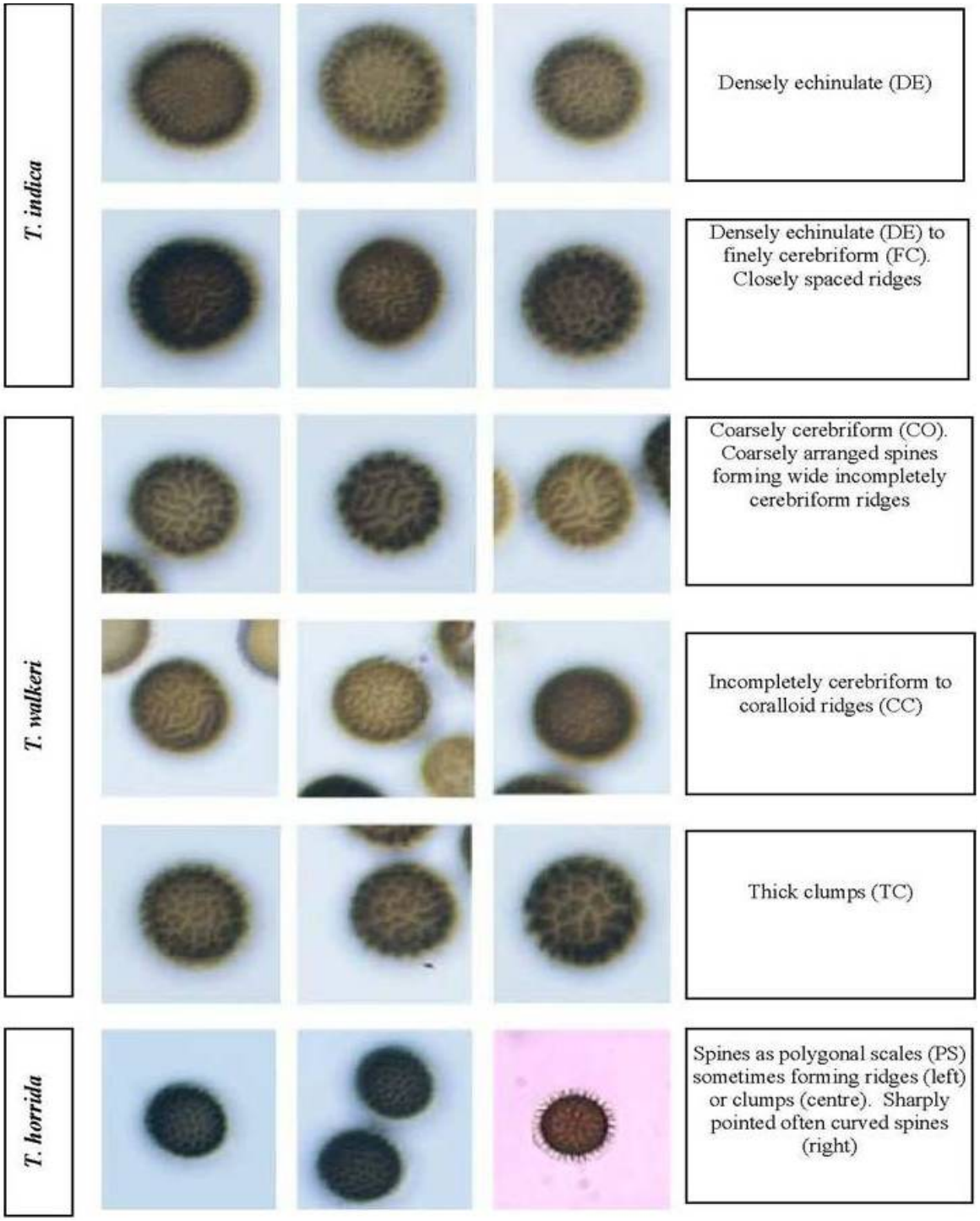


Figure 4. Pictorial key to *Tilletia* teliospore ornamentation. Use in conjunction with Table 2 (section 4.1).

Photos courtesy A. Inman, Central Science Laboratory, York, United Kingdom.

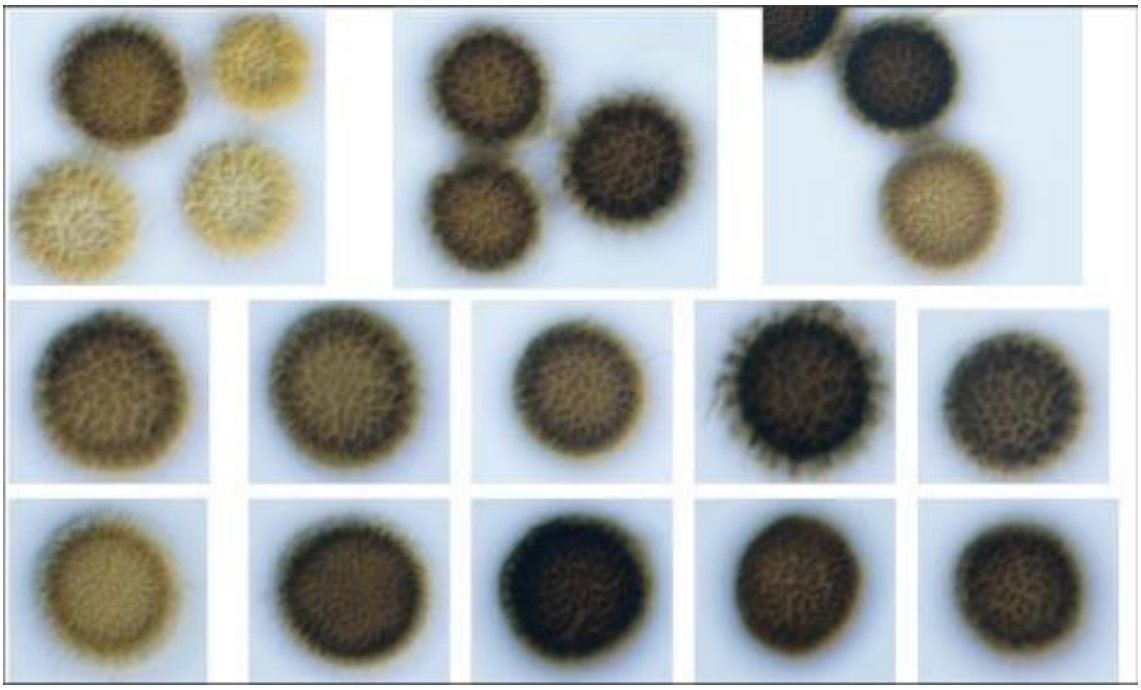


Figure 5. Teliospores of *Tilletia indica* showing surface ornamentation patterns. Spines are densely arranged, either individually (densely echinulate) or in closely spaced, narrow ridges (finely cerebriform). Scale: 10 mm = 17 µm.

Photos courtesy A. Inman, Central Science Laboratory, York, United Kingdom.

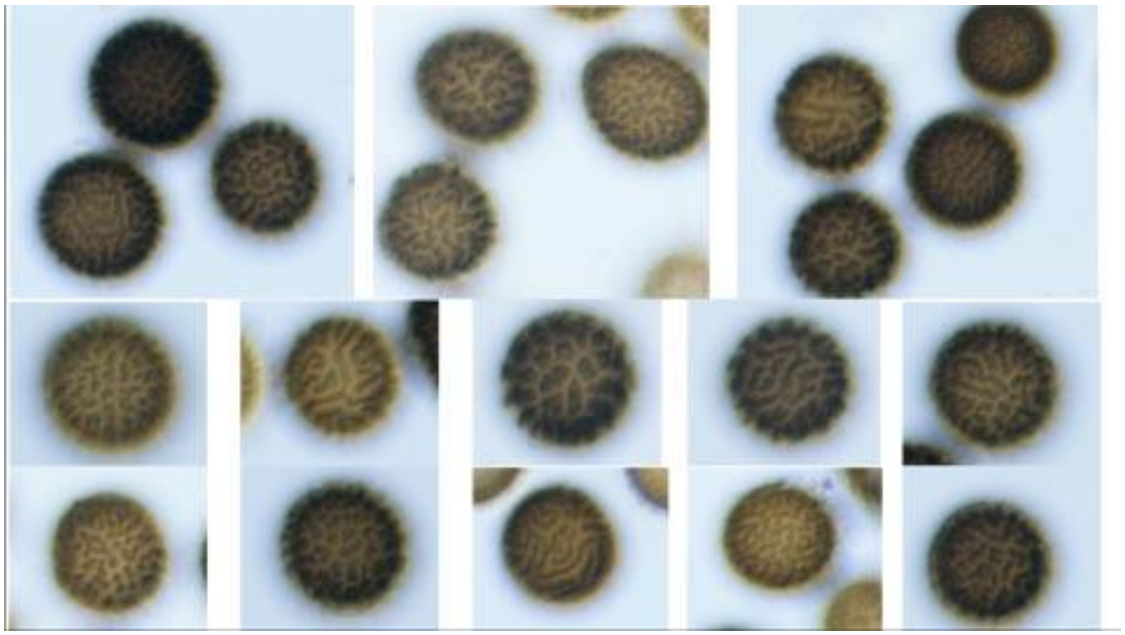


Figure 6. Teliospores of *Tilletia walkeri* showing surface ornamentation patterns. Spines are coarsely arranged and form wide, incompletely cerebriform to coralloid ridges or thick clumps. Scale: 10 mm = 17 µm.

Photos courtesy A. Inman, Central Science Laboratory, York, United Kingdom.

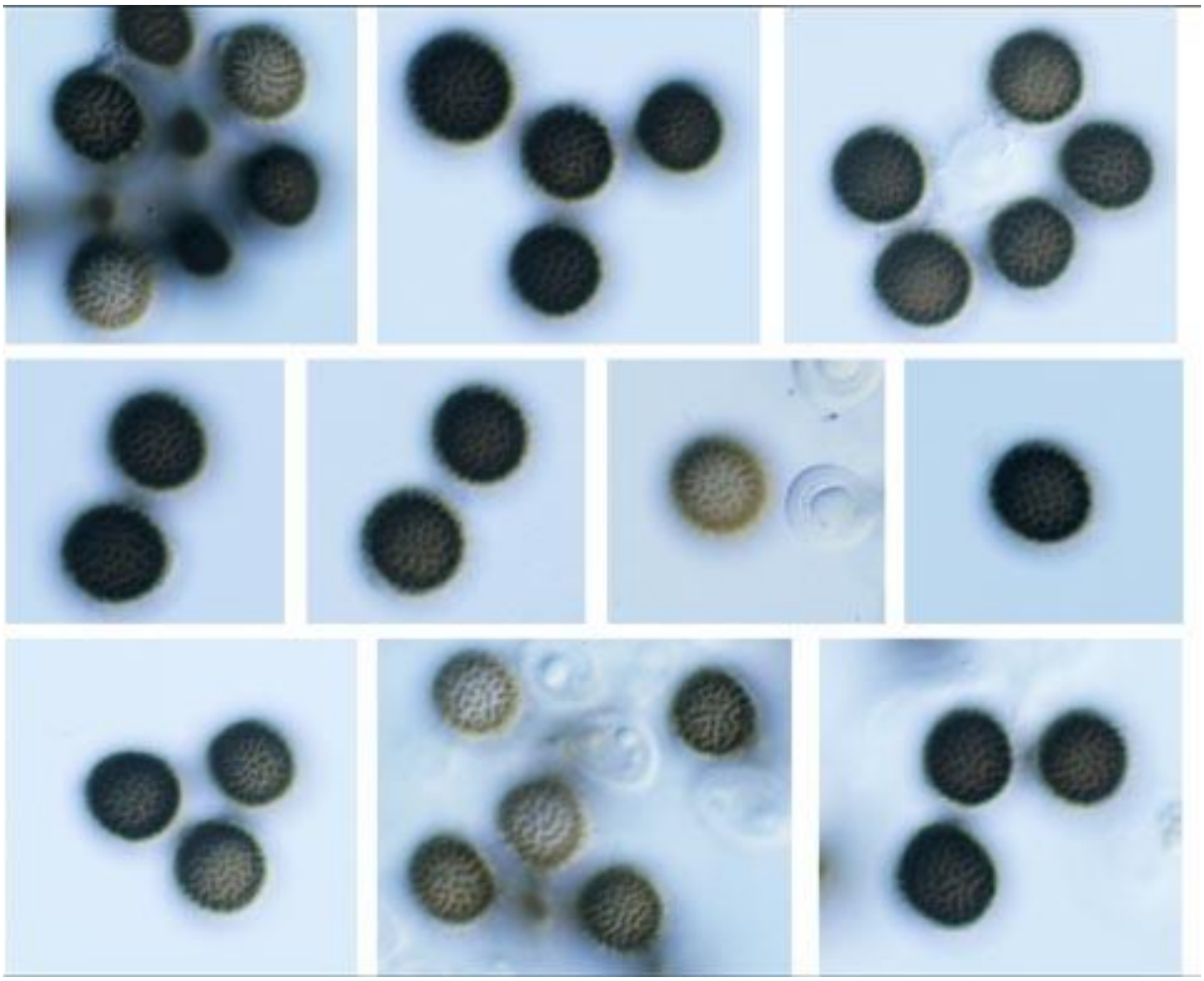
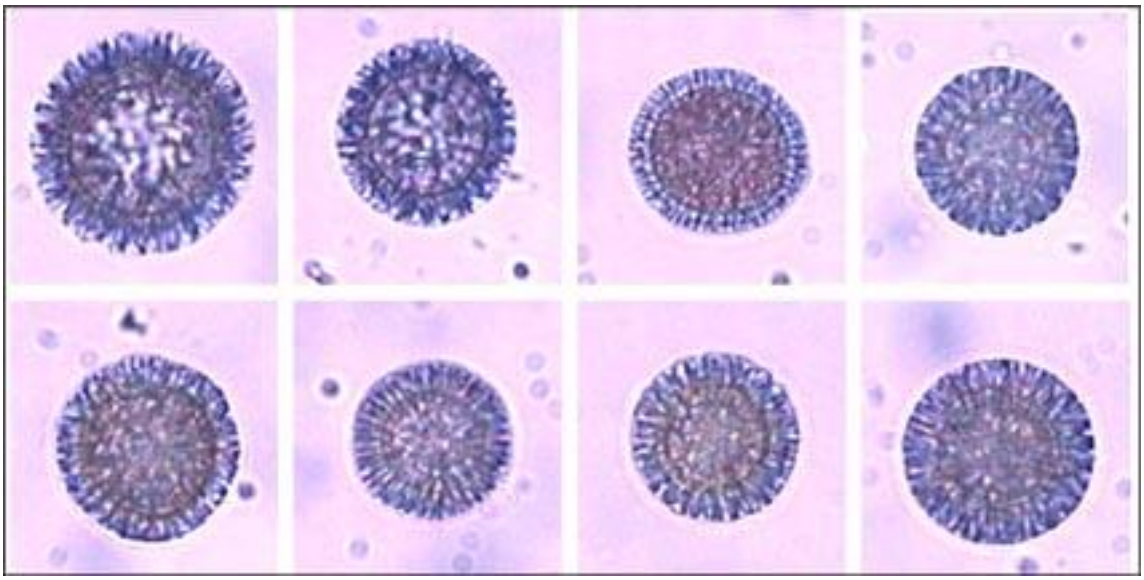
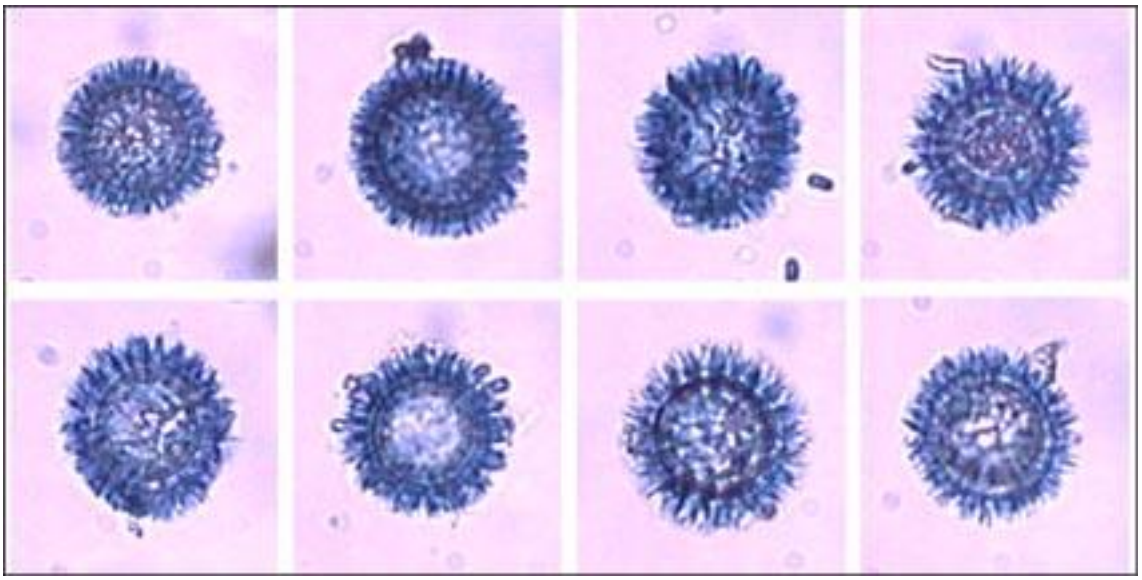


Figure 7. Teliospores of *Tilletia horrida* showing surface ornamentation patterns. Spines are arranged in polygonal scales or, occasionally, cerebriform ridges. Scale: 10 mm = 17 µm.

Photos courtesy A. Inman, Central Science Laboratory, York, United Kingdom.



A



B

Figure 8. Teliospores of *Tilletia indica* (A) and *Tilletia walkeri* (B) showing teliospore profiles in median view after bleaching and then staining with lactoglycerol-trypan blue. Note the smoother outline of *T. indica* teliospores compared with the more irregular outline of *T. walkeri* teliospores, which have more obvious gaps between spines.

Photos courtesy A. Inman, Central Science Laboratory, York, United Kingdom.

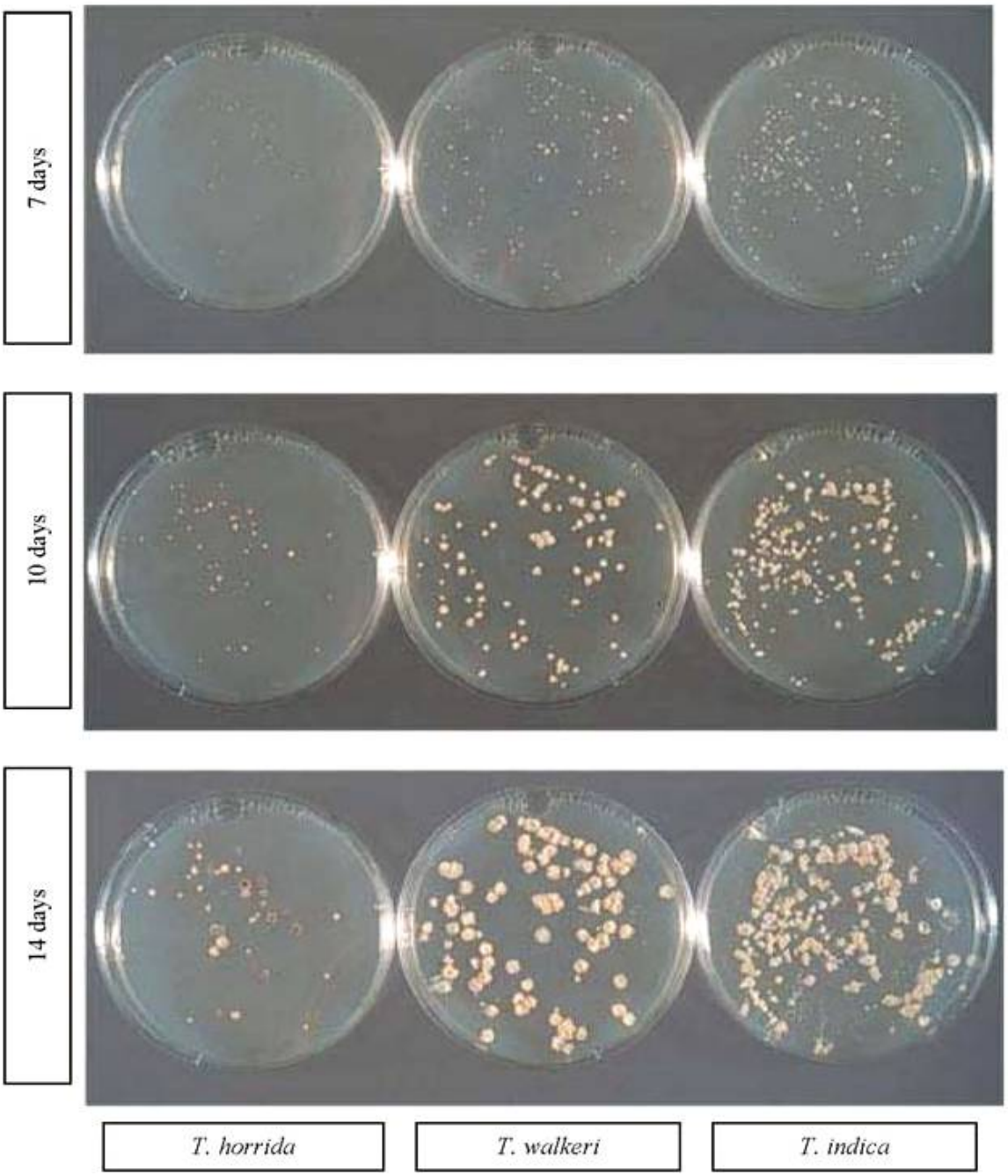


Figure 9. Colonies of *Tilletia indica* (right), *Tilletia walkeri* (centre) and *Tilletia horrida* (left) after 7 days (top), 10 days (centre) and 14 days (bottom) on potato dextrose agar (PDA) at 19 °C and a 12 h dark/light cycle. Note the slower growth and purple pigmentation after 14 days for *T. horrida* colonies.

Photos courtesy A. Inman, Central Science Laboratory, York, United Kingdom.

Publication history

This is not an official part of the standard

2006-03 CPM-1 added the subject *Tilletia indica* / *T. controversa* (2004-014) under the topic: Fungi and fungus-like organisms

2012-11 SC approved draft for MC via e-decision

2012-07 member consultation

2013-05 SC approval for adoption via e-decision (returned to TPDP)

2013-06 TPDP revised

2013-10 to SC for approval for adoption via e-decision

2013-10 SC approved the draft for the 45-days notification period via e-decision

2013-12 45 days notification period

2014-01 SC adopted DP on behalf of CPM

ISPM 27. 2006: **Annex 4** *Tilletia indica* Mitri (2014)

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