January 2010

منظمة الأغذية والزراعة للأمم المتحدة | 联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Agricultura y la Alimentación

COMMISSION ON PHYTOSANITARY MEASURES

Fifth Session

Rome, 22-26 March 2010

Adoption of International Standards: Regular Process

Agenda Item 9.2 of the Provisional Agenda

I. Introduction

1. This document presents nine annexes that the Standards Committee (SC) recommends for adoption by the Commission on Phytosanitary Measures (CPM). The annexes are as follows:

- Annex 1: a new ISPM on *Pest free potato (Solanum spp.) micropropagative material and minitubers for international trade*
- Annex 2: an appendix to ISPM 26 (*Establishment of pest free areas for fruit flies (Tephritidae)*) on *Fruit fly trapping*
- Annex 3: a new ISPM on *Design and operation of post-entry quarantine stations for plants*
- Annex 4: an amendment to ISPM 5 (*Glossary of phytosanitary terms*)
- Annex 5: an annex to ISPM 28 (*Phytosanitary treatments for regulated pests*) - Irradiation treatment for *Conotrachelus nenuphar*
- Annex 6: an annex to ISPM 28 (*Phytosanitary treatments for regulated pests*) - Irradiation treatment for *Cylas formicarius elegantulus*
- Annex 7: an annex to ISPM 28 (*Phytosanitary treatments for regulated pests*) - Irradiation treatment for *Euscepes postfasciatus*
- Annex 8: an annex to ISPM 28 (*Phytosanitary treatments for regulated pests*) - Irradiation treatment for *Grapholita molesta*
- Annex 9: an annex to ISPM 28 (*Phytosanitary treatments for regulated pests*) - Irradiation treatment for *Grapholita molesta* under hypoxia.

2. The draft ISPM on *Pest free potato (Solanum spp.) micropropagative material and minitubers for international trade*, the appendix to ISPM 26 (*Establishment of pest free areas for fruit flies (Tephritidae)*) on *Fruit fly trapping*, and the draft ISPM on *Design and operation of*

post-entry quarantine stations for plants were sent for member consultation in June 2008. The results of the 2008 member consultation process may be found in CPM-4 document CPM 2009/2.

3. In May 2009, the SC approved several draft ISPMs for member consultation in 2009, including two drafts that are presented to the CPM-5 for adoption: amendments to ISPM 5 (*Glossary of phytosanitary terms*) on deletion of the term "beneficial organism" and the draft ISPM on *Design and operation of post-entry quarantine stations for plants*. Given the number and significance of comments received during the 2008 member consultation period on the draft ISPM *Design and operation of post-entry quarantine stations for plants*, the SC decided that it should be redrafted and a revised version was sent for member consultation in June 2009.

4. During the 2009 member consultation period, six regional workshops on draft ISPMs supported the preparation of member comments: the Caribbean, Near East, Africa, Asia, Russian-speaking countries, and the Southwest Pacific. Technical, editorial and translation comments were received from seventy-four contracting parties, three RPPOs and two international organizations (Convention on Biological Diversity and International Seed Federation). The IPPC Secretariat received approximately 4400 comments on the draft standards presented for member consultation.

5. The five irradiation treatments recommended to CPM-5 for adoption as annexes to ISPM 28 (*Phytosanitary treatments for regulated pests*) were among 14 treatments presented to CPM-4 (2009). CPM-4 adopted eight of these treatments, but formal objections had been received regarding the other six treatments (see the formal objections on the IPP at: https://www.ippc.int/index.php?id=13330&tx_publication_pi1[showUid]=210959 and https://www.ippc.int/index.php?id=13330&tx_publication_pi1[showUid]=211000).

6. After a further round of drafting, the SC recommends to CPM-5 five of these treatments for adoption through the regular process, in accordance with IPPC Standard Setting Procedure (Annex 1 of the Rules of Procedure of the CPM, Stage 4, Step 7).

7. For an overview of the main points of discussion in the SC on comments received and information on the redrafting of the standards, members are invited to refer to the reports of the November 2009 meeting of the SC (https://www.ippc.int/index.php?id=13355).

II. Guidelines for submitting comments on ISPMs presented for adoption

8. In accordance with adopted procedures, contracting parties wishing to make comments on the draft standards at the CPM should send these comments to the IPPC Secretariat at least 14 days before the CPM. Contracting parties are reminded that:

- Members should endeavour to provide only substantive changes at meetings of the CPM.
- Members should indicate which comments are strictly editorial (i.e. they do not change the substance of the text) and could be incorporated by the Secretariat as considered appropriate and necessary.
- The electronic format/template for member comments should preferably be used for submitting comments and can be found on the IPP (https://www.ippc.int/index.php?id=1110646) or requested from the IPPC Secretariat.

9. In accordance with the decision of CPM-3 (2008) on provisions for the availability of standard setting documents, comments that were received during the June-September 2008 and 2009 consultation periods are available on the IPP (https://www.ippc.int/index.php?id=1110637).

III. New ISPM: *Pest free potato (Solanum spp.) micropropagative material and minitubers for international trade* (Annex 1)

10. he Interim Commission on Phytosanitary Measures (ICPM) at its sixth session (2004) introduced this topic into the work programme. The SC approved the specification 21 in

April 2004. The Expert Working Group (EWG) on drafting *Guidelines for regulating potato micropropagation material and minitubers* met on 12-16 September 2005 (Edinburgh, Scotland, UK). The first draft was discussed at the May 2006 meeting of the SC, where several issues with the documents were identified. New guidance was given by the SC to the Steward of the standard.

11. During its May 2008 meeting, the SC-7 modified the text of the draft ISPM and agreed that it should be sent for member consultation. During the 2008 consultation period, 446 comments were received from members. The draft was revised by the SC-7 during the May 2009 meeting. Its structure was modified and some of the terminology was clarified. The revised draft was sent to the SC for approval.

12. At the meeting in November 2009, the SC agreed that the draft ISPM should be submitted to CPM-5 for adoption.

13. The CPM is invited to:

1. *Adopt* as an ISPM: *Pest free potato (Solanum spp.) micropropagative material and minitubers for international trade*, contained in Annex 1.

IV. Appendix to ISPM 26 (*Establishment of pest free areas for fruit flies (Tephritidae*) on *Fruit fly trapping* (Annex 2)

14. This topic was approved by the SC in November 2005 and introduced to the work programme by CPM-1 (2006). The SC approved the specification 35 in May 2006. The draft was developed by the Technical Panel on Fruit Flies (TPFF) at its meeting in December 2007.

15. A draft was presented and reviewed during the meeting of the SC-7 in May 2008. Only a few modifications were made, and there were no major issues or concerns. The SC-7 approved the draft, as an annex to ISPM 26, for the member consultation period of 2008. During the consultation 643 comments were received.

16. In May 2009, the SC-7 discussed several changes to the proposed text, based on member comments and taking into account ISPM 26. The SC-7 recommended that the draft be sent to the SC. At the November 2009 meeting, the SC reviewed the draft and considered whether the document should be submitted in two parts, as suggested by the SC-7 (an annex and an appendix), or whether the document should be combined back into a single document, as it had originally been, and submitted as either an annex or an appendix. SC agreed that the draft ISPM should be submitted as a single appendix and approved the draft for submission to CPM-5 for adoption.

17. The CPM is invited to:

1. *Adopt* the appendix to ISPM 26 (*Establishment of pest free areas for fruit flies (Tephritidae*) on *Fruit fly trapping*, contained in Annex 2.

V. New ISPM: *Design and operation of post-entry quarantine stations for plants* (Annex 3)

18. The topic was introduced into the work programme by ICPM-6 (2004). The SC approved the specification 24 in November 2004. An expert working group met on 23-27 May 2005 in Clermont Ferrand, France to produce a draft standard. At its meeting in May 2006, the SC requested that it be redrafted to take into account issues such as increasing the emphasis on measures based on the biological characteristics of the plants or regulated pests; the draft was sent back to be revised by the Steward.

19. The revised draft was considered by the SC-7 meeting in May 2008, which agreed that it should be sent for member consultation in 2008. During the consultation, the draft received a number of substantial comments. Based on recommendation of SC-7 in November 2008, the SC

asked a small expert working group to revise the draft by e-mail for consideration by the SC at their May 2009 meeting.

20. During the May 2009 meeting, the Secretariat informed the SC that the small group had re-organized the draft. The SC concluded that the draft was ready for member consultation and no further modifications were made. The draft was sent for its second member consultation in June 2009 and received 546 comments. During its November 2009 meeting, the SC reviewed the improved draft and recommended it to CPM-5 for adoption.

21. The CPM is invited to:

1. *Adopt* as an ISPM: *Design and operation of post-entry quarantine stations for plants*, contained in Annex 3.

VI. Amendments to ISPM 5: *Glossary of phytosanitary terms* (Annex 4)

22. In 2005, ICPM-7 asked for the Glossary Working Group to consider terms in the revised ISPM 3:2005. In 2006, CPM-1 established the Technical Panel on the Glossary (TPG), which continued the work of the previous Glossary Working Group. The TPG considers suggestions for new definitions in ISPM 5, amendments to existing terms or definitions, or deletion of terms. At its meeting in 2008, having discussed the term "beneficial organism" since 2005 and after member consultation on a proposed revision of the definition in 2007, the TPG proposed deleting the term. A document proposing deletion was presented to the SC in May 2009 and sent for member consultation in June 2009. After review of the 13 comments received (including six in favour of deletion), the SC decided to recommend deletion of the term to CPM-5.

23. The CPM is invited to:

1. *Adopt* the amendment to ISPM 5 (*Glossary of phytosanitary terms*) contained in Annex 4.

VII. Irradiation treatments as annexes to ISPM 28 (*Phytosanitary treatments for regulated pests*) (Annexes 5 to 9)

24. At its meeting in December 2006, the Technical Panel on Phytosanitary Treatments (TPPT) discussed a number of submissions provided in response to the 2006 call for phytosanitary irradiation treatments. The TPPT recommended 14 draft irradiation treatments to the SC. These were reviewed via email by the SC in July 2007 and sent for member consultation under the fast-track process in October 2007.

25. The Secretariat, with the assistance of the TPPT members, attempted to resolve the formal objections received. However, the Secretariat was not able to resolve all formal objections prior to CPM-3 (2008). The TPPT continued its review of all comments received and in August 2008, the SC agreed that the revised draft treatments could be submitted for a second round of member consultation.

26. The SC again reviewed the revised draft treatments, taking into account the comments received, and recommended them to CPM-4 for adoption. Eight were adopted. However, the CPM was informed that formal objections had been received from two contracting parties regarding six of the treatments and these were returned to the SC for review. The May 2009 SC requested the TPPT to review the formal objections and present options on how to resolve the technical issues. The TPPT concluded that changes to irradiation doses were warranted and that further guidance regarding the potential occurrence of viable F1 progeny following treatment should be included in the treatment annexes. The TPPT also concluded that the treatment efficacy for *Omphisa anastomolis* is in question and that this treatment should not be recommended for adoption.

27. The SC reviewed and approved the revised drafts and suggested changes to the annexes proposed by the TPPT by email. In addition, the SC decided to recommend these five irradiation treatments to CPM for adoption as annexes to ISPM 28 (*Phytosanitary treatments for regulated pests*) through the regular process:

- Irradiation treatment for *Conotrachelus nenuphar* (Annex 5)
- Irradiation treatment for *Cylas formicarius elegantulus* (Annex 6)
- Irradiation treatment for *Euscepes postfasciatus* (Annex 7)
- Irradiation treatment for *Grapholita molesta* (Annex 8)
- Irradiation treatment for *Grapholita molesta* under hypoxia (Annex 9).

Changes made in response to the formal objections are highlighted in the draft treatments. Given these draft treatments have already been presented to CPM-4, members are requested to limit any further written comments and interventions to those which address the formal objections received 14 days prior to CPM-4 (see CPM- 4 document CPM 2009/INF/ 9 and INF/10).

28. The CPM is invited to:

1. Adopt as annexes to ISPM 28 (*Phytosanitary treatments for regulated pests*) the irradiation treatments contained in Annexes 5-9.

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

DRAFT STANDARD

PEST FREE POTATO (*SOLANUM* SPP.) MICROPROPAGATIVE MATERIAL AND MINITUBERS FOR INTERNATIONAL TRADE

(201-)

Date of this document	12 December 2009
Document category	Draft ISPM
Current document stage	SC November 2009 recommended for adoption by CPM-5; edited and formatted in new template
Origin	Work programme topic: Export certification for potato minitubers and micropropagative material
Major stages	Specification No. 21, April 2004. Member consultation (regular process) June 2008

CONTENTS

INTRODUCTION

Scope

This standard provides guidance on the production, maintenance and phytosanitary certification of pest free potato (S*olanum tuberosum* and related tuber-forming species) micropropagative material and minitubers intended for international trade.

This standard does not apply to field-grown propagative material of potato or to potatoes intended for consumption or processing.

References

ISPM 2. 2007. *Framework for pest risk analysis*. Rome, IPPC, FAO.

ISPM 5. 2009. *Glossary of phytosanitary terms*. 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 11. 2004. *Pest risk analysis for quarantine pests including analysis of environmental risks and living modified organisms.* Rome, IPPC, FAO.

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

ISPM 14. 2002. *The use of integrated measures in a systems approach for pest risk management*. Rome, IPPC, FAO.

ISPM 16. 2002. *Regulated non-quarantine pests: concept and application.* Rome, IPPC, FAO.

ISPM 19. 2003. *Guidelines on lists of regulated pests.* Rome, IPPC, FAO.

ISPM 21. 2004. *Pest risk analysis for regulated non-quarantine pests*. Rome, IPPC, FAO.

Definitions

Definitions of phytosanitary terms used in the present standard can be found in ISPM 5:2009.

For the purpose of member consultation, this section also contains terms or definitions that are new in the present draft standard. Once this standard has been adopted, these new terms and definitions will be transferred into ISPM No. 5, and will not appear in the standard itself.

potato micropropagative material	**Plants *in vitro*** of tuber-forming *Solanum* spp.
minituber	A tuber produced from potato micropropagative material in pest-free media in a facility under specified protected conditions
seed potatoes	Tubers (including minitubers) and potato micropropagative material of cultivated tuber-forming *Solanum* spp. for planting

Outline of Requirements

Facilities used for the production of potato micropropagative material and minitubers for export should be authorized or operated directly by the National Plant Protection Organization (NPPO) of the exporting country. Pest risk analysis (PRA), carried out by the NPPO of the importing country, should provide the justification for specific phytosanitary measures for regulated pests in trade of potato micropropagative material and minitubers.

The phytosanitary measures for managing risks related to potato micropropagative material include testing for the pests regulated by the importing country, and management systems for the maintenance and propagation of potato micropropagative material derived from pest free candidate plants in closed, aseptic conditions. For the production of minitubers, measures include derivation from pest free potato micropropagative material and production in a pest free production site.

To establish pest free potato micropropagative material, candidate material should be tested in a testing laboratory authorized or operated directly by the NPPO. This laboratory should meet general requirements for ensuring that all material moved into a maintenance and propagation facility is free from pests regulated by the importing country.

Facilities for the establishment of pest free potato micropropagative material and testing for pest freedom are subject to strict requirements to prevent contamination or infestation of material. Facilities for maintenance and propagation of pest free potato micropropagative material and minituber production are also subject to stringent requirements to maintain pest freedom. Staff should be trained and competent in techniques for the establishment and maintenance of pest free potato micropropagative material, the production of pest free minitubers, diagnostic testing as required, and in following administrative, management and record-keeping procedures. The management system and procedures of each facility and the testing laboratory should be defined in a manual(s). Throughout all production and testing processes, the identity of all propagative material should be preserved, and traceability should be maintained through adequate documentation.

All facilities should be audited by the NPPO. In addition, inspections by the NPPO should ensure that the potato micropropagative material and minitubers are free from the regulated pests. Pest free potato micropropagative material and minitubers moving in international trade should be accompanied by a phytosanitary certificate.

BACKGROUND

Many pests are associated with the production of potato (*Solanum tuberosum* and related tuber-forming species) worldwide. As potatoes are propagated mainly by vegetative means, there is considerable risk of introducing and spreading pests through international trade of seed potatoes. Potato micropropagative material derived from appropriately tested material and using suitable phytosanitary measures (usually within a seed potato certification scheme) may be considered free from regulated pests. Use of such material as starting material for further potato production reduces the risks of introduction and spread of regulated pests. Potato micropropagative material can be multiplied under specified protected conditions to produce minitubers. Provided that minituber production is carried out under pest free conditions using pest free micropropagative material, minitubers can also be traded with minimum risk.

Conventional micropropagation does not necessarily result in material that is free from pests. Pest freedom is verified by appropriate testing of the material.

As per ISPM 16:2002, programmes for the certification of plants for planting for seed potatoes (sometimes known as "seed potato certification schemes") frequently include specific requirements for pests as well as non-phytosanitary requirements such as varietal purity, size of the product etc. Many seed potato certification schemes require potato micropropagative material to be derived from plants that have been tested and found free from the pests covered by the scheme. The pests covered by a specific scheme may not always meet all of the phytosanitary requirements of importing countries.

REQUIREMENTS

1. Responsibilities

The National Plant Protection Organization (NPPO) of the importing country is responsible for pest risk analysis (PRA) and should, on request, have access to documentation and facilities to enable it to verify that the phytosanitary measures in the facility meets its requirements.

Only facilities authorized or operated directly by a NPPO should be used for the production and maintenance of potato micropropagative material and minitubers for export as described in this standard. The NPPO of the exporting country is responsible for auditing the phytosanitary aspects of these facilities and of the related seed potato propagation system.

2. Pest Risk Analysis

PRA provides technical justification for identifying regulated pests and for establishing phytosanitary import requirements for potato micropropagative material and minitubers. PRA should be carried out by the NPPO of the importing country in accordance with ISPM 2:2007 and ISPM 11:2004 for the pathways of "potato micropropagative material" and "minitubers" from given origins. The PRA may identify quarantine pests associated with these pathways. The PRA should also be carried out in accordance with ISPM 21:2004 as appropriate in order to identify regulated non-quarantine pests.

Importing countries should notify NPPOs of exporting countries of the outcome of the PRAs.

2.1 Pathway-specific lists of regulated potato pests

The importing country should, on the basis of the above-mentioned PRAs, establish and update regulated pest lists. Guidance on regulated pest lists is provided in ISPM 19:2003. For the purposes of this standard, the NPPO of the importing country is encouraged to establish pathway-specific

regulated pest lists for potato micropropagative material and minitubers respectively and on request should notify NPPOs of exporting countries.

2.2 Pest risk management options

The pest risk management measures are determined based on the PRA. It may be appropriate for the measures to be integrated into a systems approach (as described in ISPM 14:2002).

2.2.1 Potato micropropagative material

Phytosanitary measures for managing pest risks related to potato micropropagative material include:

- testing individual plants (candidate plants) for the pests regulated by the importing country and establishing potato micropropagative material in establishment facilities. Pest freedom is verified once all relevant testing is successfully completed (the status of the candidate plant changes to pest free potato micropropagative material)
- maintaining pest freedom using management systems for the maintenance and propagation of the pest free potato micropropagative material in a closed, aseptic environment in maintenance and propagation facilities.

In this standard potato material that has been tested and found free from the pests regulated by the importing country, or derived from such tested material, and maintained under conditions to prevent contamination and infestation is referred to as pest free potato micropropagative material.

2.2.2 Minitubers

Phytosanitary measures for managing pest risks related specifically to minituber production should be based on pest risk assessment information related to the area of production and include:

- derivation of the minitubers from pest free potato micropropagative material
- production in pest free growing media under specified protected conditions in a pest free production site free from the pests (and their vectors) regulated for minitubers by the importing country.

3. Production of Pest Free Potato Micropropagative Material

3.1 Establishment of pest free potato micropropagative material

A candidate plant, from which the pest free potato micropropagative material is derived, should be inspected, tested and found free from regulated pests. It may also be required to be grown through a complete vegetative cycle, inspected, tested and found free from pests. In addition to the laboratory testing procedure for regulated pests described below, potato micropropagative material should be inspected and found free from other pests or their symptoms and general microbial contamination.

Where candidate material is determined to be infested it will normally be disposed of. However, for certain types of regulated pests, it may be feasible, at the discretion of the NPPO, for officially recognized techniques (e.g. meristem tip culture, thermotherapy) to be used in combination with conventional micropropagation to eliminate the pest from the candidate material, and prior to the initiation of the *in vitro* multiplication programme. In such cases, laboratory testing must be used to confirm the success of this approach before multiplication commences.

3.1.1 Testing programme to verify pest freedom

A testing programme on the candidate material should be applied in an official testing laboratory. This laboratory should meet general requirements (described in Annex 1) to ensure that all potato micropropagative material moved to maintenance and propagation facilities is free from the pests regulated by the importing country. Conventional micropropagation does not consistently exclude

some pests, for example, viruses, viroids, phytoplasmas and bacteria. A list of pests that may be of concern to potato micropropagative material is provided in Appendix 1.

3.1.2 Establishment facilities

A facility used to establish pest free potato micropropagative material from new candidate material should be authorized by the NPPO specifically for this purpose. The facility should provide a secure means for establishing individual pest free potato micropropagative material from candidate plants and for holding these plants separately from tested material while awaiting required test results. Because both infested and pest free potato propagative material (tubers, plants *in vitro* etc.) may be handled in the same facility, strict procedures should be implemented to prevent contamination or infestation of pest free material. Such procedures should include:

- prohibit entry of unauthorised personnel and control of the entry of authorized staff
- provision for the use of dedicated protective clothing (including dedicated footwear or disinfection of footwear) and hand washing on entry (with particular care being taken if staff members work in areas of higher phytosanitary risk, e.g. the testing facility)
- chronological records of actions in handling material so that production can, if necessary, be checked easily for contamination and infestation if pests are detected
- stringent aseptic techniques, including disinfection of work areas and sterilization of instruments (e.g. by autoclaving) between handling materials of a different phytosanitary status.

3.2 Maintenance and propagation facilities for pest free potato micropropagative material

A facility that maintains and propagates pest free potato micropropagative material should be operated separately from the facilities that establish potato plants *in vitro* and conduct the testing for regulated pests (although exceptional circumstances are described in section 3.3). The facility should be operated as a pest free production site (as described in ISPM 10:1999) with respect to the pests of potato regulated by the importing country for potato micropropagative material. The facility should:

- maintain and propagate only officially certified pest free potato micropropagative material and permit only pest free material to enter the facility
- grow other plant species only if this is officially permitted and if:
    - the pest risks to potato propagative material have been assessed and, if identified, the plants have been tested and found to be free from regulated pests before entering the facility
    - adequate precautions are taken to separate them in space or time from the potato plants
- implement officially approved operational procedures to prevent entry of regulated pests
- control the entry of staff and provide for the use of protective clothing, disinfection of footwear and hand washing on entry (with particular care being taken if staff members work in areas of higher phytosanitary risk, e.g. the testing facility)
- use aseptic procedures
- implement regular management system checks by the manager or a designated responsible staff member and keep records.

3.3 Combined establishment and maintenance facilities

Exceptionally, establishment facilities may also maintain pest free potato micropropagative material provided that strict procedures are adopted and applied to prevent infestation of maintained material from other material of a lower phytosanitary status.

These strict procedures include:

- the procedures in sections 3.1 and 3.2 to prevent infestation of the pest free potato micropropagative material and to keep material of different phytosanitary status separate
- the use of separate laminar flow cabinets and instruments for the maintained material and for material of a lower phytosanitary status
- scheduled audit tests on the material maintained.

3.4 Additional specifications for potato micropropagation facilities and potato micropropagative material

Additional specifications for potato micropropagation facilities are provided in Annex 2 and may be required depending on the pests present in the area and the results of PRA.

Pest free potato micropropagative material established and maintained in these facilities may be propagated further to produce minitubers or may be traded internationally as such.

4. Production of Pest Free Minitubers

The following guidance for minituber production also applies to parts of minitubers that are traded internationally, such as sprouts.

4.1 Eligible material

The only potato material allowed to enter the facility should be pest free potato micropropagative material. Plants of other plant species may be permitted to be grown in the facility provided that:

- the phytosanitary risks to minitubers have been assessed and, if identified, the plants have been tested and found to be pest free before entering the facility
- adequate precautions are taken to separate them in space and/or time from the potato plants to prevent contamination.

4.2 Minituber facilities

A minituber production facility should be operated as a pest free production site (as described in ISPM 10:1999) with respect to pests regulated by the importing country for minitubers. Pests that may be of concern include those for potato micropropagative material i.e. viruses, viroids, phytoplasmas and bacteria (listed in Appendix 1) and also fungi, nematodes, arthropods etc. (listed in Appendix 2).

Production should be under protected conditions, for example a growth room, glasshouse, polythene tunnel or (if appropriate, based on local pest status) a screen house with suitable mesh size, constructed and maintained to prevent the entry of pests. If the facility includes adequate physical and operational safeguards against the introduction of the regulated pests, no additional measures should be required. However, additional measures may be considered, depending on conditions in the area of production. These may include:

- location of the facility in a pest free area, or an area or site that is well isolated from sources of the regulated pests
- a buffer zone around the facility for regulated pests
- location of the facility in an area with low pest and pest vector incidence
- production at a time of year when there is low pest and pest vector incidence.

The entry of authorized personnel to the facility should be controlled and provision should be made for use of protective clothing, disinfection of footwear and hand washing on entry. It should also be possible to decontaminate the facility if required. The growing medium, water supply and fertilizer or plant additives used in the facility should be pest free.

The facility should be monitored for the regulated pests and pest vectors during the production cycle and, if necessary, pest control measures or other corrective actions should be undertaken and documented. The facility should be well maintained and cleaned after each production cycle.

The minitubers should be handled, stored, packed and transported under conditions preventing infestation and contamination by the regulated pests.

Additional requirements for minituber production facilities are provided in Annex 3.

5. Staff Competence

Staff should be trained and competent in:

- techniques for the establishment of pest free potato micropropagative material, the maintenance of pest free potato micropropagative material, the production of pest free minitubers, and diagnostic testing as relevant
- following administrative, management and record-keeping procedures.

Procedures for maintaining staff competence should be in place and training should be updated, in particular, when phytosanitary requirements change.

6. Documentation and Record-Keeping

The management system, and operating procedures and instructions of each facility and the testing laboratory, should be documented in a manual(s). In developing such manual(s), the following should be addressed:

- the establishment, maintenance and propagation of pest free potato micropropagative material with particular attention paid to those control measures used to prevent infestation and contamination between the pest free potato micropropagative material and any material of another phytosanitary status
- the production of pest free minitubers, covering management, technical and operational procedures, with particular attention paid to those control measures used to prevent pest infection, infestation and contamination of the minitubers during their production, harvest and storage, and during transport to their destination
- all laboratory test procedures or processes to verify pest freedom.

Throughout all production and testing, the identity of all propagative material should be preserved and traceability should be maintained by adequate record-keeping. Records of all tests done on the material, as well as the results, lineage and records of the distribution of the material, should be kept in a manner that ensures traceability for the importing or exporting countries for at least five years. For pest free potato micropropagative material, the records that determine its pest free status should be maintained for as long as the micropropagative material is maintained.

Records of staff training and competencies should be maintained as determined by the NPPO and, if appropriate, in consultation with the NPPO of the importing country.

7. Auditing

All facilities, systems and records should be officially audited by the NPPO of the exporting country to ensure compliance with the procedures and maintenance of the pest free status of the plants.

The NPPO of the importing country may ask to participate in such an audit, based on bilateral agreement.

8. Phytosanitary Certification

The potato micropropagation facility, relevant records and the plants should be inspected by the NPPO to ensure compliance with the procedures and that the micropropagative material meets the importing country requirements for freedom from the regulated pests.

The potato minituber production facility, relevant records, the growing crop, and the minitubers should be inspected by the NPPO to ensure that the minitubers are free from the regulated pests.

Pest free potato micropropagative material and minitubers moving in international trade should be accompanied by a phytosanitary certificate issued by the NPPO of the exporting country according to ISPM 12:2001 and complying with the requirements of the importing country. The use of seed potato certification labels may assist with lot identification, in particular when these labels specify the reference number of the lot, including where appropriate the producer's identification number.

This annex is a prescriptive part of the standard.

ANNEX 1: General requirements for official testing laboratories for potato micropropagative material and minitubers

The requirements for laboratories testing potato micropropagative material and minitubers operated or authorized by NPPOs include the following:

- competent staff with adequate knowledge and experience of conducting appropriate microbiological, serological, molecular, bioassay and pathogenicity tests, and interpreting the results
- adequate and appropriate equipment to conduct microbiological, serological, molecular and bioassay tests
- relevant validation data for the tests conducted or at least sufficient evidence for the suitability of the test applied
- procedures to prevent contamination of samples
- adequate isolation from production facilities
- a manual(s) that describes policy, organizational structure, work instructions, and testing standards and any quality management procedures
- appropriate record-keeping for test results.

This annex is a prescriptive part of the standard.

ANNEX 2: Additional specifications for potato micropropagation facilities

In addition to the requirements in section 3, the following specifications for physical structure, equipment and operating procedures should be considered for micropropagation facilities, depending on the presence of pests in the area and the results of PRA.

Physical structure

- a double door entry with an air-curtain and with a changing area between the double doors
- appropriate rooms for washing, media preparation, subculturing and growth of plants

Equipment

- high-efficiency particulate air (HEPA)-filtered positive air pressure systems for media, subculture and growth rooms
- growth rooms with appropriate light, temperature and humidity control
- adequate equipment or procedures in the subculture room to control pest contamination (e.g. ultraviolet (UV) germicidal lamps)
- laminar flow cabinets for subculturing, which are serviced regularly
- laminar flow cabinets fitted with UV germicidal lamps

Operating procedures

- a programme for periodic disinfection/fumigation of the facility
- use by staff of disposable/dedicated footwear or disinfection of footwear
- appropriate hygienic practices for handling plant material (e.g. cutting *in vitro* plantlets with a sterile scalpel over a sterile disposable surface)
- a monitoring programme to check the level of air-borne contaminants in the subculture room, cabinets and growth room
- an inspection and disposal procedure for infested potato micropropagative material.

The presence and effectiveness of the above and any other requirements should be verified during the audits described in section 7 of the main text of this standard.

This annex is a prescriptive part of the standard.

ANNEX 3: Additional requirements for minituber production facilities

The following additional requirements for minituber production facilities should be considered, and when necessary included, depending on the presence of pests and vectors in the area and the results of PRA:

Physical structure

- double door entry with a change area for changing garments and donning protective overcoats and gloves, the change area to contain foot disinfecting pads and a washing facility for washing and disinfecting hands
- entry doors and all vents and openings covered with insect-proof screens with mesh that will prevent entry of the local pests and pest vectors
- gaps between the external to internal environment to be sealed
- production isolated from soil (e.g. concrete floors or floors covered with a protective membrane)
- designated areas for washing and disinfecting containers, and cleaning, grading, packing and storing minitubers
- air filtration and/or sterilization system
- in places where there is unreliable supply of electricity and water, standby facilities for emergencies

Management of environment

- suitable temperature, light, air circulation and humidity controls
- misting for acclimatization of transplants

Crop management

- regular pest and pest vector monitoring (e.g. using sticky insect traps) at specified intervals
- hygienic practices for handling plant material
- correct disposal procedures
- identification of production lots
- a suitable separation between lots
- use of raised benches

Growing media, fertilizer, water

- use of pest free soil-less growing medium
- fumigation/disinfestations/steam sterilization of the growing medium before planting or other methods that guarantee freedom from potato pests
- transport and storage of growing medium under conditions preventing contamination
- a water supply free of plant pests (either treated water or deep-well spring water), together with regular testing for potato pests if required
- use of inorganic fertilizer or organic fertilizer that has been treated to eliminate pests

Post-harvest handling

- sampling of minitubers for post-harvest tuber testing for indicator pests (i.e. pests whose presence indicates that the pest free status of the minituber production facility has not been maintained)
- suitable storage conditions
- grading and packing (if appropriate, according to a seed potato certification scheme)
- new or adequately sterilized containers used for packing minitubers
- containers for shipment adequate for preventing contamination by pests and pest vectors

- adequate cleaning and disinfection of handling equipment and storage facilities.

The presence and effectiveness of the above should be verified during the audits described in section 7 of the main text of this standard.

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

APPENDIX 1: Pests that may be of concern with respect to potato micropropagative material

Please note that the following list of pests should not be used without technical justification by PRA.

VIRUSES	ABBREVIATION	GENUS
Alfalfa mosaic virus	AMV	*Alfamovirus*
Andean potato latent virus	APLV	*Tymovirus*
Andean potato mottle virus	APMoV	*Comovirus*
Arracacha virus B-oca strain	AVB-O	*Cheravirus* (tentative)
Beet curly top virus	BCTV	*Curtovirus*
Belladonna mottle virus	BeMV	*Tymovirus*
Cucumber mosaic virus	CMV	*Cucumovirus*
Eggplant mottled dwarf virus	EMDV	*Nucleorhabdovirus*
Impatiens necrotic spot virus	INSV	*Tospovirus*
Potato aucuba mosaic virus	PAMV	*Potexvirus*
Potato black ringspot virus	PBRSV	*Nepovirus*
Potato latent virus	PotLV	*Carlavirus*
Potato leafroll virus	PLRV	*Polerovirus*
Potato mop-top virus	PMTV	*Pomovirus*
Potato rough dwarf virus	PRDV	*Carlavirus* (tentative)
Potato virus A	PVA	*Potyvirus*
Potato virus M	PVM	*Carlavirus*
Potato virus P	PVP	*Carlavirus* (tentative)
Potato virus S	PVS	*Carlavirus*
Potato virus T	PVT	*Trichovirus*
Potato virus U	PVU	*Nepovirus*
Potato virus V	PVV	*Potyvirus*
Potato virus X	PVX	*Potexvirus*
Potato virus Y (all strains)	PVY	*Potyvirus*
Potato yellow dwarf virus	PYDV	*Nucleorhabdovirus*
Potato yellow mosaic virus	PYMV	*Begomovirus*
Potato yellow vein virus	PYVV	*Crinivirus* (tentative)
Potato yellowing virus	PYV	*Alfamovirus*
Solanum apical leaf curling virus	SALCV	*Begomovirus* (tentative)
Sowbane mosaic virus	SoMV	*Sobemovirus*
Tobacco mosaic virus	TMV	*Tobamovirus*
Tobacco necrosis virus A or *Tobacco necrosis virus D*	TNV-A or TNV-D	*Necrovirus*
Tobacco rattle virus	TRV	*Tobravirus*
Tobacco streak virus	TSV	*Ilarvirus*
Tomato black ring virus	TBRV	*Nepovirus*

Tomato chlorotic spot virus	TCSV	*Tospovirus*
Tomato leaf curl New Delhi virus	ToLCNDV	*Begomovirus*
Tomato mosaic virus	ToMV	*Tobamovirus*
Tomato mottle Taino virus	ToMoTV	*Begomovirus*
Tomato spotted wilt virus	TSWV	*Tospovirus*
Tomato yellow leaf curl virus	TYLCV	*Begomovirus*
Tomato yellow mosaic virus	ToYMV	*Begomovirus* (tentative)
Tomato yellow vein streak virus	ToYVSV	*Geminivirus* (tentative)
Wild potato mosaic virus	WPMV	*Potyvirus*
VIROIDS		
Mexican papita viroid	MPVd	*Pospiviroid*
Potato spindle tuber viroid	PSTVd	*Pospiviroid*
BACTERIA		
Clavibacter michiganensis subsp. sepedonicus		
Dickeya and *Pectobacterium* species (formerly *Erwinia* species) *Dickeya* spp. *P. atrosepticum* *P. carotovorum* subsp. *carotovorum*		
Ralstonia solanacearum		
PHYTOPLASMAS		
e.g. purple top, stolbur		

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

APPENDIX 2: Pests that may be of concern with respect to potato minituber production

Please note that the following list of pests should not be used without technical justification by PRA.

In addition to pests listed in Appendix 1, many contracting parties require pests to be excluded from certified minituber potato production either as quarantine pests or as regulated non-quarantine pests according to the pest status in the country concerned. Some examples are:

Bacteria

- *Streptomyces* spp.

Fungi

- *Angiosorus (Thecaphora) solani* Thirumalachar & M.J. O'Brien) Mordue
- *Fusarium* spp.
- *Phytophthora erythroseptica* Pethybr. var. *erythroseptica*
- *P. infestans* (Mont.) de Bary
- *Polyscytalum pustulans* (M.N. Owen & Wakef.) M.B. Ellis
- *Rhizoctonia solani* J.G. Kühn
- *Synchytrium endobioticum* (Schilb.) Percival
- *Verticillium dahliae* Kleb.
- *V. albo-atrum* Reinke & Berthold

Insects

- *Epitrix tuberis* Gentner
- *Leptinotarsa decemlineata* (Say)
- *Phthorimaea operculella* (Zeller)
- *Premnotrypes* spp.
- *Tecia solanivora*

Nematodes

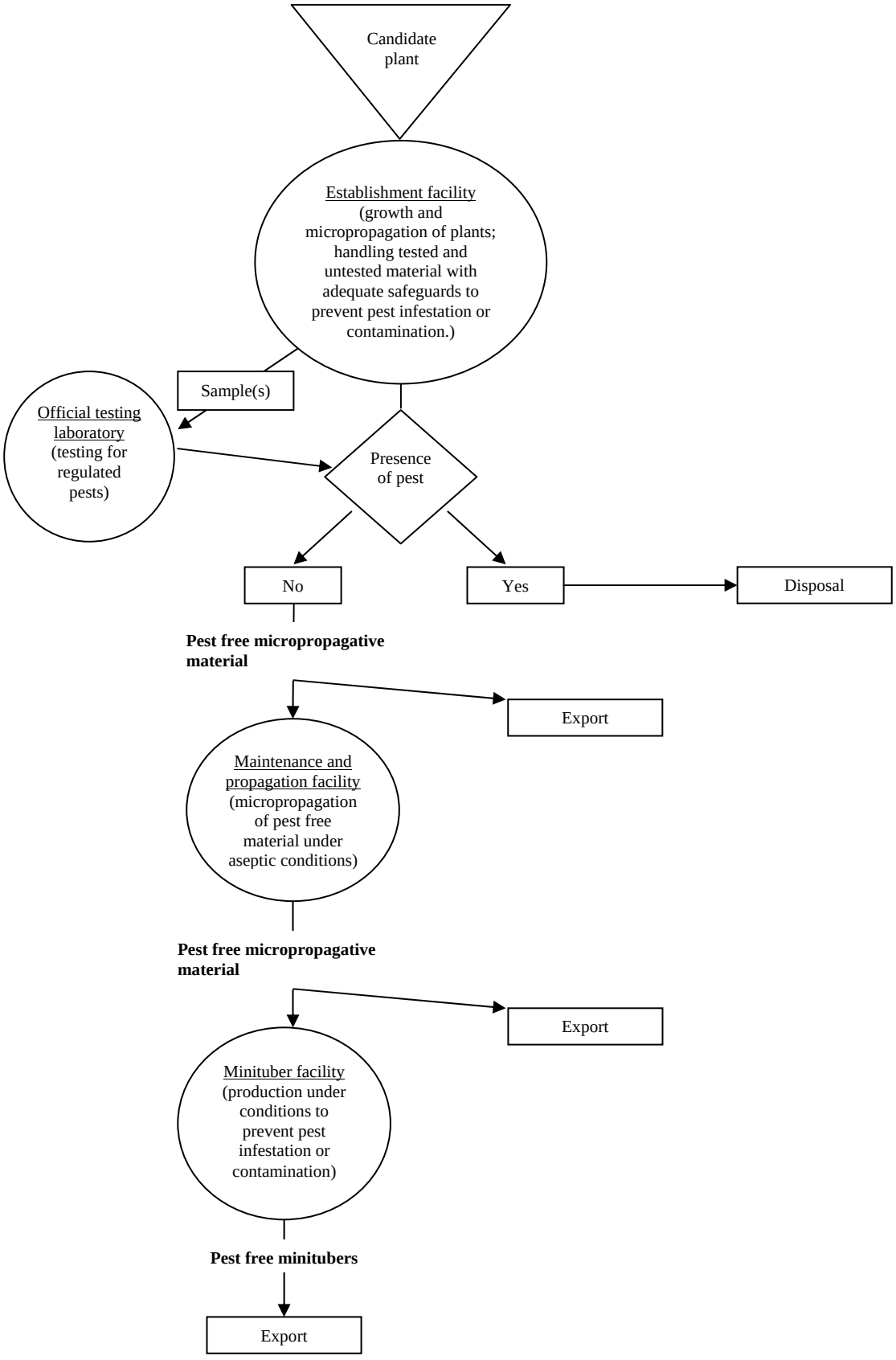
- *Ditylenchus destructor* (Thorne)
- *D. dipsaci* (Kühn) Filipjev
- *Globodera pallida* (Stone) Behrens
- *G. rostochiensis* (Wollenweber) Skarbilovich
- *Meloidogyne* spp. Göldi
- *Nacobbus aberrans* (Thorne) Thorne & Allen

Protozoa

- *Spongospora subterranea* (Wallr.) Lagerh.

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

APPENDIX 3: Flow chart showing the normal sequence of establishment, maintenance and production of pest free potato micropropagative material and minitubers



INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

DRAFT APPENDIX to ISPM 26:2006

FRUIT FLY TRAPPING

(201-)

Date of this document	15 December 2009
Document category	Draft Appendix 1 to ISPM 26:2006
Current document stage	SC November 2009 recommended for adoption by CPM-5; edited and formatted in new template; revised
Origin	Work programme topic: Trapping procedures for fruit flies (Tephritidae)
Major stages	Specification No. 35, May 2006. Member consultation, June 2008
Notes	SC-7 May 2009 recommended that the draft annex on fruit fly trapping be separated into two documents – one to become an annex to ISPM 26, the other to become an appendix to ISPM 26. SC November 2009 recommended the documents be recombined as a single appendix.

CONTENTS

APPENDIX 1: Fruit fly trapping

APPENDIX 1: Fruit fly trapping

This appendix provides detailed information for trapping fruit fly species (Tephritidae) of economic importance under different pest situations. Specific trapping systems should be used depending on the technical feasibility, the species of fruit fly and the phytosanitary status of the delimited areas, which can be either an infested area, an area of low pest prevalence (FF-ALPP), or a pest free area (FF-PFA). The information in this appendix can be used by National Plant Protection Organizations (NPPOs) to develop FF-PFA and FF-ALPP in line with guidance provided in other ISPMs related to fruit flies. It describes the most widely used trapping systems, including materials such as traps and attractants, trapping densities and delimiting surveys, as well as procedures including evaluation, data recording and analysis.

In cases where a fruit fly trapping programme is intended to be part of an export programme, the exporting country should check with the importing country to determine if the trapping programme meets the specific phytosanitary requirements of that country.

1. Pest Situations and Survey Types

There are five pest situations where surveys may be applied:

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

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

C. Pest present under eradication. The pest population is present and subject to control measures.

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 actionable, under surveillance and actionable, under eradication.

The three types of trapping surveys and corresponding objectives are:

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

Monitoring surveys are necessary in the first three situations (A, B and C) 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. Delimiting surveys are applied to determine the boundaries of an established FF-ALPP and as part of a corrective action plan when the pest exceeds the established low prevalence levels (situation B) (ISPM 30:2008) or in an FF-PFA as part of a corrective action plan when a detection occurs (situation E) (ISPM 26:2006). Detection surveys are necessary 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 relevant standards dealing with specific topics such as pest status, eradication, pest free areas or areas of low pest prevalence.

2. Trapping Scenarios

Based on the status of the pest, there are two scenarios that may gradually progress towards the subsequent scenario:

- 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 or an FF-PFA (situation C).
- 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.

In each of these scenarios, the types of trapping surveys necessary would change over time based on the pest situation.

3. Trapping Systems – Materials

The effective use of traps in undertaking fruit fly surveys relies on the combined ability of the trap, attractant and killing agent to attract and capture target fruit fly species and then to kill and preserve them for effective identification, counting data collection and analysis. Trapping systems for fruit fly surveys use the following materials:

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

A number of fruit fly species of economic importance and the attractants commonly used to attract 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)	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 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)

Scientific name	Attractant
Bactrocera cucurbitae (Coquillett)	Cuelure (CUE), 3C[2], AA
Bactrocera tryoni (Froggatt)	CUE
Bactrocera neohumeralis (Hardy)	CUE
Bactrocera tau (Walker)	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
Bactrocera tsuneonis (Miyake)	PA
Ceratitis capitata (Wiedemann)	Trimedlure (TML), Capilure, 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 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 is uncertain.

3.1 Attractants

3.1.1 Male specific

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. dorsalis, B. zonata, B. carambolae, B. invadens, B. philippinensis* and *B. musae*). 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

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 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.

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 capture of *Anastrepha* species the trimethylamine component may be removed. A synthetic attractant lasts approximately 4–10 weeks depending on climatic conditions, captures few non-target insects and captures 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																
Decus ciliatus																											
Myiopardalis pardalina																											
Rhagoletis cerasi																											

Table 2a *continued*

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 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-1					2C-2	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										
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										

Table 2b *continued*

Fruit fly species	Attractant and trap (see below for abbreviations)																								
	3C							2C-1					2C-2	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
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 pomonella																			x		x	x	x			
Toxotrypana curvicauda																										**x**

Attractant abbreviations

3C	(AA+Pt+TMA)	AS	ammonium salts
2C-1	(AA+TMA)	AA	ammonium acetate
2C-2	(AA+Pt)	BuH	butyl hexanoate
PA	protein attractant	MVP	papaya fruit fly pheromone (2-methyl vinylpyrazine)
SK	Spiroketal	Pt	putrescine
AC	ammonium (bi)carbonate	TMA	trimethylamine

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
MM	Maghreb-Med or Morocco trap	RB	Rebell trap		

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	Cone/patches	6–10
Ammonium acetate Putrescine Trimethylamine	3C	Long-lasting patches	18–26
Ammonium acetate Trimethylamine	2C-1	Patches	6–10
Ammonium acetate Putrescine	2C-2	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 widely 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.

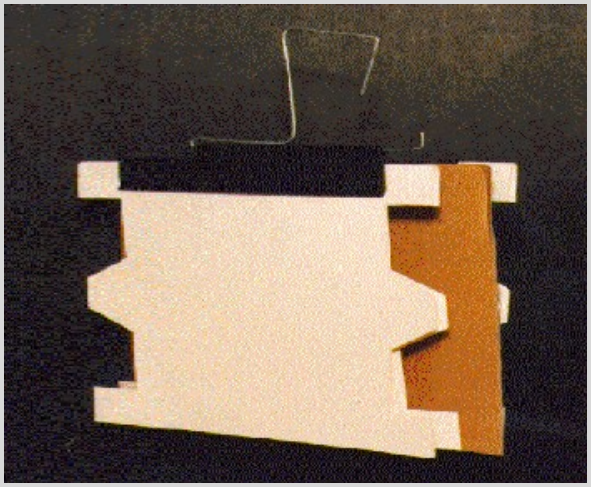


Figure 1. Cook and Cunningham (C&C) trap.

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 is used, see Table 2a.
- For attractants used and rebaiting (field longevity), see Tables 2 and 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 is used, see Tables 2a and 2b).
- For attractants used and rebaiting (field longevity), see Tables 2 and 3.
- For use under different scenarios and recommended densities, see Table 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 is used, see Tables 2a and 2b.
- For attractants used and rebaiting (field longevity), see Tables 2 and 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.

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 is used, see Table 2b.
- For attractants used and rebaiting (field longevity), see Tables 2 and 3.
- For use under different scenarios and recommended densities, see Table 4e.

Figure 4. Fluorescent yellow sticky cloak trap.

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 known as "sticky material" 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.

For many years this trap has been used in exclusion, suppression and/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).

Figure 5. Jackson trap or Delta trap.

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 is used, see Table 2a.
- For attractants used and rebaiting (field longevity), see Tables 2a and 3.
- For use under different scenarios and recommended densities, see Table 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, CAP/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 is used, see Table 2a.
- For attractants used and rebaiting (field longevity), see Tables 2 and 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.

To bait with yeast tablets, mix three to five torula tablets in 500 ml of water. 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.

Figure 9. Plastic McPhail trap.

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 annex.

- For the species for which the trap is used, see Table 2b.
- For attractants used and rebaiting (field longevity), see Tables 2 and 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.

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.

Figure 10. Modified funnel trap.

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

Figure 11. Multilure trap.

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.

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

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

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.

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 for 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 is used, see Table 2b.
- For attractants used and rebaiting (field longevity), see Tables 2b and 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 is used, see Table 2b.
- For attractants used and rebaiting (field longevity), see Tables 2b and 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 is used, see Tables 2a and 2b.
- For attractants used and rebaiting (field longevity), see Tables 2 and 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). Other versions of the Steiner traps are 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 is used, see Table 2a.
- For attractants used and rebaiting (field longevity), see Tables 2a and 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

Figure 18. Tephri trap.

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.

- For the species for which the trap is used, see Tables 2a and 2b.
- For attractants used and rebaiting (field longevity), see Tables 2a and 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 (YP) trap 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.

Figure 20. Rebell trap.

Use

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 is used, see Tables 2a and 2b.
- For attractants used and rebaiting (field longevity), see Tables 2 and 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

Trap layout 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. Traps should be relocated according to the phenology of hosts.

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 placed in carefully selected sites at the correct density and distributed in an adequate array, 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. 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 those servicing the traps, control teams and supervisors to find the trap easily.

A database or trapping book of all traps with their corresponding coordinates is kept, together with the records of trap services, rebaiting, trap captures etc. 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 (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. The interval can range from one day up to 30 days. However, the most common inspection interval is 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, being in this case two to three days 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 are in the trap surroundings. Attractants, by their nature, are highly volatile and care should be taken when storing, packaging, handling and disposing of lures to avoid compromising the lure and operator safety.

The number of traps serviced per day per person will vary depending on type of trap, survey, environmental and topographic conditions and experience of the operators.

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 surveys.

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 obtained by dividing the total number of captured fruit flies by the product obtained from multiplying the total number of inspected traps by the average number of days the traps were exposed. The formula is as follows:

$$FTD = \frac{F}{T \times D}$$

where

F = total number of fruit flies

T = number of inspected traps

D = average number of days traps were exposed in the field.

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 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 survey activities, such as the type and intensity of fruit sampling to detect immature stages of fruit flies. In those cases where trapping survey programmes are complemented with equivalent fruit sampling activities, trap densities can 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 situations
- 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 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/PA	0.25–1	0.25–0.5	0.25–0.5	0.25–0.5
Monitoring survey for suppression	MLT/McP	2C/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/PA	3–5	3–5	3–5	3–5
Monitoring survey for eradication	MLT/McP	2C/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/PA	1–2	2–3	3–5	5–12
Delimitation survey in an FF-PFA after a detection in addition to detection survey	MLT/McP	2C/PA	20–50[4]	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) and decreasing towards the surrounding trapping zones.

Trap type		**Attractant**	
McP	McPhail trap	2C	(AA+Pt)
MLT	Multilure trap	PA	protein attractant

Table 4b. Trap densities for *Bactrocera* spp. responding to methyl eugenol (ME), cuelure (CUE) and food attractants[1] (PA = protein attractants)

Trapping	Trap type[2]	Attractant	Trap density/km^2 (3)			
			Production area	Marginal	Urban	Points of entry[4]
Monitoring survey, no control	JT/ST/TP/LT/MM/ MLT/McP/TP	ME/CUE/PA	0.5–1.0	0.2–0.5	0.2–0.5	0.2–0.5
Monitoring survey for suppression	JT/ST/TP/LT/MM/ MLT/McP/TP	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	ME/CUE/PA	3–5	3–5	3–5	3–5
Monitoring survey for eradication	JT/ST/TP/MLT/LT/ MM/McP/TP	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	ME/CUE/PA	1	1	1–5	3–12
Delimitation survey in a PFA after a detection in addition to detection survey	JT/ST/TP/MLT/LT/ MM/McP/YP	ME/CUE/PA	20–50[5]	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) and decreasing towards the surrounding trapping zones.

Trap type

CH	ChamP trap	McP	McPhail trap	ST	Steiner trap
JT	Jackson trap	MLT	Multilure trap	TP	Tephri trap
LT	Lynfield trap	MM	Maghreb-Med or Morocco	YP	Yellow panel trap

Table 4c. Trap densities for *Bactrocera oleae*

Trapping	Trap type[1]	Attractant	Trap density/km^2 (2)			
			Production area	Marginal	Urban	Points of entry[3]
Monitoring survey, no control	MLT/CH/YP	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	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	AC+SK/PA	3–5	3–5	3–5	3–5
Monitoring survey for eradication	MLT/CH/YP	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	AC+SK/PA	1	1	2–5	3–12
Delimitation survey in a PFA after a detection in addition to detection survey	MLT/CH/YP	AC+SK/PA	20–50[4]	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) and decreasing towards the surrounding trapping zones.

Trap type		**Attractant**	
CH	ChamP trap	AC	ammonium bicarbonate
MLT	Multilure trap	PA	protein attractant
YP	Yellow panel trap	SK	Spiroketal

Table 4d. Trap densities for *Ceratitis* spp.

Trapping	Trap type[1]	Attractant	Trap density/km^2 (2)			
			Production area	Marginal	Urban	Points of entry[3]
Monitoring survey, no control[4]	JT/MLT/McP/ OBDT/ST/SE/ET/ LT/TP/VARs+	TML/CE/3C/ 2C/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+	TML/CE/3C/ 2C/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+	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+	TML/CE/3C/ 2C/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+	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+	TML/CE/3C/ PA	20–50[6]	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) and decreasing 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	(AA+TMA)
ET	Easy trap (with 2C and 3C attractants for female-biased captures)	3C	(AA+Pt+TMA)
JT	Jackson trap (with TML for male capture)	CE	Capilure
LT	Lynfield trap (with TML for male capture)	AA	Ammonium acetate
McP	McPhail trap	PA	Protein attractant
MLT	Multilure trap (with 2C and 3C attractants for female-biased captures)	Pt	Putrescine
MM	Maghreb-Med or Morocco	TMA	Trimethylamine
OBDT	Open Bottom Dry Trap (with 2C and 3C attractants for female-biased captures)	TML	Trimedlure
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 for *Rhagoletis* spp.

Trapping	Trap type[1]	Attractant	Trap density/km² (2)			
			Production area	Marginal	Urban	Points of entry[3]
Monitoring survey, no control	RB/RS/PALz/YP /McP	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 /McP	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 /McP	BuH/AS	3–5	3–5	3–5	3–5
Monitoring survey for eradication	RB/RS/PALz/YP /McP	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 /McP	BuH/AS	1	0.4–3	3–5	4–12
Delimitation survey in a PFA after a detection in addition to detection survey	RB/RS/PALz/YP /McP	BuH/AS	20–50[4]	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) and decreasing towards the surrounding trapping zones.

Trap type		Attractant	
McP	McPhail trap	AS	Ammonium salt
RB	Rebell trap	BuH	Butyl hexanoate
RS	Red sphere trap	CE	Capilure
PALz	Fluorescent yellow sticky trap	AA	Ammonium acetate
YP	Yellow panel trap		

Table 4f. Trap densities for *Toxotrypana curvicauda*

Trapping	Trap type[1]	Attractant	Trap density/km² (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	GS	MVP	20–50[4]	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) and decreasing towards the surrounding trapping zones.

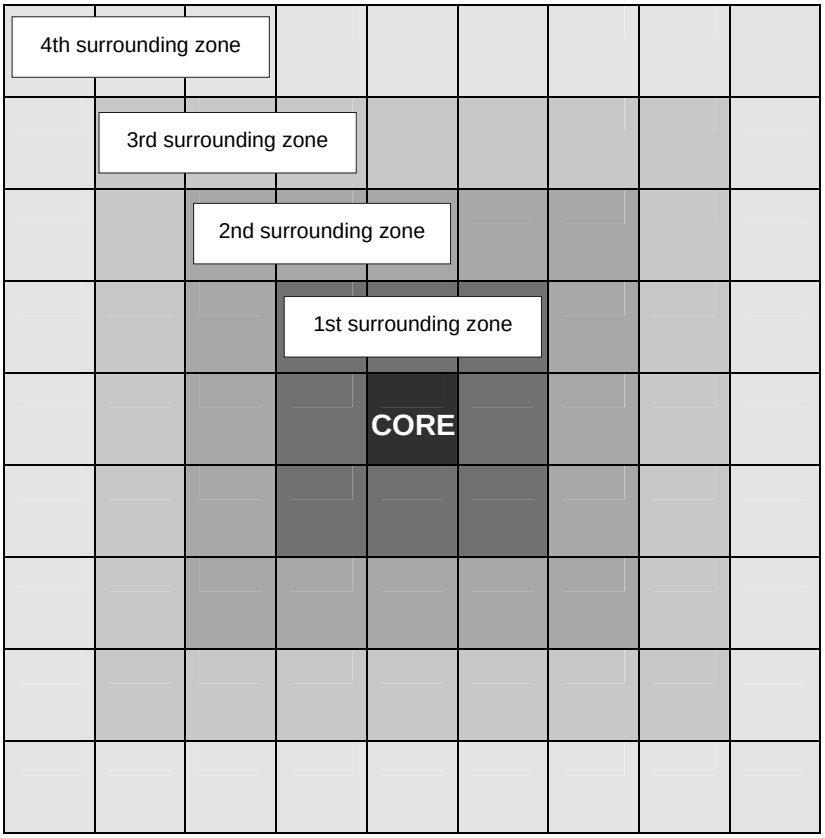
Trap type		Attractant	
GS	Green sphere	MVP	Papaya fruit fly pheromone (2-methyl-vinylpyrazine)

6. Trapping for Delimiting Surveys in Fruit Fly Free Areas

When a delimiting survey is designed to determine the boundaries of a fruit fly pest detection into an FF free area, trap density may vary by situation (climatic conditions, biology of species, etc), but there are some commonalities. The area immediately surrounding each detection is termed a core area. The

core area is defined by a set radius surrounding each detection. The size of the core area may vary depending on the species of fruit fly, types of traps and other considerations. The area defined by the radius is often squared off to produce a grid. The trapping density in the core area is higher than that used for detection surveys. Around the core area may be one or more surrounding zones where the trap density is higher than for detection surveys but usually lower than that of the core area, as appropriate. Trap densities in the surrounding zones may be proportionally tiered in a decreasing density the further away they are from the core area. An example of a delimiting survey for a single core area is presented in Figure 21. In cases where target fruit flies are detected in several traps distant from each other, the respective zones are identified individually and the area for delimiting survey is finally determined taking into account the overlap of the core zones.

A delimiting survey should be implemented as soon as possible after the initial detection of a target fruit fly species. The duration of a delimiting survey is dependent on the biology of the species. In general, delimiting survey trapping continues for three life cycles beyond the last trap capture for multivoltine species. However, one or two life cycles may be used for particular situations or fruit fly species based on scientific information, as well as that provided by the surveillance system in place.



Surrounding zones	**km^2**	***Anastrepha* spp.** **McP**	***Bactrocera* spp.** **CUE + McP**	***B. dorsalis, B. carambolae*** **ME + McP**	***Ceratitis capitata*** **TML + MLT** (MLT core only)
Core	1	32	20 + 10	10 + 10	40 + 10
1st	8	16	10	2	20
2nd	16	8	6	2	10
3rd	24	4	4	2	8
4th	32	2	2	2	4

Figure 21. Example of delimiting survey using single km^2 core and surrounding zones for various fruit flies and attractants/trap types (number of traps per km^2)

7. 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 for an acceptable level of performance based on their anticipated use.

The effectiveness of trapping should be technically reviewed periodically by individuals not directly involved in implementing the programme. 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/shade balance, 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.

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.

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 and/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.

8. Selected References

The technical justification contained in this standard is based on the following references that are accessible scientific publications. These references may provide further guidance on the methods and procedures contained in this document.

Baker, R., Herbert, R., Howse, P.E. & Jones, O.T. 1980. Identification and synthesis of the major sex pheromone of the olive fly (*Dacus oleae*). *J. Chem. Soc., Chem. Commun*., 1: 52–53.

Calkins, C.O., Schroeder, W.J. & Champers, D.L. 1984. The probability of detecting the Caribbean fruit fly, *Anastrepha suspensa* (Loew) (Diptera: Tephritidae) with various densities of McPhail traps. *J. Econ. Entomol*., 77: 198–201.

Campaña Nacional Contra Moscas de la Fruta, DGSV/CONASAG/SAGAR 1999. Apéndice Técnico para el Control de Calidad del Trampeo para Moscas de la Fruta del Género *Anastrepha* spp. México D.F. febrero de 1999. 15 pp.

Conway, H.E. & Forrester, O.T. 2007. Comparison of Mexican fruit fly (Diptera: Tephritidae) capture between McPhail traps with Torula Yeast and Multilure Traps with Biolure in South Texas. *Florida Entomologist*, 90(3).

Cowley, J.M., Page, F.D., Nimmo, P.R. & Cowley, D.R. 1990. Comparison of the effectiveness of two traps for *Bactrocera tryoni* (Froggat) (Diptera: Tephritidae) and implications for quarantine surveillance systems. *J. Entomol. Soc*., 29: 171–176.

Drew, R.A.I. 1982. Taxonomy. *In* R.A.I. Drew, G.H.S. Hooper & M.A. Bateman, eds. *Economic fruit flies of the South Pacific region*, 2nd edn, pp. 1–97. Brisbane, Queensland Department of Primary Industries.

Drew, R.A.I. & Hooper, G.H.S. 1981. The response of fruit fly species (Diptera; Tephritidae) in Australia to male attractants. *J. Austral. Entomol. Soc*., 20: 201–205.

Epsky, N.D., Hendrichs, J., Katsoyannos, B.I., Vasquez, L.A., Ros, J.P., Zümreoglu, A., Pereira, R., Bakri, A., Seewooruthun, S.I. & Heath, R.R. 1999. Field evaluation of female-targeted trapping systems for *Ceratitis capitata* (Diptera: Tephritidae) in seven countries. *J. Econ. Entomol*., 92: 156–164.

Heath, R.R., Epsky, N.D., Guzman, A., Dueben, B.D., Manukian, A. & Meyer, W.L. 1995. Development of a dry plastic insect trap with food-based synthetic attractant for the Mediterranean and the Mexican fruit fly (Diptera: Tephritidae). *J. Econ. Entomol*., 88: 1307–1315.

Heath, R.H., Epsky, N., Midgarden, D. & Katsoyanos, B.I. 2004. Efficacy of 1,4-diaminobutane (putrescine) in a food-based synthetic attractant for capture of Mediterranean and Mexican fruit flies (Diptera: Tephritidae). *J. Econ. Entomol.*, 97(3): 1126–1131.

Hill, A.R. 1987. Comparison between trimedlure and capilure® – attractants for male *Ceratitis capitata* (Wiedemann) (Diptera Tephritidae). *J. Austral. Entomol. Soc*., 26: 35–36.

Holler, T., Sivinski, J., Jenkins, C. & Fraser, S. 2006. A comparison of yeast hydrolysate and synthetic food attractants for capture of *Anastrepha suspensa* (Diptera: Tephritidae). *Florida Entomologist*, 89(3): 419–420.

IAEA (International Atomic Energy Agency). 1996. *Standardization of medfly trapping for use in sterile insect technique programmes*. Final report of Coordinated Research Programme 1986–1992. IAEA-TECDOC-883.

—— 1998. *Development of female medfly attractant systems for trapping and sterility assessment*. Final report of a Coordinated Research Programme 1995–1998. IAEA-TECDOC-1099. 228 pp.

—— 2003. *Trapping guidelines for area-wide fruit fly programmes*. Joint FAO/IAEA Division, Vienna, Austria. 47 pp.

—— 2007. *Development of improved attractants and their integration into fruit fly SIT management programmes*. Final report of a Coordinated Research Programme 2000–2005. IAEA-TECDOC-1574. 230 pp.

Jang, E.B., Holler, T.C., Moses, A.L., Salvato, M.H. & Fraser, S. 2007. Evaluation of a single-matrix food attractant Tephritid fruit fly bait dispenser for use in feral trap detection programs. *Proc. Hawaiian Entomol. Soc.*, 39: 1–8.

Katsoyannos, B.I. 1983. Captures of *Ceratitis capitata* and *Dacus oleae* flies (Diptera, Tephritidae) by McPhail and Rebell color traps suspended on citrus, fig and olive trees on Chios, Greece. *In* R. Cavalloro, ed. *Fruit flies of economic importance*. Proc. CEC/IOBC Intern. Symp. Athens, Nov. 1982, pp. 451–456.

—— 1989. Response to shape, size and color. *In* A.S. Robinson & G. Hooper, eds. *World Crop Pests*, Volume 3A, *Fruit flies, their biology, natural enemies and control*, pp. 307–324. Elsevier Science Publishers B.V., Amsterdam.

Lance, D.R. & Gates, D.B. 1994. Sensitivity of detection trapping systems for Mediterranean fruit flies (Diptera: Tephritidae) in southern California. *J. Econ. Entomol*., 87: 1377.

Leonhardt, B.A., Cunningham, R.T., Chambers, D.L., Avery, J.W. & Harte, E.M. 1994. Controlled-release panel traps for the Mediterranean fruit fly (Diptera: Tephritidae). *J. Econ. Entomol*., 87: 1217–1223.

Martinez, A.J., Salinas, E. J. & Rendon, P. 2007. Capture of *Anastrepha* species (Diptera: Tephritidae) with Multilure traps and Biolure attractants in Guatemala. *Florida Entomologist*, 90(1): 258–263.

Prokopy, R.J. 1972. Response of apple maggot flies to rectangles of different colors and shades. *Environ. Entomol*., 1: 720–726.

Robacker D.C. & Czokajlo, D. 2006. Effect of propylene glycol antifreeze on captures of Mexican fruit flies (Diptera: Tephritidae) in traps baited with BioLures and AFF lures. *Florida Entomologist*, 89(2): 286–287.

Robacker, D.C. & Warfield, W.C. 1993. Attraction of both sexes of Mexican fruit fly, *Anastrepha ludens*, to a mixture of ammonia, methylamine, and putrescine. *J. Chem. Ecol*., 19: 2999–3016.

Tan, K.H. 1982. Effect of permethrin and cypermethrin against *Dacus dorsalis* in relation to temperature. *Malaysian Applied Biology*, 11:41–45.

Thomas, D.B. 2003. Nontarget insects captured in fruit fly (Diptera: Tephritridae) surveillance traps. *J. Econ. Entomol.*, 96(6): 1732–1737.

Tóth, M., Szarukán, I., Voigt, E. & Kozár, F. 2004. Hatékony cseresznyelégy- (Rhagoletis cerasi L., Diptera, Tephritidae) csapda kifejlesztése vizuális és kémiai ingerek figyelembevételével. [Importance of visual and chemical stimuli in the development of an efficient trap for the European cherry fruit fly (*Rhagoletis cerasi* L.) (Diptera, Tephritidae).] *Növényvédelem*, 40: 229–236.

Tóth, M., Tabilio, R. & Nobili, P. 2004. Különféle csapdatípusok hatékonyságának összehasonlitása a földközi-tengeri gyümölcslégy (Ceratitis capitata Wiedemann) hímek fogására. [Comparison of efficiency of different trap types for capturing males of the Mediterranean fruit fly *Ceratitis capitata* Wiedemann (Diptera: Tephritidae).] *Növényvédelem*, 40 :179–183.

—— 2006. Le trappole per la cattura dei maschi della Mosca mediterranea della frutta. *Frutticoltura*, 68(1): 70–73.

Tóth, M., Tabilio, R., Nobili, P., Mandatori, R., Quaranta, M., Carbone, G. & Ujváry, I. 2007. A földközi-tengeri gyümölcslégy (Ceratitis capitata Wiedemann) kémiai kommunikációja: alkalmazási lehetŒségek észlelési és rajzáskövetési célokra. [Chemical communication of the Mediterranean fruit fly (*Ceratitis capitata* Wiedemann): application opportunities for detection and monitoring.] *Integr. Term. Kert. Szántóf. Kult*., 28: 78–88.

Tóth, M., Tabilio, R., Mandatori, R., Quaranta, M. & Carbone, G. 2007. Comparative performance of traps for the Mediterranean fruit fly *Ceratitis capitata* Wiedemann (Diptera: Tephritidae) baited with female-targeted or male-targeted lures. *Int. J. Hortic. Sci.*, 13: 11–14.

Tóth, M. & Voigt, E. 2009. Relative importance of visual and chemical cues in trapping *Rhagoletis cingulata* and *R. cerasi* in Hungary. *J. Pest. Sci.* (submitted).

Voigt, E. & Tóth, M. 2008. Az amerikai keleti cseresznyelegyet és az európai cseresznyelegyet egyaránt fogó csapdatípusok. [Trap types catcing both *Rhagoletis cingulata* and *R. cerasi* equally well.] *Agrofórum*, 19: 70–71.

Wall, C. 1989. Monitoring and spray timing. *In* A.R. Jutsum & R.F.S. Gordon, eds. *Insect pheromones in plant protection*, pp. 39–66. New York, Wiley. 369 pp.

White, I.M. & Elson-Harris, M.M. 1994. *Fruit flies of economic significance: their identification and bionomics*. ACIAR, 17–21.

Wijesuriya, S.R. & De Lima, C.P.F. De Lima. 1995. Comparison of two types of traps and lure dispensers for *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae). *J. Austral. Ent. Soc.*, 34: 273–275.

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

DRAFT STANDARD

DESIGN AND OPERATION OF POST-ENTRY QUARANTINE STATIONS FOR PLANTS

(201-)

Date of this document	10 December 2009
Document category	Draft ISPM
Current document stage	SC November 2009 recommended for adoption by CPM-5; edited and formatted in new template
Origin	Work programme topic: Post-entry quarantine facilities
Major stages	Specification No. 24, November 2004. Member consultation (regular process) June 2008, June 2009

CONTENTS

INTRODUCTION

Scope

This standard describes general guidelines for the design and operation of post-entry quarantine (PEQ) stations for holding imported consignments of plants, mainly plants for planting, in confinement in order to verify whether or not they are infested with quarantine pests.

References

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

ISPM 2. 2007. *Framework for pest risk analysis*. Rome, IPPC, FAO.

ISPM 5. 2009. *Glossary of phytosanitary terms*. Rome, IPPC, FAO.

ISPM 11. 2004. *Pest risk analysis for quarantine pests including analysis of environmental risks and living modified organisms*. Rome, IPPC, FAO.

Definitions

Definitions of phytosanitary terms used in the present standard can be found in ISPM 5:2009.

Outline of Requirements

Pest risk analysis (PRA) should be carried out to determine the phytosanitary measures for specified plants for planting commodities. For certain such commodities, the National Plant Protection Organization (NPPO) of the importing country may decide that post-entry quarantine is required to manage pest risks identified by PRA. Confinement of a consignment of plants for planting in a PEQ station may be an appropriate phytosanitary measure in cases where a quarantine pest is difficult to detect, where it takes time for sign or symptom expression, or where testing or treatment is required.

For a PEQ station to function successfully, its design and management should ensure that any quarantine pests that may be associated with consignments of plants for planting are suitably confined and do not move or escape from the station. The PEQ station should also ensure that consignments of plants for planting are held in a manner that best facilitates observation, research, further inspection, testing or treatment of the plants.

PEQ stations may consist of a field site, screen house, glasshouse and/or laboratory, amongst others. The type of facility to be used should be determined by the type of imported plants for planting and the quarantine pests that may be associated with them.

PEQ stations should be appropriately located and comply with physical and operational requirements based on the biology of both plants and quarantine pests that may potentially be associated with the plants for planting. The impact of such pests should also be considered.

Operational requirements for PEQ stations include policies and procedures relating to staff requirements, technical and operational procedures, and record keeping. PEQ stations should have systems in place to detect and identify quarantine pests and to treat, remove or destroy infested plant material and other materials that may harbour these pests. The NPPO should ensure that the PEQ station is audited on a regular basis.

The plants may be released from quarantine at the completion of the PEQ period if they are found to be free from quarantine pests.

BACKGROUND

Imported plants have the potential to introduce quarantine pests. When considering phytosanitary measures for such commodities, NPPOs should apply measures based on the principle of managed risk (ISPM 1:2006). In order to assess the pest risks and identify appropriate phytosanitary measures for particular pathways, PRA should be carried out. For many commodities that are traded internationally, NPPOs of importing countries identify risk management measures that mitigate pest risk without the need to apply quarantine after entry. However, for some commodities, especially plants for planting, NPPOs may indentify that a quarantine period is required.

In some cases, NPPOs may decide that a period of quarantine is necessary for a specific consignment because of the impossibility of verifying the presence of quarantine pests in that consignment at entry. This allows for testing for the presence of pests, time for the expression of signs or symptoms, and appropriate treatment if necessary.

The purpose of a PEQ station is to confine both the plants and any quarantine pest potentially associated with them so that they cannot escape or be removed from the station. When the required inspection, testing, treatment and verification activities have been completed, the consignment can be released, destroyed or kept as reference material, as appropriate.

The guidelines described in this standard may also be relevant for holding other organisms in quarantine (e.g. quarantine pests, beneficial organisms, biological control agents) for which other specific requirements may also be needed.

Determining the need for post-entry quarantine as a phytosanitary measure

PRA should be carried out to determine the phytosanitary measures for specified commodities of plants for planting according to ISPM 2:2007 and ISPM 11:2004. The PRA determines the pest risk associated with the plants for planting and identifies phytosanitary measures, which may include post-entry quarantine, to manage the risk. The physical and operational characteristics of a PEQ station determine the level of confinement provided by the station and its ability to confine adequately various quarantine pests.

Once the post-entry quarantine measure has been determined by the NPPO of the importing country, the NPPO should determine whether this measure can be met by any of the following:

- an existing PEQ station (this may include isolated field sites) without modification
- a modification of structural or operating conditions of an existing PEQ station
- a new PEQ station designed and constructed
- quarantine in a different area or country.

REQUIREMENTS

1. General Requirements for PEQ Stations

The requirements of PEQ stations for consignments of plants for planting should consider the biology of both the plants for planting and the quarantine pests that may potentially be associated with them, particularly their mode of dispersal and spread. Successful detention of consignments of plants for planting in quarantine requires prevention of any associated quarantine pests from escaping and prevention of organisms in the area outside the PEQ station from entering the station and transferring or vectoring quarantine pests out of the station.

2. Specific Requirements for PEQ Stations

PEQ stations may consist of one or more of the following: a field site, screen house, glasshouse, laboratory, amongst others. The facilities of a PEQ station to be used should be determined by the type of imported plants for planting and the quarantine pests that may be associated with them.

NPPOs should consider all appropriate issues when determining the requirements for the PEQ station (e.g. the location, physical and operational requirements, waste processing facilities, and the availability of adequate systems for detection, diagnosis and treatment of quarantine pests). NPPOs should ensure that the appropriate level of confinement is maintained by inspections and audits. Appendix 1 provides guidance on requirements for PEQ stations based on the biology of different types of quarantine pests.

2.1 Location

In determining the location of a PEQ station the following should be addressed:

- risks of accidental escape of quarantine pests
- the possibility of early detection of the escape
- the possibility of effective management measures in case of escape.

PEQ stations should provide adequate isolation and stability (e.g. with minimal exposure to severe climatic or geological events). Suitable separation from susceptible plants and related plant species should also be considered (e.g. location away from agricultural or horticultural production, forests or areas of high biodiversity).

2.2 Physical requirements

The physical design of a PEQ station should take into consideration the growth requirements of the plants for planting, the biology of any quarantine pests potentially associated with the consignment, the work flow in the station and specific emergency requirements (e.g. in the event of loss of electricity, water supply). Office facilities and supporting service infrastructure should be available as required and have suitable separation from plants for planting in the PEQ station.

Physical requirements to be considered include:

- delimitation of the station
- isolation of field sites
- differentiation of internal access zones with different levels of confinement
- structural materials (for walls, floors, roof, doors, meshes and windows)
- size of the station (to ensure effective operation of the PEQ station and associated procedures)
- compartments for internal separation of consignments
- access to the station (to avoid traffic in areas where plants for planting in quarantine are being grown)
- design of openings (for doors, windows, air vents, drains and other conduits)
- treatment systems (for air, water, solid and liquid waste)
- equipment (e.g. specialized biological safety cabinets, autoclaves)
- access to water and electricity supplies, including backup generators
- footbath at the entrance
- decontamination room for workers
- use of signs
- security measures
- access to waste disposal facilities.

2.3 Operational requirements

PEQ stations should either be operated or be authorized and audited by the NPPO of the importing country.

Specific procedures will be required in the operation of the station to manage the identified risks associated with the consignments of plants for planting in the PEQ station. A procedural manual, approved by the NPPO where appropriate, should detail the procedures by which the station meets its objectives.

Operational requirements involve appropriate policies and procedures relating to management review, regular auditing, training of personnel, general operation of the PEQ station, record keeping and traceability of plants for planting, contingency planning, health and safety, and documentation.

2.3.1 Staff requirements

Requirements may include:

- a suitable qualified supervisor who has overall responsibility for maintaining the PEQ station and for all PEQ activities
- qualified staff with responsibilities assigned for the maintenance of the PEQ station and associated activities
- appropriately qualified scientific support staff or ready access to them.

2.3.2 Technical and operational procedures

Technical and operational requirements should be documented in a procedural manual and may include:

- a limit on the number of plants for planting held at any one time in the PEQ station so as not to exceed the capacity of the station in a way that could impede inspection or compromise quarantine
- provision for disinfestations of the station before introduction of plants for planting or in the event of pest occurrence
- ensuring adequate spatial separation of different consignments or lots within the station
- a system to enable full traceability of the consignments through the PEQ station (the traceability system should use a unique identifier from plant consignment arrival through handling, treatment and testing, until release or destruction of the infested consignment)
- use of specific confinement equipment (e.g. biological safety cabinets, cages) if needed
- handling and sanitation procedures that prevent the spread of pests on hands, cutting tools, footwear and clothing, as well as procedures for disinfestation of surfaces in the PEQ station
- provision for monitoring pest occurrence in the PEQ station and its vicinity (e.g. using traps)
- appropriate inspection and/or testing to detect quarantine pests
- description of how plants are to be handled, sampled and transported to diagnostic laboratories for the testing of quarantine pests
- restricting staff contact with plants that may be at risk outside the PEQ station
- criteria for determining what constitutes a breach of quarantine and a reporting system to ensure that any breaches and adopted measures are reported without delay to the NPPO
- provision for assessment and control (e.g. maintenance and calibration) of equipment (e.g. autoclaves and biological safety cabinets)
- effective contingency plans for disruptions to or failures of quarantine (e.g. fires, accidental release of plants or pests from the station, electrical outages or other emergencies)
- a schedule for internal and external audits to check that the station meets the requirements (e.g. structural integrity and hygiene requirements)

- a procedure for dealing with non-compliances including the appropriate treatment or destruction of plant material infested with quarantine pests, and the preservation of specimens if required
- provision for disposal and inactivation of infested consignments
- procedures for decontamination and disposal of waste, including packaging and substrate
- use of dedicated or disposable personal protective equipment
- procedures that describe how documents are reviewed, amended and controlled
- a means to control the entry of authorized staff and visitors (e.g. escorting visitors, visitor access restrictions, recording system for visitors)
- a procedure to ensure that all staff are adequately qualified, including training where appropriate.

2.3.3 Record keeping

The following records may be required:

- a list of PEQ station staff and other persons authorized to enter the station (or specific parts thereof)
- a site plan of the PEQ station showing the location of the PEQ station on the site and all station entrances and access points
- a record of visitors
- a record of all PEQ activities conducted in the station (e.g. staff activities, inspections, testing, treatments, disposal and release of consignments of plants for planting in quarantine)
- a record of all consignments of plants in the PEQ station and their source of origin
- a record of equipment
- records of training and skills of staff.

2.4 Diagnosis and removal of quarantine pests or vectors

PEQ stations should have systems in place for monitoring for pest occurrence in the PEQ station and its vicinity as well as for detecting and identifying quarantine pests or potential vectors of quarantine pests. It is essential that the PEQ station has access to diagnostic expertise either from the staff within the station or other means. In any case the final diagnostic decision rests with the NPPO.

PEQ stations should have access to expertise and facilities or equipment to treat, remove or destroy as quickly as possible any infested plant material detected in the PEQ station.

2.5 Audit of PEQ stations

The NPPO should ensure that the PEQ station is audited on a regular basis to ensure that the station meets the physical and operational requirements.

3. Completion of PEQ Process

Consignments of plants for planting should be released from the PEQ station only if they are found to be free from quarantine pests.

Plants found to be infested with quarantine pests should either be treated to remove infestation or be destroyed. Destruction should be in a manner that removes any possibility of escape of the pest from the PEQ station (e.g. chemical destruction, incineration, autoclaving).

In special circumstances infested or potentially infested plants for planting may be

- shipped to another PEQ station for further inspection, testing or treatment

- returned to the country of origin or shipped to another country under restricted/safe conditions if complying with the recipient country's phytosanitary import requirements or with the agreement of the corresponding NPPO
- kept as reference material for technical or scientific work under quarantine.

In such circumstances any pest risks associated with the movement of plants should be fully addressed.

The completion of the post-entry quarantine process should be documented by the NPPO.

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

APPENDIX 1: Requirements for PEQ stations

The following may be considered by NPPOs for PEQ stations for consignments of plants for planting. The requirements are based on the biology of quarantine pests potentially associated with the plants. Other requirements may be necessary to address the risks from specific pests.

General requirements for PEQ stations	
• Physical separation of plants from other areas, including offices used by personnel • Adequate safeguards to ensure plants cannot be accessed or removed from the PEQ station without appropriate authorization • Growth of plants in pest-free growing medium (e.g. sterilized potting mix or soil-less growing medium) • Growth of plants on raised benches • Provision of suitable growing conditions for the imported plants (e.g. temperature, light and humidity) • Provision of conditions conducive for the development of signs and symptoms of pests to be expressed • Control of local pests (e.g. rodents, whiteflies, ants) and exclusion from the PEQ station by sealing all the points of penetration, including electrical and plumbing conduits (except for open ground facilities) • A system and means for sterilization, decontamination or destruction of waste (including infested plants) and equipment (e.g. cutting implements) before removal from the station • Appropriate irrigation system to prevent transmission of pests • For glasshouses and screen houses: accessible surfaces constructed of smooth and impervious material for cleaning and effective decontamination • For glasshouses and screen houses: ceilings and walls to be constructed of material resistant to deterioration and to attack by insects and other arthropods • Protective clothing (e.g. a dedicated laboratory coat and footwear or shoe covers, disposable gloves) to be worn by all staff and visitors and removed on exit from the PEQ station • Decontamination of personnel upon exit of PEQ station areas containing risk material	
Biological characteristic (of quarantine pests)	**PEQ station requirements**
Pests that are exclusively graft-transmitted (e.g. some viruses or phytoplasmas)	• Facilities of the station may include field site, screen house, glasshouse or laboratory • PEQ station clearly delimited • Appropriate separation from potential hosts • Host material restricted to PEQ station only
Pests spread by soil or water only, or in vectors that themselves are spread by soil or water only (e.g. cyst nematodes, nepoviruses)	• Facilities of the station may include screen house, tunnel or glasshouse • Windows and doors locked shut when not in use, and when open, windows should be fitted with screens • Footbath • Impermeable flooring • Appropriate treatment of waste and water (entering and leaving PEQ station) to eliminate quarantine pests • Appropriate treatment of soil to eliminate soil-borne vectors • Appropriate separation of plants from soil • Prevention of drainage water reaching water sources used to irrigate host plants • Soil traps installed in drains

Pests or pest vectors that are airborne or mobile and are greater than 0.2 mm in size (e.g. aphids)	• Facilities of the station may include screen house, glasshouse or laboratory • Self-closing and tight-fitting doors, with appropriate seals and sweeps • Entry through two doors separated by a vestibule or anteroom • A sink with hands-free operation in the anteroom • Anteroom with insecticidal spray • Mesh less than 0.2 mm (70 mesh) (e.g. for screen houses and over vents) to prevent pest or vector entry or escape • Alternative host material for the quarantine pest should not be within the expected pest or vector dispersal distance from the PEQ station (in any direction) • Pest monitoring programme that includes the use of sticky traps, light traps or other insect monitoring devices • Inward directional air flow to be provided within the heating, ventilation and air-conditioning system • Backup electricity supply system for air flow systems and to maintain other equipment • Sterilization or decontamination of waste and equipment (e.g. cutting implements) before removal from the PEQ station
Pests or pest vectors that are airborne or mobile and less than 0.2 mm in size (e.g. some mite or thrips species)	• Facilities of the station may include glasshouse constructed of regular glass, impact-resistant polycarbonate or twin-skin plastic, or a laboratory • Self-closing and tight-fitting doors, with appropriate seals and sweeps • Entry through two doors separated by a vestibule or anteroom • A sink with hands-free operation in the anteroom • Anteroom with insecticidal spray • Alternative host material for the quarantine pest should not be within the expected pest or vector dispersal distance from the PEQ station (in any direction) • Pest monitoring programme that includes the use of sticky traps, light traps or other insect monitoring devices • Inward directional air flow to be provided within the heating, ventilation and air-conditioning system • Backup electricity supply system for air flow systems and to maintain other equipment • High-efficiency particulate air (HEPA) filtration or its equivalent (HEPA filters to trap 99.97% of particles of 0.3 microns in diameter and 99.99% of particles of greater or smaller size) • Sterilization or decontamination of waste and equipment (e.g. cutting implements) before removal from the PEQ station • A backup electricity supply system for air systems to maintain negative air pressure gradients and for other equipment • Interlocking of the supply air and exhaust air systems to ensure inward flow at all times

Pests that are highly mobile or easily dispersed (e.g. rust fungi, airborne bacteria)	• Facilities of the station may include glasshouse constructed of breakage-resistant glass or twin-walled polycarbonate, or a laboratory • Footbath • Self-closing and tight-fitting doors, with appropriate seals and sweeps • Entry through two doors separated by a vestibule or anteroom • A sink with hands-free operation in the anteroom • Alternative host material for the quarantine pest should not be within the expected pest or vector dispersal distance from the PEQ station (in any direction) • Inward directional air flow to be provided within the heating, ventilation and air-conditioning system • Backup electricity supply system for air flow systems and to maintain other equipment • No direct access to the station from the outside of the building • Interlocked vestibule doors so that only one door at a time can be opened • HEPA filtration or its equivalent (HEPA filters to trap 99.97% of particles of 0.3 microns in diameter and 99.99% of particles of greater or smaller size) • All waste air filtered through HEPA filters • Sterilization or decontamination of solid and liquid waste and equipment (e.g. cutting implements) before removal from the PEQ station • Interlocking of the supply air and exhaust air systems to ensure inward flow at all times • Installation of a security alarm • A shower (may be required for staff members on leaving the station) • Monitoring systems for operational processes such as pressure differentials and wastewater treatment to prevent failure of essential systems

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

DRAFT AMENDMENT TO ISPM 5:2009

DELETION OF OLD TERM AND DEFINITION: "BENEFICIAL ORGANISM"

(200-)

Date of this document	10 December 2009
Document category	Draft amendment to ISPM 5, *Glossary of phytosanitary terms*
Current document stage	SC November 2009 recommended for adoption by CPM-5; edited and formatted in new template
Origin	ICPM-7 (2005) asked for GWG consideration of terms in revised ISPM 3:2005
Major stages	CPM-3 (2008) asked SC (TPG) to consider definition of "beneficial organism". Member consultation (regular process) June 2009.

AMENDMENTS TO ISPM 5 (*GLOSSARY OF PHYTOSANITARY TERMS*)

1. Deletion of Old Term and Definition: "Beneficial Organism"

Background

The consideration of this term began in 2005 when the Glossary Working Group (GWG) was asked by ICPM-7 to look at the terms and definitions in the revised version of ISPM 3:2005 (see ICPM-7, 2005, par. 79.2), taking into account comments made at ICPM-7. At the 2005 meeting the GWG suggested that "sterile insects" be added to the definition of "biological control" and that the existing definitions of "beneficial organism" and "biological control agent" be retained (see report of GWG, 2005, par. 5.6).

During the period between 2005 and 2007, exchanges between the Standards Committee (SC) and the Technical Panel for the Glossary (TPG) included suggestions of deleting reference to "biological control agents" or "sterile insects" or both from the definition. If both references were deleted, the definition would not be needed because the definition would be in the general meaning of "beneficial organism". However, if reference to "sterile insects" were deleted, there would be no change to the existing definition, and this would fail to take account of the intent for ISPM 3:2005 to cover sterile insects within the term for beneficial organism.

At the 2006 TPG meeting, discussions of the revision of the definition of "biological control" following CPM-1 (2006) led to the deletion of the term from the *Glossary of phytosanitary terms* at CPM-2 (2007) and the revision of the definition of "beneficial organisms'' to cover sterile insects. This was reiterated at the SC meeting in May 2007.

In its meeting in 2008, CPM-3 requested the TPG to consider further the definition for "beneficial organism" and whether the term should be maintained in the Glossary. However, discussions at CPM-3 (2008) indicated that there was still concern over the definition of "beneficial organism" and even the need for the term to be included in the Glossary.

At the TPG meeting in Copenhagen, Denmark, in October 2008, there was further discussion of the term "beneficial organism". The TPG investigated the use of the term in the Convention and found that the text of the IPPC (Article VII 1.d), where it mentions the organisms "of phytosanitary concern claimed to be beneficial", was confusing. The French version of the Convention refers to the organisms of phytosanitary importance and the Spanish version refers to organisms of interest.

In the SC meeting of November 2008, the TPG proposed that the term "beneficial organism" be withdrawn from the Glossary. The SC agreed to have a document prepared by the TPG, for review by the SC in May 2009, proposing the deletion of the term and definition of "beneficial organism" from the Glossary.

The TPG meeting in October 2009 discussed the member comments. Of the 13 different comments received, four proposed to keep the term and definition in the Glossary, two asked for further clarification and six agreed with the deletion (one of which asked for a general analysis of what are beneficial organisms). After consideration of the comments, the TPG reiterated its recommendation that the term "beneficial organism" be deleted from the Glossary. No new element was brought to the discussion, and the explanation above is unchanged.

Amendments to ISPM 5: Proposed for Deletion

beneficial organism	Any **organism** directly or indirectly advantageous to **plants** or **plant products**, including **biological control agents** (ISPM 3:2005)

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

ANNEX -- to ISPM 28:2009

IRRADIATION TREATMENT FOR *CONOTRACHELUS NENUPHAR*

(201-)

Adoption

This phytosanitary treatment was adopted by the Commission on Phytosanitary Measures in ----.

Scope of the treatment

This treatment applies to the irradiation of fruits and vegetables at 92 Gy minimum absorbed dose to prevent the reproduction in adults of *Conotrachelus nenuphar* at the stated efficacy. This treatment should be applied in accordance with the requirements outlined in ISPM 18:2003 (*Guidelines for the use of irradiation as a phytosanitary measure*)[1].

Treatment description

Name of treatment	Irradiation treatment for *Conotrachelus nenuphar*
Active ingredient	N/A
Treatment type	Irradiation
Target pest	*Conotrachelus nenuphar* (Herbst) (Coleoptera: Curculionidae)
Target regulated articles	All fruits and vegetables that are hosts of *Conotrachelus nenuphar.*
Treatment schedule	Minimum absorbed dose of 92 Gy to prevent the reproduction in adults of *Conotrachelus nenuphar*. Efficacy and confidence level of the treatment is $ED_{99.9880}$ at the 95% confidence level. Treatment should be applied in accordance with the requirements of ISPM 18:2003 (*Guidelines for the use of irradiation as a phytosanitary measure*). This irradiation treatment should not be applied to fruit and vegetables stored in modified atmospheres.

[1] The scope of IPPC treatments does not include issues related to pesticide registration or other domestic requirements for approval of treatments. Treatments also do not provide information on specific effects on human health or food safety, which should be addressed using domestic procedures prior to approval of a treatment. In addition effects on product quality are considered before their international adoption. There is no obligation for a contracting party to approve, register or adopt the treatments for use in its territory.

Other relevant information	Since irradiation may not result in outright mortality, inspectors may encounter live, but non-viable *Conotrachelus nenuphar* (larvae, pupae and/or adults) during the inspection process. This does not imply a failure of the treatment. Although the treatment may result in the presence of irradiated adults, the following factors may affect the likelihood of adults being found in traps in importing countries: – Adults are rarely (if ever) present in shipped fruit because the insect pupates off the fruit; – Irradiated adults are very unlikely to survive for more than one week, post irradiation, and they are therefore less likely to be robust or to spread than non-irradiated adults The Technical Panel on Phytosanitary Treatments based its evaluation of this treatment on the research work undertaken by Hallman (2003) that determined the efficacy of irradiation as a treatment for this pest in *Malus domestica*. Extrapolation of treatment efficacy to all fruits and vegetables was based on knowledge and experience that radiation dosimetry systems measure the actual radiation dose absorbed by the target pest independent of host commodity, and evidence from research studies on a variety of pests and commodities. These include studies on the following pests and hosts: *Anastrepha ludens* (*Citrus paradisi* and *Mangifera indica*), *A. suspensa* (*Averrhoa carambola*, *Citrus paradisi* and *Mangifera indica*), *Bactrocera tryoni* (*Citrus sinensis*, *Lycopersicon lycopersicum*, *Malus domestica*, *Mangifera indica*, *Persea americana* and *Prunus avium*), *Cydia pomonella* (*Malus domestica* and artificial diet) and *Grapholita molesta* (*Malus domestica* and artificial diet) (Bustos *et al*., 2004; Gould & von Windeguth, 1991; Hallman, 2004, Hallman & Martinez, 2001; Jessup *et al*., 1992; Mansour, 2003; von Windeguth, 1986; von Windeguth & Ismail, 1987). It is recognised, however, that treatment efficacy has not been tested for all potential fruit and vegetable hosts of the target pest. If evidence becomes available to show that the extrapolation of the treatment to cover all hosts of this pest is incorrect, then the treatment will be reviewed.

References	Bustos, M.E., Enkerlin, W., Reyes, J. & Toledo, J. 2004. Irradiation of mangoes as a postharvest quarantine treatment for fruit flies (Diptera: Tephritidae). *Journal of Economic Entomology*, 97: 286–292. Gould, W.P. & von Windeguth, D.L. 1991. Gamma irradiation as a quarantine treatment for carambolas infested with Caribbean fruit flies. *Florida Entomologist*, 74: 297–300. Hallman, G.J. 2003. Ionizing irradiation quarantine treatment against plum curculio (Coleoptera: Curculionidae). *Journal of Economic Entomology*, 96: 1399–1404. Hallman, G.J. 2004. Ionizing irradiation quarantine treatment against Oriental fruit moth (Lepidoptera: Tortricidae) in ambient and hypoxic atmospheres. *Journal of Economic Entomology*, 97: 824–827. Hallman, G.J. & Martinez, L.R. 2001. Ionizing irradiation quarantine treatments against Mexican fruit fly (Diptera: Tephritidae) in citrus fruits. *Postharvest Biology and Technology*, 23: 71–77. Jessup, A.J., Rigney, C.J., Millar, A., Sloggett, R.F. & Quinn, N.M. 1992. Gamma irradiation as a commodity treatment against the Queensland fruit fly in fresh fruit. *Proceedings of the Research Coordination Meeting on Use of Irradiation as a Quarantine Treatment of Food and Agricultural Commodities*, 1990: 13–42. Mansour, M. 2003. Gamma irradiation as a quarantine treatment for apples infested by codling moth (Lepidoptera: Tortricidae). *Journal of Applied Entomology*, 127: 137–141. von Windeguth, D.L. 1986. Gamma irradiation as a quarantine treatment for Caribbean fruit fly infested mangoes. *Proceedings of the Florida State Horticultural Society*, 99: 131–134. von Windeguth, D.L. & Ismail, M.A. 1987. Gamma irradiation as a quarantine treatment for Florida grapefruit infested with Caribbean fruit fly, *Anastrepha suspensa* (Loew). *Proceedings of the Florida State Horticultural Society*, 100: 5–7.

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

ANNEX -- to ISPM 28:2009

IRRADIATION TREATMENT FOR *CYLAS FORMICARIUS ELEGANTULUS*

(201-)

Adoption

This phytosanitary treatment was adopted by the Commission on Phytosanitary Measures in ----.

Scope of the treatment

This treatment applies to the irradiation of fruits and vegetables at 165 Gy minimum absorbed dose to prevent the development of F1 adults of *Cylas formicarius elegantulus* at the stated efficacy. This treatment should be applied in accordance with the requirements outlined in ISPM 18:2003 (*Guidelines for the use of irradiation as a phytosanitary measure*)[2].

Treatment description

Name of treatment	Irradiation treatment for *Cylas formicarius elegantulus*
Active ingredient	N/A
Treatment type	Irradiation
Target pest	*Cylas formicarius elegantulus* (Summers) (Coleoptera: Brentidae)
Target regulated articles	All fruits and vegetables that are hosts of *Cylas formicarius elegantulus*.
Treatment schedule	Minimum absorbed dose of 165 Gy to prevent the development of F1 adults of *Cylas formicarius elegantulus*. Efficacy and confidence level of the treatment is $ED_{99.9952}$ at the 95% confidence level. Treatment should be applied in accordance with the requirements of ISPM 18:2003 (*Guidelines for the use of irradiation as a phytosanitary measure*). This irradiation treatment should not be applied to fruit and vegetables stored in modified atmospheres.

[2] The scope of IPPC treatments does not include issues related to pesticide registration or other domestic requirements for approval of treatments. Treatments also do not provide information on specific effects on human health or food safety, which should be addressed using domestic procedures prior to approval of a treatment. In addition effects on product quality are considered before their international adoption. There is no obligation for a contracting party to approve, register or adopt the treatments for use in its territory.

Other relevant information	Since irradiation may not result in outright mortality, inspectors may encounter live, but non-viable *Cylas formicarius elegantulus* (eggs, larvae, pupae and/or adults) during the inspection process. This does not imply a failure of the treatment. The Technical Panel on Phytosanitary Treatments based its evaluation of this treatment on the research work undertaken by Follet (2006) and Hallman (2001) that determined the efficacy of irradiation as a treatment for this pest in *Ipomoea batatas*. Extrapolation of treatment efficacy to all fruits and vegetables was based on knowledge and experience that radiation dosimetry systems measure the actual radiation dose absorbed by the target pest independent of host commodity, and evidence from research studies on a variety of pests and commodities. These include studies on the following pests and hosts: *Anastrepha ludens* (*Citrus paradisi* and *Mangifera indica*), *A. suspensa* (*Averrhoa carambola*, *Citrus paradisi* and *Mangifera indica*), *Bactrocera tryoni* (*Citrus sinensis*, *Lycopersicon lycopersicum*, *Malus domestica*, *Mangifera indica*, *Persea americana* and *Prunus avium*), *Cydia pomonella* (*Malus domestica* and artificial diet) and *Grapholita molesta* (*Malus domestica* and artificial diet) (Bustos *et al*., 2004; Gould & von Windeguth, 1991; Hallman, 2004, Hallman & Martinez, 2001; Jessup *et al*., 1992; Mansour, 2003; von Windeguth, 1986; von Windeguth & Ismail, 1987). It is recognised, however, that treatment efficacy has not been tested for all potential fruit and vegetable hosts of the target pest. If evidence becomes available to show that the extrapolation of the treatment to cover all hosts of this pest is incorrect, then the treatment will be reviewed.

References	Bustos, M.E., Enkerlin, W., Reyes, J. & Toledo, J. 2004. Irradiation of mangoes as a postharvest quarantine treatment for fruit flies (Diptera: Tephritidae). *Journal of Economic Entomology*, 97: 286–292. Follett, P.A. 2006. Irradiation as a methyl bromide alternative for postharvest control of *Omphisa anastomosalis* (Lepidoptera: Pyralidae) and *Euscepes postfasciatus* and *Cylas formicarius elegantulus* (Coleoptera: Curculionidae) in sweet potatoes. *Journal of Economic Entomology*, 99: 32–37. Gould, W.P. & von Windeguth, D.L. 1991. Gamma irradiation as a quarantine treatment for carambolas infested with Caribbean fruit flies. *Florida Entomologist*, 74: 297–300. Hallman, G.J. 2001. Ionizing irradiation quarantine treatment against sweet potato weevil (Coleoptera: Curculionidae). *Florida Entomologist*, 84: 415–417. Hallman, G.J. 2004. Ionizing irradiation quarantine treatment against Oriental fruit moth (Lepidoptera: Tortricidae) in ambient and hypoxic atmospheres. *Journal of Economic Entomology*, 97: 824–827. Hallman, G.J. & Martinez, L.R. 2001. Ionizing irradiation quarantine treatments against Mexican fruit fly (Diptera: Tephritidae) in citrus fruits. *Postharvest Biology and Technology*, 23: 71–77. Jessup, A.J., Rigney, C.J., Millar, A., Sloggett, R.F. & Quinn, N.M. 1992. Gamma irradiation as a commodity treatment against the Queensland fruit fly in fresh fruit. *Proceedings of the Research Coordination Meeting on Use of Irradiation as a Quarantine Treatment of Food and Agricultural Commodities*, 1990: 13–42. Mansour, M. 2003. Gamma irradiation as a quarantine treatment for apples infested by codling moth (Lepidoptera: Tortricidae). *Journal of Applied Entomology*, 127: 137–141. von Windeguth, D.L. 1986. Gamma irradiation as a quarantine treatment for Caribbean fruit fly infested mangoes. *Proceedings of the Florida State Horticultural Society*, 99: 131–134. von Windeguth, D.L. & Ismail, M.A. 1987. Gamma irradiation as a quarantine treatment for Florida grapefruit infested with Caribbean fruit fly, *Anastrepha suspensa* (Loew). *Proceedings of the Florida State Horticultural Society*, 100: 5–7.

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

ANNEX -- to ISPM 28:2009

IRRADIATION TREATMENT FOR *EUSCEPES POSTFASCIATUS*

(201-)

Adoption

This phytosanitary treatment was adopted by the Commission on Phytosanitary Measures in ----.

Scope of the treatment

This treatment applies to the irradiation of fruits and vegetables at 150 Gy minimum absorbed dose to prevent the development of F1 adults of *Euscepes postfasciatus* at the stated efficacy. This treatment should be applied in accordance with the requirements outlined in ISPM 18:2003 (*Guidelines for the use of irradiation as a phytosanitary measure*)[3].

Treatment description

Name of treatment	Irradiation treatment for *Euscepes postfasciatus*
Active ingredient	N/A
Treatment type	Irradiation
Target pest	*Euscepes postfasciatus* (Fairmaire) (Coleoptera: Curculionidae)
Target regulated articles	All fruits and vegetables that are hosts of *Euscepes postfasciatus.*
Treatment schedule	Minimum absorbed dose of 150 Gy to prevent the development of F1 adults of *Euscepes postfasciatus*. Efficacy and confidence level of the treatment is $ED_{99.9950}$ at the 95% confidence level. Treatment should be applied in accordance with the requirements of ISPM 18:2003 (*Guidelines for the use of irradiation as a phytosanitary measure*). This irradiation treatment should not be applied to fruit and vegetables stored in modified atmospheres.

[3] The scope of IPPC treatments does not include issues related to pesticide registration or other domestic requirements for approval of treatments. Treatments also do not provide information on specific effects on human health or food safety, which should be addressed using domestic procedures prior to approval of a treatment. In addition effects on product quality are considered before their international adoption. There is no obligation for a contracting party to approve, register or adopt the treatments for use in its territory.

Other relevant information	Since irradiation may not result in outright mortality, inspectors may encounter live, but non-viable *Euscepes postfasciatus* (eggs, larvae, pupae and/or adults) during the inspection process. This does not imply a failure of the treatment. The Technical Panel on Phytosanitary Treatments based its evaluation of this treatment on the research work undertaken by Follet (2006) that determined the efficacy of irradiation as a treatment for this pest in *Ipomoea batatas*. Extrapolation of treatment efficacy to all fruits and vegetables was based on knowledge and experience that radiation dosimetry systems measure the actual radiation dose absorbed by the target pest independent of host commodity, and evidence from research studies on a variety of pests and commodities. These include studies on the following pests and hosts: *Anastrepha ludens* (*Citrus paradisi* and *Mangifera indica*), *A. suspensa* (*Averrhoa carambola*, *Citrus paradisi* and *Mangifera indica*), *Bactrocera tryoni* (*Citrus sinensis*, *Lycopersicon lycopersicum*, *Malus domestica*, *Mangifera indica*, *Persea americana* and *Prunus avium*), *Cydia pomonella* (*Malus domestica* and artificial diet) and *Grapholita molesta* (*Malus domestica* and artificial diet) (Bustos *et al*., 2004; Gould & von Windeguth, 1991; Hallman, 2004, Hallman & Martinez, 2001; Jessup *et al*., 1992; Mansour, 2003; von Windeguth, 1986; von Windeguth & Ismail, 1987). It is recognised, however, that treatment efficacy has not been tested for all potential fruit and vegetable hosts of the target pest. If evidence becomes available to show that the extrapolation of the treatment to cover all hosts of this pest is incorrect, then the treatment will be reviewed.

References	Bustos, M.E., Enkerlin, W., Reyes, J. & Toledo, J. 2004. Irradiation of mangoes as a postharvest quarantine treatment for fruit flies (Diptera: Tephritidae). *Journal of Economic Entomology*, 97: 286–292. Follett, P.A. 2006. Irradiation as a methyl bromide alternative for postharvest control of *Omphisa anastomosalis* (Lepidoptera: Pyralidae) and *Euscepes postfasciatus* and *Cylas formicarius elegantulus* (Coleoptera: Curculionidae) in sweet potatoes. *Journal of Economic Entomology*, 99: 32–37. Gould, W.P. & von Windeguth, D.L. 1991. Gamma irradiation as a quarantine treatment for carambolas infested with Caribbean fruit flies. *Florida Entomologist*, 74: 297–300. Hallman, G.J. 2004. Ionizing irradiation quarantine treatment against Oriental fruit moth (Lepidoptera: Tortricidae) in ambient and hypoxic atmospheres. *Journal of Economic Entomology*, 97: 824–827. Hallman, G.J. & Martinez, L.R. 2001. Ionizing irradiation quarantine treatments against Mexican fruit fly (Diptera: Tephritidae) in citrus fruits. *Postharvest Biology and Technology*, 23: 71–77. Jessup, A.J., Rigney, C.J., Millar, A., Sloggett, R.F. & Quinn, N.M. 1992. Gamma irradiation as a commodity treatment against the Queensland fruit fly in fresh fruit. *Proceedings of the Research Coordination Meeting on Use of Irradiation as a Quarantine Treatment of Food and Agricultural Commodities*, 1990: 13–42. Mansour, M. 2003. Gamma irradiation as a quarantine treatment for apples infested by codling moth (Lepidoptera: Tortricidae). *Journal of Applied Entomology*, 127: 137–141. von Windeguth, D.L. 1986. Gamma irradiation as a quarantine treatment for Caribbean fruit fly infested mangoes. *Proceedings of the Florida State Horticultural Society*, 99: 131–134. von Windeguth, D.L. & Ismail, M.A. 1987. Gamma irradiation as a quarantine treatment for Florida grapefruit infested with Caribbean fruit fly, *Anastrepha suspensa* (Loew). *Proceedings of the Florida State Horticultural Society*, 100: 5–7.

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

ANNEX -- to ISPM 28:2009

IRRADIATION TREATMENT FOR *GRAPHOLITA MOLESTA*

(201-)

Adoption

This phytosanitary treatment was adopted by the Commission on Phytosanitary Measures in ----.

Scope of the treatment

This treatment applies to the irradiation of fruits and vegetables at 232 Gy minimum absorbed dose to prevent the emergence of adults of *Grapholita molesta* at the stated efficacy. This treatment should be applied in accordance with the requirements outlined in ISPM 18:2003 (*Guidelines for the use of irradiation as a phytosanitary measure*)[4].

Treatment description

Name of treatment	Irradiation treatment for *Grapholita molesta*
Active ingredient	N/A
Treatment type	Irradiation
Target pest	*Grapholita molesta* (Busck) (Lepidoptera: Tortricidae)
Target regulated articles	All fruits and vegetables that are hosts of *Grapholita molesta.*
Treatment schedule	Minimum absorbed dose of 232 Gy to prevent the emergence of adults of *Grapholita molesta*. Efficacy and confidence level of the treatment is $ED_{99.9949}$ at the 95% confidence level. Treatment should be applied in accordance with the requirements of ISPM 18:2003 (*Guidelines for the use of irradiation as a phytosanitary measure*). This irradiation treatment should not be applied to fruit and vegetables stored in modified atmospheres.

[4] The scope of IPPC treatments does not include issues related to pesticide registration or other domestic requirements for approval of treatments. Treatments also do not provide information on specific effects on human health or food safety, which should be addressed using domestic procedures prior to approval of a treatment. In addition effects on product quality are considered before their international adoption. There is no obligation for a contracting party to approve, register or adopt the treatments for use in its territory.

Other relevant information	Since irradiation may not result in outright mortality, inspectors may encounter live, but non-viable *Grapholita molesta* (larvae and/or pupae) during the inspection process. This does not imply a failure of the treatment. The Technical Panel on Phytosanitary Treatments based its evaluation of this treatment on the research work undertaken by Hallman (2004) that determined the efficacy of irradiation as a treatment for this pest in *Malus domestica*. Extrapolation of treatment efficacy to all fruits and vegetables was based on knowledge and experience that radiation dosimetry systems measure the actual radiation dose absorbed by the target pest independent of host commodity, and evidence from research studies on a variety of pests and commodities. These include studies on the following pests and hosts: *Anastrepha ludens* (*Citrus paradisi* and *Mangifera indica*), *A. suspensa* (*Averrhoa carambola*, *Citrus paradisi* and *Mangifera indica*), *Bactrocera tryoni* (*Citrus sinensis*, *Lycopersicon lycopersicum*, *Malus domestica*, *Mangifera indica*, *Persea americana* and *Prunus avium*), *Cydia pomonella* (*Malus domestica* and artificial diet) and *Grapholita molesta* (*Malus domestica* and artificial diet) (Bustos *et al*., 2004; Gould & von Windeguth, 1991; Hallman, 2004, Hallman & Martinez, 2001; Jessup *et al*., 1992; Mansour, 2003; von Windeguth, 1986; von Windeguth & Ismail, 1987). It is recognised, however, that treatment efficacy has not been tested for all potential fruit and vegetable hosts of the target pest. If evidence becomes available to show that the extrapolation of the treatment to cover all hosts of this pest is incorrect, then the treatment will be reviewed.
References	Bustos, M.E., Enkerlin, W., Reyes, J. & Toledo, J. 2004. Irradiation of mangoes as a postharvest quarantine treatment for fruit flies (Diptera: Tephritidae). *Journal of Economic Entomology*, 97: 286–292. Gould, W.P. & von Windeguth, D.L. 1991. Gamma irradiation as a quarantine treatment for carambolas infested with Caribbean fruit flies. *Florida Entomologist*, 74: 297–300. Hallman, G.J. 2004. Ionizing irradiation quarantine treatment against Oriental fruit moth (Lepidoptera: Tortricidae) in ambient and hypoxic atmospheres. *Journal of Economic Entomology*, 97: 824–827. Hallman, G.J. & Martinez, L.R. 2001. Ionizing irradiation quarantine treatments against Mexican fruit fly (Diptera: Tephritidae) in citrus fruits. *Postharvest Biology and Technology*, 23: 71–77. Jessup, A.J., Rigney, C.J., Millar, A., Sloggett, R.F. & Quinn, N.M. 1992. Gamma irradiation as a commodity treatment against the Queensland fruit fly in fresh fruit. *Proceedings of the Research Coordination Meeting on Use of Irradiation as a Quarantine Treatment of Food and Agricultural Commodities*, 1990: 13–42. Mansour, M. 2003. Gamma irradiation as a quarantine treatment for apples infested by codling moth (Lepidoptera: Tortricidae). *Journal of Applied Entomology*, 127: 137–141. von Windeguth, D.L. 1986. Gamma irradiation as a quarantine treatment for Caribbean fruit fly infested mangoes. *Proceedings of the Florida State Horticultural Society*, 99: 131–134. von Windeguth, D.L. & Ismail, M.A. 1987. Gamma irradiation as a quarantine treatment for Florida grapefruit infested with Caribbean fruit fly, *Anastrepha suspensa* (Loew). *Proceedings of the Florida State Horticultural Society*, 100: 5–7.

INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES

ANNEX -- to ISPM 28:2009

IRRADIATION TREATMENT FOR *GRAPHOLITA MOLESTA* UNDER HYPOXIA

(201-)

Adoption

This phytosanitary treatment was adopted by the Commission on Phytosanitary Measures in ----.

Scope of the treatment

This treatment applies to the irradiation of fruits and vegetables at 232 Gy minimum absorbed dose under hypoxic conditions to prevent oviposition of *Grapholita molesta* at the stated efficacy. This treatment should be applied in accordance with the requirements outlined in ISPM 18:2003 (*Guidelines for the use of irradiation as a phytosanitary measure*)[5].

Treatment description

Name of treatment	Irradiation treatment for *Grapholita molesta* under hypoxia
Active ingredient	N/A
Treatment type	Irradiation
Target pest	*Grapholita molesta* (Busck) (Lepidoptera: Tortricidae)
Target regulated articles	All fruits and vegetables that are hosts of *Grapholita molesta.*
Treatment schedule	Minimum absorbed dose of 232 Gy to prevent oviposition of *Grapholita molesta*. Efficacy and confidence level of the treatment is $ED_{99.9932}$ at the 95% confidence level. Treatment should be applied in accordance with the requirements of ISPM 18:2003 (*Guidelines for the use of irradiation as a phytosanitary measure*).

[5] The scope of IPPC treatments does not include issues related to pesticide registration or other domestic requirements for approval of treatments. Treatments also do not provide information on specific effects on human health or food safety, which should be addressed using domestic procedures prior to approval of a treatment. In addition effects on product quality are considered before their international adoption. There is no obligation for a contracting party to approve, register or adopt the treatments for use in its territory.

Other relevant information	Since irradiation may not result in outright mortality, inspectors may encounter live, but non-viable *Grapholita molesta* (larvae, pupae and/or adults) during the inspection process. This does not imply a failure of the treatment. Although the treatment may result in the presence of irradiated adults, the following factors may affect the likelihood of adults being found in traps in importing countries: – Only a very small percentage of adults are likely to emerge after irradiation; – Irradiated adults are very unlikely to survive for more than one week, post irradiation, and they are therefore less likely to be robust or to spread than non-irradiated adults. The Technical Panel on Phytosanitary Treatments based its evaluation of this treatment on the research work undertaken by Hallman (2004) that determined the efficacy of irradiation as a treatment for this pest in *Malus domestica*. Extrapolation of treatment efficacy to all fruits and vegetables was based on knowledge and experience that radiation dosimetry systems measure the actual radiation dose absorbed by the target pest independent of host commodity, and evidence from research studies on a variety of pests and commodities. These include studies on the following pests and hosts: *Anastrepha ludens* (*Citrus paradisi* and *Mangifera indica*), *A. suspensa* (*Averrhoa carambola*, *Citrus paradisi* and *Mangifera indica*), *Bactrocera tryoni* (*Citrus sinensis*, *Lycopersicon lycopersicum*, *Malus domestica*, *Mangifera indica*, *Persea americana* and *Prunus avium*), *Cydia pomonella* (*Malus domestica* and artificial diet) and *Grapholita molesta* (*Malus domestica* and artificial diet) (Bustos *et al*., 2004; Gould & von Windeguth, 1991; Hallman, 2004, Hallman & Martinez, 2001; Jessup *et al*., 1992; Mansour, 2003; von Windeguth, 1986; von Windeguth & Ismail, 1987). It is recognised, however, that treatment efficacy has not been tested for all potential fruit and vegetable hosts of the target pest. If evidence becomes available to show that the extrapolation of the treatment to cover all hosts of this pest is incorrect, then the treatment will be reviewed.

References	Bustos, M.E., Enkerlin, W., Reyes, J. & Toledo, J. 2004. Irradiation of mangoes as a postharvest quarantine treatment for fruit flies (Diptera: Tephritidae). *Journal of Economic Entomology*, 97: 286–292. Gould, W.P. & von Windeguth, D.L. 1991. Gamma irradiation as a quarantine treatment for carambolas infested with Caribbean fruit flies. *Florida Entomologist*, 74: 297–300. Hallman, G.J. 2004. Ionizing irradiation quarantine treatment against Oriental fruit moth (Lepidoptera: Tortricidae) in ambient and hypoxic atmospheres. *Journal of Economic Entomology*, 97: 824–827. Hallman, G.J. & Martinez, L.R. 2001. Ionizing irradiation quarantine treatments against Mexican fruit fly (Diptera: Tephritidae) in citrus fruits. *Postharvest Biology and Technology*, 23: 71–77. Jessup, A.J., Rigney, C.J., Millar, A., Sloggett, R.F. & Quinn, N.M. 1992. Gamma irradiation as a commodity treatment against the Queensland fruit fly in fresh fruit. *Proceedings of the Research Coordination Meeting on Use of Irradiation as a Quarantine Treatment of Food and Agricultural Commodities*, 1990: 13–42. Mansour, M. 2003. Gamma irradiation as a quarantine treatment for apples infested by codling moth (Lepidoptera: Tortricidae). *Journal of Applied Entomology*, 127: 137–141. von Windeguth, D.L. 1986. Gamma irradiation as a quarantine treatment for Caribbean fruit fly infested mangoes. *Proceedings of the Florida State Horticultural Society*, 99: 131–134. von Windeguth, D.L. & Ismail, M.A. 1987. Gamma irradiation as a quarantine treatment for Florida grapefruit infested with Caribbean fruit fly, *Anastrepha suspensa* (Loew). *Proceedings of the Florida State Horticultural Society*, 100: 5–7.