NSPM-14

Requirements for Establishment of Pest Free Areas for Tephritid Fruit Flies

Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation
Directorate of Plant Protection, Quarantine & Storage
N.H.IV, Faridabad-121001

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Contents

Endorsement

This standard on **'Requirements for Establishment of Pest Free Areas for Tephritid Fruit flies'** provides necessary guidance and requirements for establishment, maintenance and verification of pest free areas for fruit flies and use as a risk management option for undertaking phytosanitary certification of export of fresh fruits of mango from pest-free areas or provide scientific justification for phytosanitary measures for protection of endangered pest free area. This standard would enable the recognition of pest free areas in line with provisions of international agreements and thus facilitate the trade.

This standard is approved for adoption on 12th May 2005 by:

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(P.S. Chandurkar)
Plant Protection Adviser
Dte of Plant Protection, Quarantine & Storage,
NH-IV., **Faridabad-121001.**

Review and Amendment

This standard would be subject to periodic review and amendment by Plant Protection Adviser (PPA) and updated and revised, if necessary. The standard holder should ensure that the current edition of this standard is being used.

Control & Distribution of the standard

The master copy of this standard shall be held with PPA and controlled copies would be distributed by Joint Director (PQ), Directorate of Plant Protection Quarantine & Storage, Faridabad to the National/Regional Plant Quarantine Stations; State Department of Agriculture/ Horticulture; ICAR Research Institutes/State Agriculture Universities: APEDA as listed below and to any other organization, to whom the distribution has been approved by the PPA. Any clarifications/enquiries regarding this standard would be made to the Joint Director (PQ), Dte of PPQS, Faridabad-121001**.**

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INTRODUCTION

SCOPE

This standard describes the specific requirements for the establishment, maintenance and verification of pest free areas (PFAs) for fruit flies of Tephritidae in line with the international standards on phytosanitary measures established by IPPC, FAO, Rome.

BACKGROUND

The NPPO of exporting countries would be required to establish fruit fly free areas, in order to consider the export of fresh fruits without any post-harvest treatment, including detailed description of the activities to maintain the condition in the area to guarantee the soundness of the surveillance and monitoring system used. Once the NPPO of importing country approves the condition of the area as pest free, the NPPO of exporting country shall communicate the name of an official responsible for periodically providing information on trapping measures at the national level as well as the name of specialists authorized to perform the official identification of fruit fly specimens which may appear in the area of interest. Further records of the daily activities, which are carried out to maintain the condition in that area including audits should be made available. It is also considered necessary to use standard traps, specific lures and harmonized trapping procedures and proper documentation of records to ensure the fruit fly free area status is maintained so as to comply with the requirements of importing country.

Adoption of uniform and harmonized survey and monitoring protocols are critical for establishment of fruit fly area freedom in the designated pest free areas using permanent trapping grids. The surveys are required to be carried out over a continuous period of 12 months during which period no detection of suspected fruit fly should occur. If fruit flies are detected and subsequently eradicated, the surveys should be continued for another 12 months from the date of eradication.

REFERENCES

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Requirements for the establishment of pest free areas, 1997. ISPM No. 4, FAO, Rome
A submission supporting area freedom from Queens land fruit fly and Mediterranean fruit fly for the Riverland, Sun raysia and Riverina pest free areas of mainland Australia. October 2000. AQIS, Department of Agriculture, Fisheries and Forestry, Canberra ACT, Australia.
*Surveillance for quarantine fruit flies (in a portion of a generally infested area).*1998. RSPM No.10, NAPPO, Ontario, Canada

DEFINITIONS AND ABBREVIATIONS

Area:	An officially defined country, part of a country or all or parts of several countries.
Buffer zone:	An area in which a specific pest does not occur or occurs at a low level and is officially controlled, that either encloses or adjacent to an infested area, an infested place of production or a pest free production site, and in which phytosanitary measures are taken to prevent the spread of the pest.
Delimiting survey:	Survey conducted to establish the boundaries of an area considered to be infested by or free from a pest.
Detection survey:	Survey conducted in an area to determine if pests are present.
IPPC:	International Plant Protection Convention as deposited in 1951 with FAO, Rome and as subsequently amended.
Monitoring survey:	Ongoing survey to verify the characteristics of a pest population.
National Plant Protection Organization (NPPO):	Official service established by a government to discharge the functions specified by the IPPC.
Official:	Established, authorized or performed by a NPPO
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Pest:	Any species, strain or biotype of plant, animal, or pathogenic agent injurious to plants or plant products.
Pest free area (PFA):	An area in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained.
Pest record:	A document providing information concerning the presence or absence of a specific pest at a particular location, at a certain time, with in an area (usually a country) under described circumstances
Pest status (in area):	Presence or absence, at the present time, of a pest in an area, including where appropriate its distribution, as officially determined using expert judgment on the basis of current and historical pest records and other information.

Phytosanitary certification:	Use of phytosanitary procedures leading to the issue of phytosanitary certificate
Phytosanitary measure:	Any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of pests.
Phytosanitary regulation:	Official rule to prevent the introduction and/or spread of quarantine pests, by regulating the production, movement or existence of commodities or other articles, or the normal activity of persons, and by establishing schemes for phytosanitary certification.
Quarantine pest:	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled.
Survey:	An official procedure conducted over a definite period to determine the characteristics of a pest population or to determine which species occur in an area.
Surveillance:	An official process, which collects and records data on pest occurrence or absence by survey, monitoring or other procedures.

OUTLINE OF REQUIREMENTS

This standard outlines procedures for undertaking surveillance and monitoring protocols for fruit flies. The development of such protocols are critical for establishment of fruit fly free areas in line with the established international standards. Collection and documentation of information regarding the occurrence and distribution of fruit fly species and their host species, operation of a national plan with clearly defined management structure and responsibilities is vital for the success of the programme and also qualified and trained field inspectors and the adequate funding to meet the operational costs.

It is very much essential to delimit the proposed areas by recognised natural boundaries or reference points for establishment of fruit fly free areas and should be isolated sufficiently by a buffer zone represented by sparsely thin vegitation or absence of non-host species. Further this standard describes the operating procedures especially correct trapping density for establishing permanent trapping grids and correct positioning of traps, trap types and lures, recharging of traps, inspection and monitoring of traps at specified intervals and collection and forwarding of trapped flies for identification and action to be taken in the event of detection of fruit fly species such as supplementary trapping and systemic fruit inspection and sampling

1.0. GENERAL REQUIREMENTS

1.1. Documentation of information

The information on detailed occurrence and distribution of various fruit fly species (*Bactrocera* spp.) in India and their host range should be clearly documented based on the literature search and as verified by the specimens deposited with the national insect collection maintained by the Division of Entomology, Indian Agriculture Research Institute, New Delhi or any other authenticated insect collection and pest recods.

1.2. Operation of national plan

The Central Government should establish a national plan for fruit fly surveillance involving State Governments and the associated bodies, research institutions, agriculture universities, growers associations etc., and the plan of action, management structure and responsibilities, training and resource requirements and budgetary support should be clearely documented. Such plan should include quarantine surveillance against exotic fruit fly incursions and emergency action plans.

1.3. Management structure & responsibilities

Directorate of Plant protection, Quarantine & Storage (Dte of PPQS) established under Ministry of Agriculture, being the National Plant Protection Organization has the overall responsibility for organizing survey and monitoring programmes for determination of pest free areas (PFAs) in association with the State Governments. The State Directorate of Horticulture/Agriculture should nominate a programme coordinator for effective implementation of the regular survey and monitoring programme for fruit flies in the respective state and should ensure that the overseas country requirements are met with by ensuring the day to day running of the regular fruit fly monitoring programme and also responsible for timely reporting the survey results and take immediate necessary action in the event of detection of any fruit flies. The state programme coordinators should operate permanent trapping grids in the designated PFAs. For this purpose, suitably qualified and trained field inspectors should be employed or contracted for regular operation of trapping grids established in the designated PFAs. The field inspectors should be made responsible for the development of the trapping grids in the designated PFA's and, maintaining grid maps, installation of traps and detailed pest records. They should ensure proper inspection of traps is carried out at regular intervals as required, recharging/replacement of traps as considered necessary at specified intervals, collection and forwarding of specimens to reference entomologist for identification, timely reporting of the activities and effective implementation of appropriate measures following the detection of fruit flies of concern.

A Reference Entomologist should be nominated by the respective State Agriculture University (SAU) and approved by the Plant Protection Adviser, who is responsible for the

timely identification of all larvae and adults of fruit flies (*Bactrocera* spp.) that are referred through the monitoring programmme or any other source. The reference entomologist nominated by the respective SAUs should have the requisite expertise in precise identification of fruit fly species.

1.4. Qualification & training requirements of field inspectors

The field inspectors employed/contracted under the programe should have a minimum of basic degree in Agriculture/Horticulture and have been adequately trained in the field of fruit fly surveillance viz., identification of fruit flies, preparation of trapping grids, trap positioning, type of lures and their preparation, inspection and recharging traps, recording trap data, collection and forwarding of specimens for identification and management of pest records. The training programme for field inspectors should be arranged either at the Indian Institute of Horticulture Research, Bangalore or Central Institute for Sub-tropical Horticulture Research, Lucknow at the beginning of each programme. At the end of training, the field inspectors should be audited for evaluating their fruit fly surveillance capabilities.

1.5. Funding

The Central Government through Directorate of Plant protection, Quarantine & Storage should provide appropriate budgetary support for operation of regular fruit fly surveillance programme in the designated PFA's in respective state At the beginning of each financial year, the respective state programme coordinators should submit appropriate proposals along with the survey plans to the Plant Protection Adviser for approval. The proposals should reflect the cost of operation of surveillance and monitoring programme in designated PFA's, such as the traps and lures, bar code recorders, computer facilities, establishment and stationary costs. The proposals should cover training/meeting costs, contractual services and honorariums to reference entomologists and surveillance auditors etc.

2.0. SPECFIC REQUIREMENTS

2.1. Definition of area

The proposed areas in which PFAs are required to be established should be clearly delimited by readily recognizable boundaries and reference points (latitude/longitude) and preferably isolated by areas with sparse native vegetation or absence of fruit fly host species so as to act as buffer zones. The description of such area should provide for the extent of area in square kilometers, climatic conditions of the area, fruit fly host species distributed in the area, cropping season, cropping system and crop production practices including pre and post-harvest control measures. Further all the roads leading to the fruit fly exclusion zones (FFEZ) should be appropriate displayed with road signs and regulated by check posts.

2.2. Survey plan

A suitable survey plan should be drawn by the respective state programme coordinator and forwarded to the Plant Protection Adviser sufficiently in advance at the beginning of each financial year for necessary approval.

The survey plan should include:

- Definition of purpose of survey
- Target pest (s) involved
- Target crop(s) involved
- Scope of the survey (geographical area, production system, season)
- Timing of survey (date, frequency, duration)
- Methodology of survey (Trap density & location, trap type, etc.)
- Grid map of traping
- Field recording of data
- List of personnel (Zonal supervisors/field inspectors) drawn for survey
- Particulars of Reference Entomologist
- Budgetary support
- Reporting procedures

The survey should be carried out as per the plan approved by the Plant Protection Adviser, Dte of PPQS, N.H.IV., Faridabad-121001.

2.3. Requirements of survey

- Maps sowing the boundaries of nominated pest free areas/municipalities/and location of orchards in each area/municipality covered by the monitoring survey
- List of properties of orchards and location site
- Grid map sowing trapping sites
- GPS Coordinator
- Bar Code Recorder for recording trap data
- Servicing kit (for details refer to 2.9)
- Rain coat with cap
- A pair of gum boots
- Traps and lures

2.4. Trapping density

The density of trapping in the proposed area would depend upon the risk of introduction of specific fruit fly species. The density of trapping would be higher for those areas with high probability of introduction. The risk zones are classified into three categories viz., high risk zones which include national or international seaports/airports, train stations, tourist places, market places of metropolitan/municipal areas; medium risk zones include growing orchards/production sites/processing places located in rural areas located in proposed areas; and low risk zones include sparsely vegetated or non-fruit fly host areas (buffer zones) located adjoin to the proposed areas.

- For exotic fruit fly species that respond to trimed/capi lure (such as *Ceratitis capitata* and *C. rosae*) and cue lure (such as *Bactrocera tryoni*), the traps should be placed in host plants at a density of:
  - 4 traps per Km^2 in high risk zones;
  - 2 traps per Km^2 in medium risk zones;
  - 1 trap per Km^2 in low risk zones.

- For fruit fly species (*Bactrocera* spp (exotic or domestic); other than *B. cucurbitae*) that respond to methyl-euginol, the traps should be placed in host plants at a density of:
  - 2 traps per Km^2 in high risk zones;
  - 1 trap per Km^2 in medium risk zones;
  - 1 trap per 2.5 Km^2 in low risk zones.

- For fruit fly species that do not respond to available para-pheromones (such as exotic *Anasterepha* spp; gravid females of *Bactrocera* spp), the McPhail traps should be placed in host plants at a density of:
  - 5 traps per Km^2 in high risk zones;
  - 4 traps per Km^2 in medium risk zones:
  - 2 traps per Km^2 in low risk zones.

2.5. Trap positioning and marking

The trapping sites should be easily identifiable preferably with a bar code label and data of installation and date of recharging of lure, whenever replaced should be appropriately recorded. Traps should be placed in the best vegetative cover available. The traps should be located within the canopy of host trees bearing fruits, approximately half the distance from the trunk to the outer edge of the foliage and at least 1.5-2.0 m above the ground depending upon the height of the crop. If no fruiting trees available in the vicinity of grid, the traps should be relocated in adjoing fruit bearing tree or in its absence placed in trees with suitable foliage (i.e. broad leaved trees). The traps should not be hanged just below the foliage of the tree nor should the entrance of trap be blocked by the foliage.

At least two traps are placed in each site viz.,

- one Lynfield or modified Steiner trap charged with Cue-lure plus malathion
- one Lynfield or modified Steiner trap charged with Methyl eugenol lure plus malathion

The two traps should be located at least 3 metres apart. A plastic flagging tape may be attached to the tree or near by for easy location of trap. If possible, GPS coordinates (latitude/longitude) of trap site should be obtained.

2.6. Quarantine Surveillance

For quarantine surveillance against unwanted exotic species, traps should be placed in suburban areas, tourist resorts, refuse dumps, near diplomatic missions, at education institutes that cater to overseas students, and ports of entry, to detect foreign species that may be introduced through contaminated exotic fruits brought in by travelers. At least two traps should be placed at each site, one trimed lure and the other methyl-euginol traps alternated with cue lure traps are installed at 3 m apart to catch exotic fruit fly species. If any fruit fly species is caught in the trap, the same shall be collected and immediately forwarded to Fruit fly specialist located at the Indian Institute of Horticulture Research, Bangalore for identification. The results of trapping and the identification should be reported to the Plant Protection Adviser in the forms prescribed in the standard and the area should be kept under intense surveillance by increasing the trap density as per item 2.17.

2.7. Grid mapping

The mapping of permanent trapping grids should be prepared in respect of each PFA for laying the traps and copies of the grid maps of each PFA should be made available with all the field inspectors and the state programme coordinator and Plant Protection Adviser of Dte of PPQS, Faridabad preferably in digitised format. The trap position on a map may be marked by overlaying a square grid of the same scale drawn on a tracing paper or alternatively the trap grid may be directly drawn on to the map of area surveyed. The each trap site may be marked at the intersection of the lines of grid. The field inspector should record the map reference and the number of the site in the order of servicing run.

2.8. Type of traps/lures used

The various trap/lure types used for survey and monitoring specific fruit flies given in Appendix-I. The Lynfield traps should be used for trapping fruit flies in low rainfall areas. It is a non-sticky disposable pot type trap for trapping adult male flies. The trap consists of a modified clear 1 litre plastic container with a 100 mm base, a 90 mm diameter top and is 115 mm deep. It has a screw top lid, which may be white or yellow. There are four entry holes of 25 mm in diameter evenly spaced 15 mm below the lip of the trap. Two, three or four dental cotton wicks containing liquid lure are held together with a wire clip and hung from a wire loop under the lid of the trap. The hook holding the wick is formed by a wire inserted through the center of the lid, which extends about 25 cm above it so that it can be attached to the branch of a tree allowing the trap to hang freely. An insecticide toxic and information label, preferably with bar code may be affixed on to the trap body.

For high rainfall areas, the modified Steiner traps should be used. The Steiner trap is a horizontal cylindrical plastic trap (about 120 mm long and 90 mm dia) capped on one side with cylindrical holes of 25 mm on either side with a looped wire at the center to hung the wick impregnated with an appropriate with insecticide and hooked on the top to facilitate hanging of the trap from tree. The trap has rain protectant cap on the top of cylinder

The McPhail traps are flask shaped glass or plastic screw capped bottle with a hook at the top for hanging. The trap has raised opening at the bottom to allow the entry of fruit flies. These traps should be used with the Lynfield or Steiner traps as supplementary traps to catch both male and female flies. These are called as 'wet traps' because the lure used is a liquid protein hydrolysate or fruit juice as food for the fruit fly. About 150-200ml of liquid lure or attractant is required for each trap.

Jackson traps, which are triangular traps, made up of thick paperboard with a wick impregnated with lure attached by a clip at the center with a complete opening on both sides and a sticky paper plate is inserted at the bottom of the trap and usually used with sex attractant lures such as trimed lures or capi lures. Jackson traps are quite unsuitable since it would be difficult to collect the trapped flies from sticky surface of the bottom of the trap.

The type of lures and insecticide used, lure mixtures, and application volume are described in Appendix-II & III. The field inspectors should avoid lure contamination, while preparing the lures and insecticide by handling wicks with specifically marked long nosed pliers and by using separate brushes for handling dead flies and cleaning of traps.

2.9. Inspection & recharging of traps

The trimed/capi-lures, cue-lures or methyl euginol lures are replaced at quarterly intervals in a year in first week in March, June, September and December. The entire trap (base and lid is replaced at least every 12 months and more often if they become brittle. All used wicks should be put in the bag provided together for burial at rubbish disposal site. If the wicks are held in storage jars for more than a week the lure tends to gravitate towards the wicks at the bottom of the jar. Therefore once in a week turn the jars upside down to redistribute the lure.

The McPhail traps are serviced by carefully removing the trap body and decanting the liquid contents into a 500 ml plastic container with a screw capped lid. Any remaining insects should be brushed into the container and the trap should be cleaned with fresh water before recharging with new lure mixture. The trap number should be marked on the lid of the 500 ml container and placed securely in a holding box with other containers in vertical position. Soon after returning to the laboratory, the inspector should pour the contents of trap through a stainless steel sieve, wash with fresh water and transfer the contents of sieve on to a paper towel. The inspector should pick up the suspected fruit flies and further transfer to screw caped specimen vials containing 70% alcohol and suitably label the specimens and forward to reference entomologist for identification.

While during inspection, if any trap found to be damaged, the entire trap should be replaced immediately with a new one. Records are kept of all inspections and trap recharging by the field inspectors. Copies of records shall be maintained at the office of the zonal supervisor for the audit purposes.

2.10. Servicing kit

Each field inspector should be provided with a service kit consists of the following viz.,

- Metal or Plastic box
- Two or three) glass or plastic containers (screw capped) for storing the wicks soaked with lure and insecticide (Separate containers for different lure and insecticide)
- Two (or three) pairs of long-nosed tweezers (for changing each type of lure)
- One or two pairs of plastic gloves
- Two (or three) small camel-haired paint brushes (for handling specimens)
- Two (or three) medium stiff artist brush (for removing flies and cleaning each type of lure trap)
- One glass jar with screw capped lid for storing Dichlorvos insecticide squares
- Screw-capped plastic vials (30-50 ml) with labels (for storing the dead fruit fly specimens)
- Field lense (pocket type, 10 or 20 X)
- Flagging tape
- Plastic disposable bags
- One box containing soft tissue
- One screw capped bottle (300-500 ml capacity) containing 80% alcohol
- Work book
- Marking Pen
- Spare traps (Lynfield or equivalent)

2.11. . Trap inspection and monitoring

Traps should be inspected at weekly intervals during late spring, summer, and early autumn and at fortnightly intervals during winter. The surveys should be organized for at least two consecutive years for determination of PFAs for fruit flies (*Bactrocera* spp.).

2.12. Record of trapping data

The trapping data should be recorded preferably with the help of a bar code recorder and plotted on to a digitised grid map stored in a computer for a quick analysis and transfer of data to state programme coordinator under intimation to Plant Protection Adviser, Dte of PPQS, Faridabad. The results of weekly trapping would be recorded in the workbook, which contain worksheets (Appendix-IV)

2.13. Collection & forwarding of trapped flies

All insects from traps should be examined and all fruit fly species including suspect fruit flies are forwarded to the reference entomologist for identification along with specimen forwarding sheet (Appendix-V). The specimen (s) are placed in individual plastic vial(s) in 70-80% alcohol and a suitable label with details of the trap number, location, host species and date of inspection, name of inspector marked with black and white lead pencil should be

placed inside vial. The vials should be forwarded on the same day for identification to reference entomologist for identification. If there is any doubt about the identification of suspect fruit flies by the reference entomologist, the specimen should be further submitted to fruit fly taxonomist located at the Indian Institute of Horticulture Research, Bangalore/Central Institute for Sub-tropical Horticulture Research, Lucknow, as the case may be for positive identification. The reference entomologist shall forward the results of identification to the concerned field inspector in the prescribed format (Appendix-VI) with the copies made available to zonal supervisor and state programme coordinator under intimation to PPA.

2.14. **Relocation of traps**

Fruit flies are most attracted to trees with ripening fruit. Once the fruit is picked the trap should therefore be relocated to the next nearest tree with ripening fruit. If there are no other fruiting trees available, the trap may remain in the same tree as long as it has foliage to shade the trap. Whenever the trap is relocated, the date and its location must be recorded on the worksheets and specimen dispatch sheets forwarded to reference entomologist.

2.15. Reporting results of survey

The state programme coordinator should communicate the report of results of survey (Appendix-VII) on weekly basis during late spring, summer and autumn and at fortnightly intervals during the winter months. At the end of each year, a consolidated report should be forwarded detailing the survey, detection of out break of suspected fruit flies and the action taken.

2.16. Supplementary trapping

When a fruit fly species has been positively identified, a grid of supplementary traps should be placed in the area around the original trap site where fruit fly was caught. This consists of 16 Lynfield or modified Steiner traps and 16 McPhail traps which are located as follows.

- 6 Lynfield or Steiner traps + 6 McPhail within a radius of 40 m
- 5 Lynfield or Steiner traps + 5 McPhail within a radius of 200 m
- 5 Lynfield or Steiner traps + 5 McPhail within a radius of 500 m

The traps should be ‘staggered’ so that there is no clear passage between the traps or large gaps in the system where flies could remain undetected. All the traps should be hung in the same way as the permanent traps. Lynfield or Steiner traps and McPhail traps can be hung at the same site provided they are distanced 3 m apart and never hung on the same tree.

Supplementary traps require inspection twice per week for two weeks and every week thereafter for 3 months provided there are no new flies caught in the traps.

If new flies are caught in any supplementary traps, the supplementary trapping area should be increased by another 500 meters from the catch site. However no extra traps are required in

the existing supplementary trapping system. The trapping results should immediately be communicated to the PPA for taking appropriate emergency action.

2.17. Fruit inspection/ sampling

Where fruit fly species detection has been confirmed and supplementary traps are laid, a larval search must be carried out within 200 m radius of the original trap. All fallen host fruits should be collected and carefully dissected either on site or in the laboratory. Where fruits are found infested will be incubated in the laboratory to allow development to the adult fly. Some of the larvae should also be collected and preserved as per Appendix-VIII and immediately be dispatched to the Reference Entomologist of the concerned State.

2.18. Suspension & reinstatement of pest free status of the area

If fertilized females or fruit fly larvae are detected the pest free status of the area must be cancelled in 8 km radius around the area, where they were trapped. If only males are detected, the location details and emergency measures taken will be reported to the Plant Protection Adviser for further communication to NPPO of importing country. Reinstatement of suspended areas can takes place, when time equivalent to three generations of the pest has passed without additional detections. Such reinstatement of pest free status should be considered with the approval of NPPO of importing country

2.19. Auditing & Review

The Dte of PPQS would conduct audit of fruit fly surveillance to ensure correct trap density used, correct trap and lure type used, proper positioning of trap at the site including labeling of the trap, recharge of lures at specified intervals, avoiding contamination of servicing equipment at the time of recharging, proper maintenance and timely replacement of damaged traps, inspection of traps carried out at specified intervals and correct entries made on the worksheet, familiarity with the procedure of collection and forwarding of specimens for identification, timely submission of reports, proper management of pest records and compliance with the requirements of this standard. The results of audit of fruit fly surveillance should be reported to the Plant protection Adviser in prescribed format (Appendix-IX). The Plant protection Adviser after receiving the report would communicate to the State Programme Coordinator regarding non-confirmities observed and the corrective action to be taken to improve the functioning. The State authorities are responsible for on-going internal auditing of their activities and procedures within the identified PFAs.

Appendix-1: Particulars of trap type/lures against fruit fly species

S. No.	Target fruit fly species	Trap type	Lure/Attractant used
1	*Anastrepha* spp* & others not attracted by para-pheramones	McPhail	Protein hydrolisate
2	*Bactrocera* spp (mostly cucurbitae and *B.* tryoni (Queens land fruit fly)*	Lynfield/Steiner	Cuelure plus malathion
3	*Bactrocera* spp (mostly *dorsalis* complex group)	Lynfield/Steiner	Methyl euginol plus malathion
4	Cera*titis capitata* (Mediterranean fly) and *C. rosae**-males	Jackson/Steiner	Trimed/capilure plus dichlorovos impregnated 1.5 cm^2square discs.
5	*C. capitata* and *C. rosae** -females	McPhail	Protein hydrolisate

***Exotic fruit fly species of Quarantine significance to India**

Appendix-2: Application Volume of Lure plus Insecticide to each trap

Lure Mixture	Volume	Application
*Cue lure + malathion (CUE)	4 ml	2 ml applied to each side of a 4 wick clip
*Methyl euginol + malathion (ME)	4 ml	2 ml applied to each side of a 3 wick clip
Trimed/Capi lure	4 ml	2 ml applied to each side of a 4wick clip

***Cue lure mixture: 125 ml UL malathion to 1litre of cue lure and Methyl euginol lure mixture: 125 ml UL malathion to 1litre of methyl euginol**

Appendix-3: Mixtures for McPhail traps

Protein Lure:

- 1.6 g ammonium carbonate
- 40 g of borax powder
- 2g sodium hydroxide
- 12.5 ml protein hydrolysate (Flavex)
- 2 litres of warm water

Mix the protein hydrolysate with half the volume of water. Add the dry ingredients to the remaining water and stir until completely dissolved. Add to the protein hydrolysate mixture. This mixture (sufficient for 10traps) should be freshly made before out on a trap run. After the trap run any remaining mixture should be discarded.

Orange juice attractant:

- 2.5 g ammonium carbonate
- 1.0 g potassium sorbate
- 280 ml fresh pulp free orange juice (100% pure from supermarket)
- 600 ml warm water

Mix the orange juice and water and add the dry ingredients (sufficient for 30 traps). Agitate until dissolved. Stand mixture for 24 hrs in a cool place. Before using, dilute 1 part of the mixture to 10 parts of water. The concentrate can be stored in a refrigerator for up to 7 days.

Appendix-4

Field Record sheet for Fruit flies									
Name of Fruit fly Monitoring Area						**Week/Month:** From: To:			
Trap No.	**GPS Coordinate**		**Location of trap**	**Date Insp.**	**Host**	**Lure Type**	**No of flies/ trap**	**Species identified**	**Date recharge**
	LT	**LG**							

Signature:
Name of field inspector:
Address for communication:
Tel/Fax:
E-mail:

Appendix-5

Specimen Forwarding Form			
To: _____ _____ _____ (Name & Address of Reference Entomologist)		Ref No: Date of Forwarding:	
Trap No	Location	No of fruit flies caught	Date on which trap cleared

Signature & Date:
Name of Field Inspector:
Address for communication:
Tel/Fax:
E-mail:

Appendix-6

Specimen Identification Report			
To: _____ _____ _____ (Name & Address of Field Inspector)			**Ref No:** **Dated:**
Trap	**Location**	**Name of fruit fly species identified**	**No of flies**

Signature & Date:
Name of Reference Entomologist
Address for Communication
Fax:
E-mail:

Appendix-7

Fruit fly Surveillance & Monitoring Report

1. **Area involved:**
2. **Period of Reporting**
3. **No of traps inspected:**
4. **No of traps recorded with fruit flies:**
5. **Details of fruit flies detected**

S. No.	Location	Fruit fly species detected	No of flies detected	Life stage detected

6. **Action taken on detection of fruit lies:**

7. **Signature & Date**
8. **Name**
9. **Designation of Officer**

Appendix-8

Preparation and Dispatch of fruit fly larvae for identification

1. **Larval Preparation**:

    - Wash larvae thoroughly in clean water
    - Kill larvae by immersion in hot water (just off the boil)
    - Allow the water to cool at room temperature
    - Transfer larvae to 30% ethanol for 30 min
    - Transfer larvae to 50% ethanol for 30 min
    - Preserve larvae in 70% ethanol in a specimen vial

2. **Infested fruit preparation**

    - Leave larvae in the fruit
    - Place the fruit in 5-6 sheets of news paper (to absorb any liquid
        - Place the package in a secure container (not a plastic bag but preferably a food container with a freezer block

3. **Larval dispatch**

    - Place a small label containing the details of collection viz., location, trap number, date of collection, host species, name of the collector. The label should be written with lead pencil
    - Also affix the label on the external side of vial.
    - Place the specimen vials in a holder
    - Seal the package and affix the address of Reference Entomologist and dispatch with an instruction 'Handle with care. Biological specimen. Rush for Delivery'.

Appendix-9

Auditing of Fruit fly surveillance and monitoring programme

1. Area audited:
2. Area inspector involved:
3. Audited by:
4. Date of auditing:

5. Whether correct trap density used?

- Quarantine zone (International Air pots/Sea ports –250 m. Yes/No
- High risk zone (Metropolitan/Municipal area) – 500 m Yes/No
- Medium risk zone (Rural area/orchard production sites) – 1000 m Yes/No
- Low risk zone (Rural area/Non-host species) – 2500 m Yes/No
- Comments/Action needed.

6. Does the lure correspond with the trap?

- Cue lure plus malathion (4 ml/4wicks) Yes/No
- Methyl euginol lure plus malathion (3ml/3 wicks) Yes/No
- Trimed lure (4ml/4 wicks) Yes/No
- Comments/Action needed

7. Whether the traps are hung in right host species during the season? Yes/No

- Comments/Action needed

8. Where more than one trap is installed at the site, the same are spaced at 3 m apart? Yes/No

- Comments/Action needed

9. Are the traps hung within canopy of the tree and about the half distance from the trunk to the outer edge of the foliage and no closer than 1.5 m from the ground? Yes/No

- Comments/Action needed

10. Are the traps properly labeled? Yes/No

- Comments/Action needed

11. Does the inspector take appropriate precautions to avoid contamination of trap and servicing equipment? Yes/No

- Comments/Action needed

12. What is the condition of traps/lures inspected at the time of auditing?

	Excellent	Good	Acceptable	Improvements Needed
Wicks				
Traps				

- Comments/Action needed

13. Does the inspector inspect the traps at regular intervals and record the information in worksheets up to date? Yes/No

- Weekly intervals (February to October) Yes/No.
- Fortnightly (November-January) Yes/No.
- Comments/Action needed

14. Does the inspector service the traps according to prescribed schedules and replace the damaged traps?

    - Lure replacement (March, June, September and December) Yes/No
- Trap replacement (12 months) Yes/No
- Comments/Action needed

15. Have the traps been recharged and replaced correctly according to schedule?

- Cue lures Yes/No
- ME lures Yes/No
- Comments/Action needed

16. Are worksheets completed correctly and submitted to the Reference Entomologist timely? Yes/No

- Comments/Action needed

17. Is the inspector familiar with the procedures for collecting and forwarding of trapped flies? Yes/No

- Comments/Action needed

18. What is the condition of servicing equipments?

	Excellent	Good	Acceptable	Improvement Needed
Servicing box				
Wick container				
Spare traps				
Tweezers				
Brushes				
Specimen vials				

- Comments/Action needed

19. Does the inspector pass the fruit fly identification test? Yes/No

- Comments/Action needed

20. Does the inspector require additional training or revision? Yes/No

- Comments/Action needed

21. Non-Conformities and Corrective Action to be taken
(List item numbers that need corrective action and date action will be taken)

Item No.	**Non-Confirmities Noticed**	**Corrective action to be taken**	**Date by which action to be taken**

- Comments/Action needed

22. Any other comments

23. Signature & Date
    Name of Auditing Officer

24. Signature & Date
    Name of Area Inspector

25. Signature & Date
    Name of Zonal Supervisor

26. Corrective Action Follow-up

(List item number-corrective action taken-date action completed)

Item No.	Corrective Action taken	Date by which action completed

27. Signature & Date

Name of Zonal Supervisor

28. Signature & Date

Name of Surveillance Auditor