

6. Shipping Procedures

Transboundary shipment of sterile insects has taken place on a continuous basis since the Sterile Insect Technique (SIT) was first developed. So far the total number of sterile insects shipped is estimated at over 960 billion in more than 12,000 shipments to 22 recipient countries from 50 sterile insect production facilities in 25 countries. During this period of almost 50 years, only one problem associated with shipping live sterile insects has been recorded. This is a recent case with non-irradiated screwworms that were shipped to different locations for release. Human error was the cause of this incident that could have been prevented if standard operation procedures (SOP's) had been observed (see 4.3 IRRADIATION AND PROCESS CONTROL). This single case in thousands of sterile insect shipments carried out throughout nearly 50 years shows that any system is subjected to failure and it illustrates the importance of strict observance of SOP's to mitigate the risk of hazards occurring. In almost half a century, and over 300 billion sterile pupae of Tephritid fruit fly species (see APPENDIX E: HISTORY OF TRANSBOUNDARY SHIPMENTS OF STERILE TEPHRITID FRUIT FLIES), no shipment of sterile insects has ever been subjected to prohibition by national or international plant protection or regulatory authorities.

The risks from transboundary movement of sterile insects have been determined to be negligible (see APPENDIX F: TRANSBOUNDARY SHIPMENTS OF STERILE INSECTS) if procedures outlined in this manual are followed. Some countries do not regulate shipment of sterile insects, others only require labelling and documentation, and still others are regulating sterile insects under their biological control measures. With the increase in the number of countries applying SIT and the number of new production sites, this guideline will assist factories or any other organization shipping sterile insects to follow standard operation procedures thus assuring safe shipment while facilitating trade.

6.1. Packaging Procedures

Packaging for Shipping

Size and weight of packages are designed to minimize breakage.

a) *Plastic bottles:*

Sealed bottles should only be used for short-distance transport of irradiated pupae to a local fly emergence facility. When refrigerated vans are used

for the transport, no additional packing or insulating material is required around the bottles.



Figure 19: Inside view of a box used to ship sterile medfly pupae from Guatemala (USDA-Moscamed rearing facility)

b) *Cardboard boxes:*

Polyethylene bags of sterile pupae are loaded into secure cardboard shipping boxes for longer distance transportation to emergence and release facilities. As an example, the shipping boxes used to hold the 4-liter bags of pupae that fit into the canisters of Hussman irradiators is as follows: the box is constructed of double-walled corrugated cardboard of 74 x 34 x 34 cm with a top and bottom full overlap. Inside the box, a central compartment, 46 cm long, is lined with additional layers of corrugated cardboard. Nine bags of pupae are placed lengthwise within this central compartment in three layers of three bags each. Layers, as well as bags within a layer, are separated by spacers of double- and single-wall, respectively, corrugated cardboard. The space remaining at either end of the box (≈ 10 cm of the length of the box) is used to hold two packages each of frozen "blue ice", wrapped in newspaper) (see **Figure 19**).

Once full, a box is sealed closed with carton staples (placing staples in locations where they will not hit the bags of pupae) and two bands of fibre-reinforced plastic adhesive tape (see **Figure 20**).



Figure 20: Boxes used for shipping sterile medfly pupae from Guatemala (USDA-Moscamed rearing facility)

Labelling

All boxes are properly labelled with the words: “Fragile” and “Biological Material”. In some cases, the mention “Live Insects” and some indication of the storage conditions (“This Side Up”, “Handle with Care”) are also present on the boxes (see Figure 20 and Figure 21). It is to be noted that the conventional mention “Keep Refrigerated Do Not Freeze” might be somehow confusing since, as mentioned in 6.2 SHIPPING AND HANDLING PROCEDURES, the boxes should not be held at temperature below 20°C.

To facilitate tracking of consignments, these should have complete information on the location of the addressee, a shipment number and in addition, boxes for each shipment have to be numbered consecutively in large, clear writing on the outside of the box; e.g., “Shipment #, Box 3 of 24”.

6.2. Shipping and Handling Procedures

Boxes should not be handled abruptly or be subjected to inadequate piling and compacting to prevent accumulation of unwanted levels of metabolic heat.

Prior to shipping and during transit sealed boxes should be placed in close and clean facilities to avoid risk of carrying contaminating pests in shipments (hitch-hikers).

Ideally, boxes of pupae should be held at or slightly below 20° C during transportation. In all cases, the containers must not be held under freezing conditions or spend more than a few minutes at temperatures above 30° C (or under conditions, such as prolonged exposure to direct sunlight, that would create internal temperatures above 30° C). Data loggers should be placed inside the containers in order to monitor temperatures during transport.

For local transportation, air-conditioned or refrigerated vans should be used if ambient conditions are likely to result in overheating of pupae. For long-distance shipment, pupae are typically carried by commercial airlines in a portion of the cargo hold where temperature and air pressure are held at “cabin” levels.



Figure 21: Three labels placed on boxes containing sterile medfly pupae shipped from Argentina (Mendoza rearing facility) to Spain (region of Valencia)

Airline routing should be selected to minimize transshipment points and overall shipment time. Although pupae have been held under hypoxia for 40 hours for some programmes, quality begins to drop rapidly when hypoxia extends beyond ≈24 hours. Use of plastic bottles rather than bags and boxes increases the effects of extended hypoxia on insect quality.

The supervisor of packing and shipping should complete a data-sheet with the specifications and

conditions of the sterile pupae being shipped. The minimum information that the datasheet should contain is shown in 7.7 DATASHEET FOR SHIPMENT OF STERILE PUPAE. The datasheet should be signed by the supervisor and a copy should always accompany the consignment. The supervisor should also file a copy of each of the documents (see 6.3 SHIPPING DOCUMENTS) which accompany the consignment regardless of the destination (i.e., national or international).

Upon arrival at final destination and after the consignment has been cleared by the national phytosanitary and customs authorities, the receiver must carefully check the datasheet that accompanies the consignment and verify: (i) that the datasheet has been signed by the shipper, and (ii) that the content of the package matches the information reported on the datasheet. Of particular importance is verifying the condition of the irradiation indicators attached to each pupae container. The indicators must clearly show that they have been exposed to the specified absorbed irradiation dose as explained in 4.3 IRRADIATION AND PROCESS CONTROL. The receiver must then sign a statement that the product has been received according to specifications. Any discrepancy on the consignment content should immediately be reported to the shipper and a decision on keeping or discarding the consignment should be made. Any visual sign on the indicators of inadequate pupae irradiation is sufficient to dispose, in a safely manner, the whole consignment content.

6.3. Shipping Documents

Packages should be accompanied by the necessary documentation to guarantee timely and safe delivery. Shippers should be vigilant of the following:

- Documentation should conform: (i) to relevant regulations of exporting and importing countries, especially concerning import permit, national transit permit, phytosanitary certificate, irradiation certificate, labeling and notification, and (ii) to transit regulations should the shipment transit through a third country (i.e., a country that is neither the country of origin nor the country of destination of the consignment) (see **Figure 22**).
- Documents should include clear instructions to handlers and officials at the point of embarkment, transshipment and entry on how the package should be treated to avoid damage to the contents and on action to be taken if the package is breached.
- The documentation should indicate that package content is perishable and therefore rapid transit of the material should be allowed.
- The receiver should have the necessary documentation to provide rapid feedback when the package is delayed.
- The receiver might request data on the quality of the sterile insects being reared
- The receiver should request, for each consignment, a datasheet with a minimum of information as shown in 7.7 DATASHEET FOR SHIPMENT OF STERILE PUPAE.
- Documents should also include clear instructions to officials at transshipment or entry points on how a lost package that is found is to be discarded.



Figure 22: “Transit” documents for shipment of sterile medfly pupae from Guatemala to Israel through the Netherlands

6.4. Relevant Literature

Brazzel, J.R., C. Calkins, D.L. Chambers & D.B. Gates. 1986. Required quality control tests, quality specifications, and shipping procedures for laboratory produced Mediterranean fruit flies for sterile insect control programs. APHIS 81-51, USDA-APHIS, Hyattsville, MD.

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