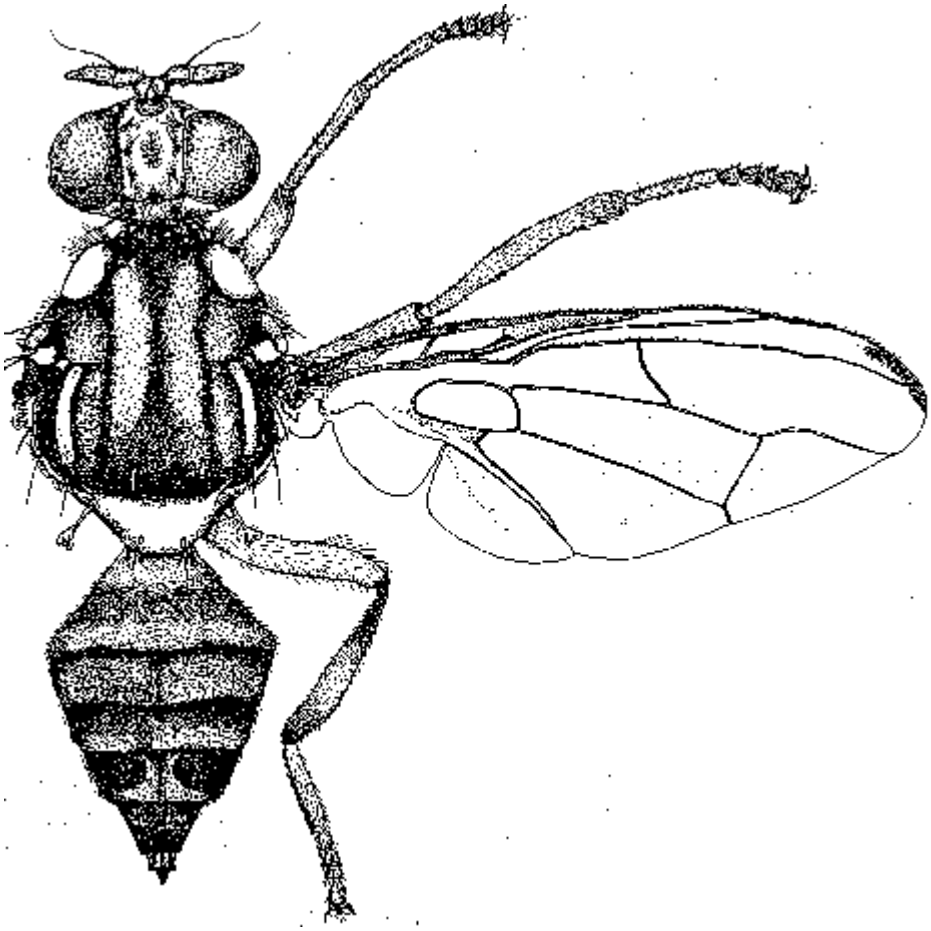
Food & Agriculture Organisation (FAO)

# ACTION PLAN

# PEACH FRUIT FLY

*Bactrocera zonata* (Saunders)

International Atomic Energy Agency (IAEA)





May 2000

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## COMMENTS

This Action Plan was originally compiled and edited by Dr. Jeffrey N. L. Stibick, Plant Protection and Quarantine, Animal & Plant Health Inspector, Service, US Department of Agriculture. Modifications have been made by the Insect & Pest Control Section of the Joint FAO/IAEA Division for adaptation and use by National Plant Protection Organization, Ministries of Agriculture and other parties involved in control of this serious agricultural pest. Thanks are extended to Mr. William Routhier, California Department of Food and Agriculture, Lemon Grove, California for his careful review and recommended changes to the text; Dr. Ian M. White for providing the updated list of fruit flies that respond or do not respond to known attractants in the Addendum, as well as, verification of technical data on the global distribution of the pests, taxonomy, etc. Thanks to CAB International for use of the drawing used on the cover of the Action Plan taken from the 1992 publication *Fruit Flies of Economic Significance: Their Identification and Bionomics* authored by I.M. White and M. M. Elson-Harris; and, finally, to Dr. Mahmoud Taher, Senior FAO Plant Protection Officer for the Near East Region, for review of the text.

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Joint FAO/IAEA Division
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May 2000

## AUTHORIZATION

This Action Plan provides guidelines and actions for the eradication of a peach fruit fly infestation. This Action Plan can be used to supplement other information, Manuals, or guidelines issued by Ministries of Agriculture, Natural Plant Protection Organizations, and others involved in pest prevention, exclusion, or control.

It is to be used in conjunction with other manuals when conducting emergency program activities. The information and instructions contained in this Action Plan originally were developed with and approved by representatives of the Animal and Plant Health Inspection Service (APHIS), cooperating States, the Agricultural Research Service, Cooperative State Research Services, and affected industry and later modified by FAO/IAEA for use by its Member States.

All program technology and methodology employed is determined through discussion, consultation, or agreement with the cooperating plant health officials.

## NOTICE

Recommendations in this Action Plan which involve the use of pesticides concern products which are registered or exempted under the local laws as appropriate. Precautions on the pesticide label and all instructions in this Action Plan must be carefully followed.

Plant protection personnel may not make any warranty or representations, expressed or implied, concerning the use of these products and shall not be responsible for any loss, damage, or injury sustained as a result of the use of any product as specified in the Action Plan.

The use of trade names in this Action Plan does not imply an endorsement of those products or of the manufacturers thereof by pest control programmes.

# I. GENERAL INFORMATION

## A. Action Statement

The information contained in this document is intended for use only when a peach fruit fly (PFF) infestation is known to exist. This Action Plan is to be used for guidance in implementing eradication procedures and in preventing spread to other locations. It provides technical and general information needed to implement any phase of a PFF eradication program. Specific emergency program action is to be based on information available at the time of infestation.

## B. Background Information

The PFF is native to Asia. This tephritid fly occurs in Southeast Asia, Egypt, India, Mauritius, Moluccas Islands, Pakistan, Reunion Island, Sri Lanka, and Thailand. An infestation in California in 1984 was eradicated. The PFF has been recorded worldwide on 42 different fruit hosts. Injury to fruit occurs through oviposition punctures and subsequent larval feeding.

## C. Life Cycle Application

Insect development is temperature dependent. Egg, larval, and adult reproductive development are influenced by air temperatures. Pupal development is influenced by soil temperatures. In both environments, there is a minimum temperature threshold below which no measurable development takes place. A model can be designed to use air temperature data for all insect stages and to predict the entire life cycle. Temperature data area available from the National, private, State, university, or industry sources or are generated by strategically placed soil probes and thermometers. If available, electronic temperature recording equipment, such as a HP4CI or Biophenometer TA51, should be used.

Many of the critical parameters for PFF have yet to be determined. In the absence of other reliable data, the developmental threshold (taken from Oriental fruit fly (OFF)) is assumed to be 12.2 ºC in air and 9.4 ºC in soil. The number of degrees accumulated above the developmental threshold for a life stage for 1 day are called day degrees (DD). For the air model depicted in the table below, 344 DD must be accumulated before own life cycle has been completed. Note: Since PFF pupae can be reportedly overwinter for periods of up to 46 days, these formulas must be used with extreme caution.

**Formula:**

| *Minimum Daily* | | *Maximum Daily* | | *Total* | | *Average Daily* | | *Threshold* | | *Day Degrees* |
|---|---|---|---|---|---|---|---|---|---|---|
| Temp ºC | + | Temp ºC | = | $\frac{\text{Temp ºC}}{2}$ | = | Temp ºC | - | Temp ºC | = | Temp ºC |

Example: (Air Model 12.2 C Threshold)

| *Minimum Daily* | | *Maximum Daily* | | *Total* | | *Average Daily* | | *Threshold* | | *Day Degrees* |
|---|---|---|---|---|---|---|---|---|---|---|
| 12 2 ºC | + | 23.3 ºC | = | $\frac{\text{35.5 ºC}}{2}$ | = | 17.75 ºC | - | 12.2 ºC | = | 5.6 DD |

Program actions are guided in part by insect life cycle data. Eradication treatments, length of trapping activities, and regulatory functions are affected primarily by the length of time it takes to complete each phase of the life cycle. Unforeseen delays in completion of the life cycle must be anticipated.

## II. SURVEY PROCEDURES

(See Addendum D for Technical Survey Information)

### A. Delimiting Survey

When one or more PFF are collected in an area, a delimiting survey will be implemented immediately to determine population distribution. Using the site of detection as the epicenter (focal point), Jackson traps will be set out in a 10-3-3-3-3 per square kilometer ($km^2$) trap array sequence. The traps are to be serviced weekly, with core traps serviced daily for the first week. Traps will be maintained through three PFF generations after the last fly find.

IPMT McPhail traps are to be placed in the core area and the first buffer area at the same rate as the Jackson traps.

If a fly is found in a particular square kilometer $mi^2$, that area becomes an additional core area.

### B. Monitoring/Evaluation Survey

A monitoring/evaluation survey will be conducted in that area where eradication treatments are applied (See Section IV.F. for details).

### C. Fruit Cutting Survey

Preferred host fruit from the core, first buffer, and surrounding preferred host areas can be surveyed, depending on host availability. Fruit from the core area is to be cut and examined at the site. If fruit fly larvae are found the infested samples are taken in a sealed container for identification by an authorized entomologist.

### D. Host Collection and Holding

Fruit can be collected within approximately 200 meters (m) of a detection and held for at least one PFF life cycle at an optimum and developmental temperature of 27 C and 70 percent relative humidity. Security of the facility where the fruit is held must be equal to those established for a quarantine insect rearing facility.

### E. Detection survey

The area beyond the 7-kilometer (km) buffer area (up to a 160 km radius from the core area) is trapped at the minimum rate of one Jackson trap per $km^2$. These traps are to be serviced for three generations and relocated after each servicing, depending on preferred host availability.

### F. Orientation of Survey Personnel

New personnel will be trained, on the job, by experienced personnel. Three working days will be necessary to teach the many important facets of the PFF survey.

### G. Survey

Records noting the areas surveyed, sites trapped, dates, locations, and hosts in which detections were made will be maintained.

## III. REGULATORY PROCEDURES

### A. Instructions

Regulatory actions will be required until the pest is eradicated. Officers must follow instructions for regulatory treatments or other procedures when authorizing the movement of regulated articles. Understanding the instructions and procedures will serve as a basis for explaining such procedures to persons interested in moving articles affected by the quarantine and regulations. Only authorized treatment procedures may be used.

General instructions that are to be followed in regulatory treatments are found in the Appendix.

### B. Regulated Articles

1. Those fresh fruits, nuts, vegetables, and berries listed in Addendum C which exist in the regulated area, will be listed as regulated articles.

2. Cannery waste.

3. Soil within the drip area of plants which produce the fruits, nuts, vegetables, or berries listed as regulated articles.

4. Any other product, article, or means of conveyance of any character whatsoever, when it is determined by an inspector that it presents a hazard of spread of PFF and the person in possession thereof has been so notified.

### C. Quarantine

Regulatory action will be required if:

More than five adult flies or an unmated female and a male are found in an area less than 3 $km^2$ within one estimated PFF life cycle, or

1. One mated female, or larva, or pupa are detected, or

2. A single adult fly is found which is determined to be associated with a current eradication project.

**Note:** These action triggers assume that there is an established and active surveillance underway at the time of the detection, preferably based on a sampling grid of some kind.

When detections are made, implement the following steps:

1. Issue Emergency Action Notifications to all growers and establishments that grow, handle, or process regulated articles within 7.5 km of the epicenter. Emergency Action

Notifications and/or comparable notifications are issued by field personnel to the property owners or managers of all establishments handling, moving, or processing articles capable of spreading the PFF. Notifications will be issued pending authoritative confirmation and/or further instruction from the Minister of Agriculture or other authority as appropriate.

2. If necessary, the Minister of Agriculture will issue a letter directing field offices to initiate specific emergency action under the appropriate legal authorities for that country.

3. The Minister of Agriculture will notify cooperators of the PFF detection, actions taken, and actions contemplated.

4. A narrative description of the regulated area with support documents will be developed by the Ministry of Agriculture (MOA) and its cooperators. The regulated area will also be clearly defined and marked on maps. The regulated area will normally be 225 $km^2$.

5. MOA will publish rules covering the emergency regulations as appropriate.

### D. Regulated Establishments Inspection

Efforts to detect the pest within the regulated area will be made at establishments where regulated articles are sold, handled, processed, or moved. Establishments that might be involved are: airports, landfill sites, fruit stands, farmers' markets, produce markets, flea markets, and any other establishments that handle regulated articles.

### E. Use of Authorized Chemicals

This Action Plan contains recommendations for various chemicals, methods of application, rates of application and any special application instructions. Concurrence by the MOA, National Plant Protection Authorities may be necessary for the use of any chemical or procedure for regulatory purposes.

### F. Approved Regulatory Treatments

1. *Soil Treatment*. An approved insecticide applied to the soil within the dripline of host plants.

   Diazinon--(Diazinon AG-500) 108 ml (54 g. avoirdupois (advp)) active ingredient (a.i.) of 48 percent diazinon in enough water to soak 5 centimeters (cm) of soil over 250 square meter to kill larvae, pupae, and emerging adults. Adjust water hydrogen-ion concentration (pH) to 6.5 or less prior to adding insecticide. The treatment interval will be

described in the specific exemption issued by Environmental Protection authorities in the country. Normally, treatments are applied at a 14- to 16-day interval.

Diazinon--Work Diazinon 14 G 3 to 5 cm into soil at the rate of 39 kilos/HA (5.6 kilos of a.i./HA) 40 grams per 3.5 meters diameter drip circle (9.6 $m^2$). The area should be treated with water that has been buffered (6.0-6.5 pH) to enhance percolation of the material into the soil.

2. *Fumigation*. The application of an approved fumigant as a treatment (methyl bromide, Phostoxin) alone or in conjunction with cold treatment procedures.

3. *Cold Treatment*. The use of cold temperatures as a treatment on selected products, either alone or in conjunction with fumigation.

4. *Vapor Heat Treatment*. This treatment uses heated air saturated with water vapor to raise the temperature of the commodity to a required point for a specified length of time.

5. *Irradiation of Fruits and Vegetables.* This is a viable treatment alternative that can be used to address quarantine security. NPPOs in some countries have approved treatment schedules that can be used for disinfestation purposes. The IAEA recommends a generic dose of 150 Gy for all fruit fly species and 300 Gy for all insects. Please check with the import requirements of the NPPO of the destination country for additional details.

6. *Bait treatment of commercial orchards*. The use of protein hydrolyzate baits mixed with malathion, fenthion, or spinosad in low risk areas for 2 generations prior to movement of the host commodity can also be used as a means of certifying shipments for quarantine security purposes.

## G. Principal Activities

The following identifies principal activities necessary for conducting a regulatory program to prevent the spread of PFF. The extent of regulatory activity required is dependent on the degree of infestation. For example, safeguarding fruit stands throughout the entire regulated area which are engaged in only local retail activity may not be necessary when the regulations that are imposed are based on a limited and light infestation. On the other hand, mandatory checks of passenger baggage at airports and the judicious use of road patrols and roadblocks may be necessary where general or heavy infestations occur.

1. Advising regulated industry of required treatment procedures.

2. Supervising, monitoring, and certifying commodity

treatments of regulated articles.

3. Contact visits with:

   a) Security and airline personnel
   b) Fruit stands
   c) Local growers and packers
   d) Farmers', produce, and flea markets
   e) Commercial haulers of regulated articles
   f) Public transportation
   g) Post Office contacts

4. Visiting canneries and other processing establishments.

5. Monitoring the movement of waste material to and from landfills to ensure adequate disposal of regulated articles.

6. Monitoring the movement of regulated articles through major airports and other transportation centers.

7. Observing major highway and quarantine boundaries for movement of host materials.

8. Public relations is a key element and can involve signs along roadways, at airports and other public places. It should also use local media to inform the general public of ways they may assist.

## H. Removing Areas from Quarantine

Area placed under regulation may be removed from quarantine requirements after the PFF has been declared eradicated. Project management will identify areas to be removed at such time that three PFF life cycles have been completed since the last specimen recovery. One life cycle must have elapsed since the cessation of control activities. MOA should publish a Notice of Quarantine Revocation when areas are removed from quarantine requirements.

## I. Orientation of Regulatory Replacement Personnel

Only trained or experienced personnel will be initially trained by the individual being replaced. A training period of up to 3 working days is necessary for the orderly transfer of these functions.

## J. Regulatory Records

Records will be maintained as necessary to carry out an effective, efficient, and responsible regulatory program. See Addendum G of this Action Plan for detailed instructions.

## IV. ERADICATION PROCEDURES

The MOA, in consultation with its cooperators, methods and research agencies, will outline treatments to be used and must be notified of all treatment plans. If treatments selected or proposed are not in conformance with current pesticide labels, an emergency exemption can be provided.

Eradication of any new PFF infestations is essential. The following provides approved procedures available for use in most situations. Local conditions will determine the most acceptable procedure or combination of procedures for achieving eradication.

### A. Eradication/Control Method Selection

The following criteria will provide guidance for the selection of appropriate treatments to achieve eradication. Treatments suggested are the minimum recommended response to the criteria. Additional treatments can be applied if mutually agreed upon by cooperating agencies. Eradication measures will continue for at least two PFF life cycles. Trapping to verify eradication will continue for at least one PFF cycle after eradication measures have stopped.

1. If two adult flies other than mated females are detected within a 9 km radius and within one estimated life cycle, the minimum response would be the initiation of ground applied male annihilation treatments.

2. If the infestation criteria requiring regulatory action is met within an urban area, the minimum recommended response includes the initiation of ground applied male annihilation treatments, soil treatments, and fruit stripping. Similar fly detections in a commercial area may be treated as above with the addition of bait sprays. Bait sprays from the ground can be used in urban areas as well. The back pack airstream sprayers can make ULV type applications and have successfully eradicated fruit fly infestations in localised outbreaks.
3.

### B. Recommended Pesticides

1. Malathion
2. Spinosad
3. Diazinon
4. Naled (Dibrom)

Some pesticide bait, and lure formulations can damage painted surfaces, plastic, and some uncoated metal surfaces. Care must be exercised when formulating and applying these compounds. Possible damage caused by accidental contamination can be eliminated or minimized by promptly cleaning the affected surface.

## C. Approved Eradication Treatments

1. *Male Annihilation Option*

Spot Treatment: Apply the lure/insecticide using a Panama pump gun (available from Forestry Supplies, Mississippi) or a hydraulic oil squirt can to localized spots on utility poles, trees, fences, etc. The bait will burn foliage, therefore, leaves should not be treated unless no other sites exits.Alternatively, fiber blocks saturated with the attractant and insecticide or cordallitos (short segments of cotton rope or cigarette filters) also can be used effectively as lure & kill stations. Fiber blocks can easily be nailed or stapled to a surface temporary and removed or collected after 90 days.

Apply the mixture at the rate of 3 to 5 milliliters (ml) per station at a height of about 2 meters above the ground out of the reach of children. Apply at least 240 evenly distributed stations per $km^2$ or 60 to 80 to a city block. This equals about 1 bait station every 45-50 meters. Apply treatment every 2 weeks. The area of coverage will be 25 $km^2$ around each fly find.

Male Annihilation Formulation (formulated by weight)

Naled 52 g. ---------- 10 percent (by weight) Dibrom 14 EC

***or***

Malathion, technical grade
---------- 20 percent (by weight)
*Min-U-Gel ---------- 23 percent (by weight) Min-U-Gel 400
Male Lure 325 ml. ------ 67 percent (by weight) methyl eugenol

The proper viscosity of the formulation must be maintained (i.e., the surface of a spot application is thick enough to hold indentations) to avoid splash back, run off, and possible ineffective treatments on nonporous surfaces.

*Normally 113 g. (by weight) of Min-U-Gel is sufficient to maintain appropriate viscosity. However, additional amounts may be required to achieve desired results.

Procedure for mixing methyl eugenol/Dibrom/Min-U-Gel:

1. Safety equipment must be worn when mixing – protective coveralls, gloves, face shield, helmet, respirator, and boots.

2. Mix materials on a plastic tarp to contain any splatter.

3. Using the closed mixing system, place 11.36 liters (3 gallons) of methyl eugenol in a container and add 1.57 liters (53 ounces) of Dibrom 14EC. Use an electric drill with a stirring paddle attachment to mix it thoroughly. Add 3.6 kg (8 pounds) to 4.53 kg (10 pounds) of Min-U-Gel slowly while mixing.

4. Using a funnel screen, pour the material into black plastic jugs and label, as required.

2. *Aerial Proteinaceous Bait Spray Option*

Treatment or retreatment should not be considered if weather reports indicate a 50 percent or greater chance of precipitation within 48 hours.

The objectives are to eradicate the pest and minimize environmental contamination. Any treatment or retreatment recommendations must consider these objectives.

Application of full-coverage protein bait spray will be scheduled and applied 7 to 10 days apart. The area of full-coverage bait spray will extend a minimum of 2.5 km beyond any known infestation. It may be expanded to 4.0 km from any find if the infestation is heavy. Weather conditions may dictate changes in spray schedule. After an estimated two PFF generations of negative trapping, spray operations may be discontinued.

Ultra low volume (ULV) Malathion (Cythion)—71 ml. liquid volume (62.37 avdp g. a.i.) of 91 percent technical grade Malathion plus 284 ml. of Miller's NU-LURE (protein bait) per acre.

Research is underway at the present time to substitute Spinosad (SpinTor 2SC - Naturalyte Insect Control) in lieu of Malathion in protein bait sprays to control fruit flies. For further information about registration, efficacy and formulation, contact DowElanco, Indianapolis, Indiana.

*3. Supplemental Eradication Methods*

a) *Soil Treatment*: Properties with confirmed larval infestations and the environs within 200 m will have approved soil treatments applied within a minimum of 1 m outside the dripline of all host plants and a minimum of a 1 m radius around any spot where host fruit may have

dropped or rolled. Take particular care to soak cracks or crevices in or next to barriers to horizontal movement of larvae (i.e., sidewalks, stones, etc.). Apply prescribed treatments at intervals stated in the specific exemption, as appropriate. Normally, the interval is 14-16 days.

Diazinon--(Diazinon AG-500) 108 ml. (54 avdp g.) a.i. of 48 percent diazinon in enough water to soak 5 cm of soil over 900 $m^2$ (5.6 kilos of a.i./ha) to kill larvae, pupae, and emerging adults. Adjust water pH to 6.5 or less prior to adding insecticide.

Diazinon--Work Diazinon 14 G 3-5 cm in into soil at the rate of 39 kilos per ha (5,6 kilos of a.i./ha) or 41 g. per 3.6 meter diameter drip circle (9.6 $m^2$). The area should be treated with water that has been buffered (6.0-6.5) to enhance percolation of the material into the soil.

b) *Ground Applied Proteinaceous Bait Spray:* All hosts (available shelter, oviposition, or food sites in any stage of development) on the infested property, adjacent properties, and within approximately 200 m of the known find will be sprayed at the prescribed intervals. Ground spraying may be discontinued after an estimated two PFF generations of negative trapping or after the initiation of male annihilation or of aerial treatment.

The bait may be applied as a limited coverage application to hosts and plants providing shelter or resting areas by means of a backpack sprayer or equivalent unit.

Applications are sprayed out of reach of children or pets. If full coverage application is desired, a mistblower or similar unit can be utilized. Treatments are to be applied 7 to 10 days apart.

Subsequent applications, if in orchards or groves, may be decreased by treating every other tree.

Ground application of protein bait spray formulations historically have not significantly reduced infestations in urban areas unless it is done so on an area-wide basis in a centrally-coordinated fashion. This can overcome the failure to gain access to all sites requiring treatment, equipment constraints and timeliness of applications. If properly organised and carried out, such treatments can eradicate small outbreaks in urban areas.

c) *Fruit Stripping:* All ripe preferred host fruit within 200 m

of a confirmed larval site should be promptly stripped and placed in a plastic bag and properly disposed of in an approved landfill.

### D. Orientation of Eradication/Control Personnel

Only trained and experienced personnel will be used. Replacement personnel will be trained by the individual being replaced. A training period of up to 3 working days is necessary for the orderly transfer of these functions.

### E. Eradication/Control Records

Records noting the location, dates, number, and type of treatments and materials and formulations used will be maintained for all areas treated. See Addendum G of this Action Plant for detailed instruction.

### F. Monitoring

An effective monitoring program will be implemented to aid in the evaluation of program efforts and environmental impact. The application and use of pesticides will be assessed through the use of appropriate monitoring program criteria. The evaluation must effectively address Agency, cooperator, and public concerns.

The monitoring program may include the following elements:

1. Determine efficacy of pesticides against the target pest.

2. Evaluating dye cards to monitor aerial bait applications.

    a) Droplet size
    b) Droplet distribution
    c) Bait deposition
    d) Identification of wind drift components
    e) Identification of skips

3. Sampling to evaluate effect on environmental components.

    a) Water sampling to detect any insecticide levels resulting from direct application, leaching, and run-off.

    b) Soil sampling to determine insecticide levels and residues.

    c) Foliage sampling to identify residues.

    d) Biological organism sampling before, during, and after applications to determine impact of insecticides.

    e) Air sampling to determine presence of pesticides.

The monitoring program is to be a combined effort between the Member State in

which the emergency programme is being conducted.  If specific plans need to be developed for monitoring activities, the will request assistance and guidelines from the MOA FAO.

## V. CONTACTS

When a PFF eradication program has been implemented, its success will depend on the voluntary cooperation, assistance, and understanding from other involved groups. The following is a list of groups which either are involved in or must be kept informed of all operational phases of an emergency program.

1. Other National and local agricultural officials
2. Grower groups
3. Commercial interests
4. The general public
5. Universities and Institutes
6. State and local law enforcement officials
7. Public Health agencies
8. Foreign agricultural interests
9. National, and local news media
10. Post Office contacts

## VI. ADDENDA

## Addendum A - Definitions

| | |
|---|---|
| Active ingredient (a.i.) | The actual amount of insecticide contained in a given formulation. |
| Aerial Proteinaceous Bait Treatment | Using an aircraft to apply an ultra-low volume mixture of insecticide and protein hydrolysate bait to a treatment area. |
| Array | The trapping pattern in a 2.56 $km^2$ area. |
| Array Sequence | The trapping pattern (array) beginning with the core area and continuing outward through each buffer area ending with the outer buffer area. |
| Bactrocera zonata (Saunders) | The scientific name of the PFF. |
| Bait | An attractant and food source mixed with an insecticide for treating PFF infestations. |
| Buffer Area | The area extending beyond the boundary of the core - 1, 6; 3.2, 4.8 and 6.4 km. buffer. |
| Cold Treatment | The use of cold temperatures as a treatment on selected products, either alone or in conjunction with fumigation. |
| Commercial Production Area | An area where host material is produced for sale and not personal consumption. |
| Confirmed Detection | A positive identification by a recognized expert of a submitted life form (specimen) as being PFF. |
| Core Area | An area of 2.56 $km^2$ surrounding a confirmed PFF detection. |
| Day Degrees | An accumulation of heat units above a developmental threshold. |
| Delimiting Survey | Determining whether an infestation exists and if so, the extent of the infestation in an area where the PFF has been detected. |
| Detection | The collection of any life stage of PFF. |
| Detection Survey | The installation and monitoring of traps in an area not known to be infested with PFF. |
| Developmental Threshold | The minimum (or maximum) temperature below (or above) which physiological development stops (peaks). |
| Epicenter/Focal Point | The initial site of an infestation. |
| Eradication | The confirmed removal of all PFF life forms in a specified geographical area as determined by the completion of three life cycles without pest specimens being recovered. |
| Fruit Cutting Survey: | Cutting fruit and examining for larvae. |
| Fumigation | The application of an approved fumigant as a treatment (methyl bromide, Phostoxin) alone or in conjunction with cold treatment procedures. |
| Generation (Life Cycle) | The period of time required for the pest to complete all stages of development. |
| Ground Proteinaceous Bait Spray | Using ground equipment to spray host vegetation in a PFF infested area with a mixture of insecticide and protein hydrolysate bait. |
| Host | A plant species capable for reproduction of the PFF. |
| Infestation | The collection of five adult flies, or an unmated female and a male within an area of 2.56 $km^2$ within one estimated life cycle or the detection of one mated female, a larva, a pupa, or a single adult fly determine to be associated with the current eradication project. |
| Infested Area | An area 4 km around all direction sites unless biological factors indicate the need for more or less area. |
| Lure Bait | A male attractant with a thickening agent and an (Methyl eugenol) insecticide. |
| Male Annihilation Procedure | An eradication procedure that is designed to kill the adult PFF male. Bait stations consisting of a male lure, thickening agent, and an insecticide are applied with ground equipment. |
| Monitoring/Evaluation Survey | Using interdependent visual and trapping surveys, as well as environmental sampling, in an area where an insecticide treatment has been applied to evaluate the effectiveness of the application. |
| Regulated Area | An area that extends at least 9.1 linear km in any direction from the epicenter or an infestation. This area is normally expressed in square kilometers. |
| Regulatory Survey | Trapping conducted around establishments where regulated articles are sold, handled, processed, or transported. |
| Soil Treatment | The application of an approved insecticide to the soil of nursery stock and within the dripline of host plants. |
| Ultra low-volume (ULV) Bait Spray | A mixture of an insecticide with protein hydrolysate bait. This mixture is applied in very small droplets by aircraft or by ground. Normal insecticide rate is 71 ml. per acre. |

| | |
|---|---|
| Urban/Residential Area | An area containing multiple- or single-family dwellings. |
| Vapor Heat Treatment | The use of heated air saturated with water vapor to raise the temperature of the commodity to a prescribed limit. This temperature is high enough to kill any PFF eggs or larvae that may be infesting the commodity. |

**Addendum B - Safety**

Personnel and public safety must be prime considerations at all times. Safety practices should be stressed in preprogram planning and through out the duration of actual program operations. Supervisors must enforce on-the-job safety procedures. For complete instructions, see V, D, in the Emergency Programs Manual.

**Addendum C - Hosts**

The following host list was developed from literature citations, contacts with plant protection officials and research scientists familiar with the Peach fruit fly. Fruits actually found infested with PFF larvae are marked with a ★. Starred hosts should be included on any list of regulated hosts for quarantine purposes.

In recent years, this insect has expanded its global distribution and host range. The adventive nature of this fly demands that regulatory agencies give greater attention to its presence in order to take prudent measures for its early detection, containment and elimination.

As this pest spreads to new areas, it will be exposed to new and different hosts suitable for its reproduction, and may attack closely related species within the same genus. For this reason, some of the closely related species are included below without a star. Since it is not fully known what will be suitable hosts for PFF should it become established in other parts of the world, any host listed below should be carefully inspected for possible infestation. In fact, it is not known which hosts may be preferred by adult PFF and no assumptions have been made in this regard.

This pest is similar to the Oriental fruit fly, *Bactrocera dorsalis* (Hendel) in terms of its broad host preferences. PFF may be similar to OFF in other regards. Some scientists believe that PFF may be a hybrid or intermediate form resulting from the cross of OFF with the guava fly, *B. correcta* (Iwahashi & Routhier, in press).

Hosts are listed first by scientific name followed by common name(s). An attempt has been made to select the most widely recognised common name although common names vary from location to location. Those species without an accepted or approved common name are given at the end of the list. All hosts starred (★) on these lists should be regulated for PFF.

| **Scientific Name** | **Common Name** |
|---|---|
| ★*Abelmoschus esculentus* | Okra |
| ★*Aegle marmelos* | Indian bael |
| *Annona cherimola* | Cherimoya |
| *Annona muricata* | Soursop |
| ★*Annona reticulata* | Custard apple, Annona |
| ★*Annona squamosa* | Custard apple |
| ★*Careya arborea* | Patana oak; Kumbhi |
| ★*Carica papaya* | Papaya, common |
| *Citrofortunella japonica* | Calamondin orange |
| ★*Citrullus lanatus* | Watermelon |
| ★*Citrus aurantilifolia* | Sour lime |
| ★*Citrus aurantium* | Sour orange |
| ★*Citrus limon* | Lemon; baramasi |
| ★*Citrus medica* | Citron |
| *Citrus maxima* | Pummelo |
| ★*Citrus nobilis* | King orange;Tangor |
| ★*Citrus paradisi* | Grapefruit |
| ★*Citrus reticulata* | Mandarin (tangerine) |
| ★*Citrus sinensis* | Orange, sweet |
| ★*Coccinia grandis* | Gourd, Ivy |
| ★*Cucumis melo* | Cantaloupe |
| *Cucumis sativus* | Cucumber |
| ★*Cucumis utilissimus* | Melon, long |

| Scientific Name | Common Name |
|---|---|
| ★*Cydonia oblonga* | Quince |
| *Elaeocarpus angustifolius* | blue marbletree; New Guinea-quandong |
| *Elaeocarpus grandiflorus* | |
| ★*Elaeocarpus madopetalus* | Ma-kok-nam |
| ★*Eriobotrya japonica* | Loquat; Lokat |
| *Eugenia brasiliensis* | Brazil cherry |
| *Eugenia uniflora* | Surinam cherry |
| *Felijoa sellowiana* | Pineapple guava |
| *Ficus benghalensis* | Banyan fig |
| ★*Ficus carica* | Fig, common |
| *Ficus macrophylla* | Moreton Bay fig |
| *Ficus retusa* | Glossy leaf fig |
| *Ficus rubiginosa* | Port Jackson fig |
| *Ficus* spp. | Fig |
| ★*Fortunella japonica* | Chinese-orange; Kumquat;Narange |
| ★*Grewia asiatica* | Phalsa |
| ★*Lagenaria siceraria (= L. vulgaris)* | White flower; bottle gourd, calabash gourd |
| ★*Luffa acutangula* | Ribbed or ridged gourd; Kali torai, Jhinga, Luffa; |
| ★*Luffa aegyptiaca* | Smooth loofah; Sponge gourd;Ghia torai |
| ★*Lycopersicum esculentum* | Tomato;Tamatar |
| ★*Madhuca indica (=Bassia latifolia)* | Mahua; Mohua; Mowra-buttertree |
| ★*Malus* spp. | Apple |
| ★*Malus (=domestica) sylvestris* | Apple, common |
| *Mangifera foetida* | Bachang mango |
| ★*Mangifera indica* | Mango |
| *Mangifera odorata* | Kuine |
| *Manilkara emarginata* | Sapodilla, a |
| *Manilkara hexandra* | Balata sapodilla |
| ★*Manilkara zapota* | Sapodilla |
| *Momordica balsamina* | Balsam apple hawthorn |
| ★*Momordica charantia* | Balsam pear, bitter melon; bitter gourd |
| *Momordica cochinchinensis* | Balsam apple, a |
| *Ochrosia elliptica* | Bourbon orange |
| ★*Persea americana* | Avocado |
| ★*Phoenix dactylifera* | Date palm |
| *Prunus americana* | American plum |
| ★*Prunus armeniaca* | Apricot |
| *Prunus avium* | Sweet Cherry |
| *Prunus cerasifera* | Plum |
| *Prunus domestica* | Garden plum (common European prune) |
| *Prunus dulcis* | Almond |
| *Prunus ilicifolia (ornamental)* | Cherry, hollyleaf |
| *Prunus lusitanica* | Portuguese laurel cherry |
| *Prunus lyonii* | Cherry, catalina |
| ★*Prunus persica* | Peach |
| ★*Prunus persica var. nectarina* | Nectarine |
| *Prunus salicia x Prunus cerasifera* | Methley plum |
| *Prunus salicina* | Japanese plum |
| ★*Psidium cattleianum* | Strawberry guava;Chinese guava |
| *Psidium cattleianum littorale* | Red strawberry guava |
| *Psidium cattleianum lucidum* | Yellow strawberry guava |
| ★*Psidium guajava* | Guava |
| ★*Punica granatum* | Pomegranate |
| ★*Putranjiva roxburghii* | Olive, wild; Indian amulet plant |
| ★*Pyrus communis* | Pear |

| Scientific Name | Common Name |
|---|---|
| ★*Pyrus pashia* | Kaenth |
| *Pyrus pyrifolia* | Pear, sand |
| *Solanum aculeatissimum* | Nightshade, a |
| ★*Solanum auriculatum* | Wild tobacco; Tabac marron |
| ★*Solanum melongena* | Eggplant |
| *Solanum muricatum* | Pepino |
| *Solanum pseudocapsicum* | Jerusalem cherry |
| *Solanum seaforthianum* | Brazilian nightshade |
| *Solanum verbascifolium* | Mullein nightshade |
| ★*Syzygium aquea* | Water apple;Watery roseapple;Lal;Jumrool |
| ★*Syzygium cumini* | Java plum; Jambolana |
| ★*Syzygium jambos* | Rose-apple;Jamrosat; jambos; Malabar-plum |
| *Syzygium malaccense* | Malay-apple |
| ★*Syzygium samarangense* | Java apple;Water apple |
| *Terminalia bellirica* | Myrobalan |
| ★*Terminalia catappa* | Tropical or Indian almond |
| *Terminalia chebula* | |
| ★*Ziziphus mauritiana* | Chinese-date (India jujube);Ber |

**Addendum D - Technical Survey Information**

## I. The Jackson Trap

A Richmond dental wick capable of holding 6 ml of solution, 1 cm in diameter and 2.5 cm in or 4 cm in long will be installed in the trap. The wick will be baited with a mixture of 80 percent methyl eugenol, and 20 percent Malathion by volume. A wick can hold 3 to 5 ml. Avoid overloading the wick or it will drip. The initial servicing will require 6 ml of lure. Subsequent servicings will require adding sufficient lure to saturate the wick without dripping. A period of 8 weeks between rebaitings is optimum but will depend on lure evaporation under existing weather conditions. The following chart may be employed as a guide:

| Period | Temperature | Rebaiting Intervals |
|---|---|---|
| Winter | 10 – 15.5 ºC Daytime Highs | 12 weeks |
| Spring/Cool Summer | 21 – 26.6 ºC Daytime Highs | 8 weeks |
| Hot Summer/ Hot Fall | 32 ºC and over Daytime Highs | 4 weeks |
| Cool Fall | 21 – 26.6 ºC Daytime Highs | 8 weeks |

If a blowing rain should occur, all traps should be replaced as soon as possible due to contamination.

Each trapper can service 20 to 30 traps per day.

A. When baiting traps, turn trap on end and add 3 ml of ME + Malathion to the end of the wick. Then turn the other end of the trap up and add 3 ml to the other end of the wick. This will total 6 ml. Take extreme care not to drip any of the lure on the insert or trap body, or the efficiency of the trap will decrease. If lure is on the outside, the flies will mill around and may not enter the trap at all.

   Take care not to saturate wicks to the point that they will drip sometime after the trap is placed in the host.

   Care must be taken when baiting the trap. An accidental spill, even a few drops, will cause a decrease in the effectiveness of the trap or may make it totally ineffective.

B. Once a trapper selects a trap site, the location will be plotted on a map which has been sectioned or gridded into 1 square kilometer or quadrant (10 x 10 km)

blocks. In addition, a trap location record (normally a file card), with a rough drawing or sketch of the specific trap location, will be prepared to document trapping activities such as dates of placement and servicing. The trap should be moved to hosts of equal or greater preference.

## II. The McPhail Trap

A. Fill McPhail traps with approximately 600 ml of protein hydrolyzate bait solution which is composed of:

325 ml. of protein hydrolyzate bait--9% by weight
453.6 g. of borax--5% by weight
3.78 liters of water--86% by weight

These solutions are best prepared with warm water and stirred. Stir again before adding solution to trap. Trap should be filled to just below lip.

## III. Quality Control

Field supervisors oversee each trapper's work. In addition to arranging schedules, helping with problems, and overall direction, the following quality control items are carried out:

**A. Evaluation.** The field supervisor periodically checks a number of traps run by each trapper. On an evaluation sheet the supervisor lists the trap number, location, description, and date and notes the condition of the wick, trap placement, and trapping schedule. Trappers are advised of results and problem areas worked out.

**B. Trapping Directory - Map Requirement**

1. Trap Location Directory. A list of all trappers. traps, servicing dates, field supervisors, and a copy of each trap card giving the exact location of each trap is maintained in a directory.

2. Map. A large-scale master map, overlayed with a grid showing coordinates used in the survey, will be maintained and updated each day. The map will show the location of all traps and finds throughout the regulated area.

**C. Initial Trap Training and Public Relations**

*1. Trap placement*

New trappers will be given individual instruction on proper trap placement.

a) Selection of trapping sites. In selecting possible trap sites,

consideration should be given to the availability of food and shelter near hosts with fruit. If two or more possible trap locations meet this criteria, preference should be given to the site that has a greater variety of hosts and shelter. In many cases, single trees will be the only host available and should be utilized. Never pick a location solely because it will look good on a map. For PFF, traps placed at the edges of orchards or in plants providing food and shelter have a higher likelihood of catching specimens than traps placed near the center. Placing a trap in a poor or second rate host, or even in a prime host without fruit when food and shelter or hosts with mature fruit are available, has the effect of making the lure compete with natural attractants. In some cases, a very desirable host may be lacking in mature fruit or have insufficient shade for trap placement. In such cases, a nearby honeydew source is a desirable trap location. Generally, it is not advisable to place a trap in a host without fruit unless it shows evidence of abundant honeydew or possesses inflorescences. Both serve as a food source. Honeydew is a sweetish, clear excretion produced by certain insects such as aphids, scale insects, mealy bugs, and white flies. It is a good food source for adult fruit flies. A fungus called sooty mold lives on the honeydew. This mold turns the leaves on the tree black. The presence of sooty mold is an indication that the host is infested with insects that produce honeydew. Inflorescences possess nectar, on which the flies can also feed, and provide shelter during the heat of the day.

Those hosts which are likely to bear mature fruit and/or be attractive feeding/shelter sites for most of the year should form the bulk of the trapped hosts. The common guava, citrus and the mango are choice honeydew sources.

Trees having sparse foliage should be avoided when other protection is available. This is true especially during the summer months, since these trees do not produce enough shade. When a tree does not have sufficient shade, the trap should be placed in some other host or non-host nearby.

Desirable trap sites should be noted on the Trap Location Record to facilitate future trap locations. This may be done at the time of initial trap placement or as the sites are noted during trap servicing.

b) Placement of trap in host. Generally, it is not advisable to place a trap in a host without fruit except when the tree is being used as a trap site adjacent to a host which has insufficient shade.

The trap should be placed in a host or non-host at a point high enough to be out of reach of children, livestock, or pets. It should be secured in a manner to prevent it from being blown down. During the summer or warmer portions of the year, the trap must be placed in open shade; whereas, in the winter or cooler time of the year, it should be placed in a southern exposure, but not in direct sunlight. It is preferable to place it 1/2 to 2/3 the distance from the trunk to the outer edge of the foliage.

The trap should not hang below or outside the foliage of the tree. The trap should not be placed in dense foliage that may protrude into the trap or give the fly a resting place that would prevent it from entering the trap.

It is desirable to have foliage below the level of the trap but not necessarily directly beneath the trap. A pole with a metal hook attached to one end can be used to place the trap sufficiently high in the host to be out of easy reach of children and curious adults.

2. *Public Relations*

Good public relations are an important part of the survey specialist's duties. Trappers are constantly in view and frequently in contact with the public. They should be courteous at all times. Prolonged conversations should be avoided, but short, cordial conversations concerning work are desirable. Do not be drawn into arguments concerning program activities.

Survey Officers represent the Ministry of Agriculture and present an image of that Agency to the observing public. Dress, personal appearance, and actions should be appropriate to make a good impression with the general public.

Shorts and tee-shirts may not be worn. Long pants or slacks, and shirts or blouses with sleeves are prescribed for comfort and protection.

Shoes must be worn. Leather shoes with heavy soles help prevent punctures from nails and broken glass.

Identification badges must be worn every workday at chest level for easy identification.

When entering a property for the first time, always attempt to contact the property owner or caretaker, explain the work

briefly, and ask permission to place the trap. In conversation with the public, traps should be referred to as "Insect survey traps." If no one is home a notice should be left.

*3. Preliminary Training*

A vial of five dead, marked PFF (wing-clipped and color-marked) is sent to each field supervisor by registered mail. These are randomly placed on a Jackson trap insert and shown to all trappers. As part of the demonstration, the flies will be submitted for identification as described in normal operational procedures.

## D. Quality Control Advisors

In a large program, quality control advisors may be employed. These personnel will monitor the trapping program. The advisor works with trappers assisting will proper trap location, baiting, host selection, trap deployment, and record-keeping. Deficiencies and recommended improvements in the trapping district are reported to the field supervisor. Such reports are also given to the program manager. Periodic staff meetings of advisors are held to exchange viewpoints and discuss improvements. The advisors should randomly place marked flies or other indicators in the traps to verify that the trappers and supervisors are properly servicing each trap according to the proper schedule.

## E. PFF Quality Control Trapping Test Program

During the course of a large eradication program, it may be advisable to bait a selected number of traps with marked, dead PFF. This would maintain a high level of trapping awareness as well as ensure consistency in both trapping and reporting procedures. Previously killed and marked PFF will be obtained elsewhere and handled at project headquarters. The following procedure is suggested to minimize risk but actual procedures may vary, depending on agreement with Member State cooperators. Project managers will contact MOA for procedures to implement this test program.

*1. Trap Selection*

Each field supervisor will randomly select 5 to 15 traps per trapper to be tested and provide all data to the program offices at least 1 full week in advance of test date.

2. *Preparation*

   The field supervisor will be notified of the approximate delivery time of the specimens. Specimens will be selected and checked for color markings. As a precaution, the color will be changed each month, and the right or left wing will be clipped. Only the program office will be aware of the color and clipping schedule.

3. *Mailing*

   Each marked specimen will be placed in its own vial with a quality control identification number. The number will be recorded in a quality control log. The marked flies will then be sent by registered mail to the field supervisor. The field supervisor will send the program office a list of the traps to be baited for logging by specimen number. Specimens will be placed in traps no earlier than 1 day before normal servicing.

4. *Return*

   When a marked specimen is detected, standard trapping procedures are followed. However, the specimen is returned in the original vial, the pest detection report slip is given the quality control number under remarks, and the specimen is returned to the program office via registered mail.

5. *Oral Tests*

   To maintain trapper awareness, an occasional test may be given. General discussion may follow each test so that all concerned will benefit.

**Addendum E - Life History**

## I. Systematic Position

Peach fruit fly - ***Bactrocera zonata*** (Saunders)--[Diptera, Tephritidae]

Class: Insecta
Order: Diptera
Family: Tephritidae

Also known as *Bactrocera maculigera* Doleschall, *Chaetodacus* zonatus Bezzi, *Dacus (Chaetodacus) zonatus* Hendel, *Dacus (Strumeta)zonatus* Narayanan & Batra, *Dasyneura zonata* Saunders, *Rivellia persicae* Bigot, and *Strumeta zonatus* Perkins. This is one of about 440 species of the genus *Bactrocera*. The genus is found principally in Asia, Australia and on the islands of the Pacific. A few species can be found in Africa and only one in Southern Europe.

## II. Biology

### SUMMARY

The PFF is a strong flier and is active throughout the year, when temperatures exceed 16 $^{o}$C. In India and Pakistan, adults appear in early spring and attack jujube, changing to loquat and peach by late April-June, and then to gourds, mango, bael, citrus, guava, pomegranate and sapodilla for the rest of the year. Peak populations occur July-October, then decline November-December. The pre-oviposition period is 10 to 23 days. The female lays an average of 137 eggs in batches of two to nine under the rind of the host fruit. These hatch in 2-3 days. Larvae feed on the fruit for 1 to 3 weeks, then emerge to pupate 2-15 cm in the ground. The pupal period varies from 4 days in summer to over 6 weeks in winter. On the strength of published observations, PFF can apparently survive winters in temperate climates.

### GENERAL

Adults of the PFF have been observed to mate in dim light in the laboratory, and during twilight in the field. Both males and females may mate several times, but the female may lay fertile eggs 2 to 7 days after mating throughout its life span. The pre-oviposition period, which also includes sexual maturation (8-16 days), is therefore 10 to 23 days to the first egg when the time for sexual maturity is included.

Eggs

The females lay white, elliptical eggs which taper at both ends. The eggs, similar to OFF, are 1.1 millimeter (mm) long and 0.2 mm wide and have a micropyle to one end. The PFF female punctures the chosen fruit with its ovipositor and deposits 2-9 eggs within the fruit. The females lay eggs throughout the day but prefer to lay most of their eggs in the afternoon. The ovipositional punctures may serve to introduce microbial pathogens into the fruit, thereby causing the fruit to decay rapidly. The PFF can multiply rapidly in a suitable environment because the adult female can lay up to 93 eggs in 1 day, and as many as 564 in its lifetime. Under favorable condition, the eggs

hatch into larvae within 2 days. This incubation period may be delayed when temperatures are below normal.

Larvae

The typical larva of the PFF is a creamy-white, legless maggot which feeds on fruit pulp and may grow to a length of about 7-10 mm within the fruit. The larval stage lasts about 4-16 days depending upon temperature. The larvae later drop to the ground through conspicuous holes in the fruit, for pupation in the soil. When disturbed the larvae double over and jump about. This phenomenon has also been observed under laboratory conditions and may be important for their dispersal.

Damage

The larvae will normally destroy the interior of the fruit as they feed on the pulp. Further damage is done by the presence of the conspicuous, unsightly holes through which the larvae exit for pupation. This damage to the fruit is similar to that caused by the Mediterranean fruit fly (Medfly) and the melon fly.

The PFF has been reared from 33 fruits, a number of which are important crops (Kapoor 1993).

Pupae

Although soil is not necessary for pupation, the larva usually pupates within 1-6 inches of the soil surface, depending on soil texture and compactness. The typical pupa is encased in a dark-brown cylindrical puparium, about 5.0 mm long. This is the quiescent stage, lasting from 4 to 16 days in the summer, and according to the literature, up to 46 days in the winter. The adult fly emerges from the soil.

The life cycle may be completed in 20 days, under optimum conditions, but is prolonged by cool temperatures.

Adults

The adult fly is about the size of a housefly. It is reddish brown, with yellowish abdominal crossbands and transparent wings with a small brown spot on the tip of each wing. The antennae are short, less then the vertical length of the head.

The newly emerged adult is not sexually mature and has little or no stored source of energy. Under favorable conditions, the fly attains sexual maturity within 8 (rarely 6) to 16 days and will produce several generations of progeny in a year.The adult PFF feeds on honeydew, decaying fruits, plant nectar, and plant sap.

The average life span of the adult in the field will normally depend on the existence and presence of natural enemies, the nature and abundance of available food, and on weather conditions. Under laboratory conditions, life spans of 78 days have been recorded.

Dispersal

During mark-recapture experiments, adult flies were recaptured 25 kilometer from their release sites. It can therefore, disperse very quickly into new areas in search of food and acceptable host for oviposition. Indications are that the PFF tends to remain in one area when adequate food and hosts are available. This suggests that a new infestation may be contained, in part, by preventing the artificial movement of infested produce from the area (as may be required by quarantine regulations). The dispersal of the PFF is affected not only by adult flight, but by the wind and by the movement of infested produce by man. For resting and feeding, adults disperse to trees or hosts with inflorescences or aphid infestations and visit hosts with suitable fruit primarily for oviposition purposes. During the hottest part of the day the adults hide in foliage, inflorescences, or other such places where temperatures are lower.

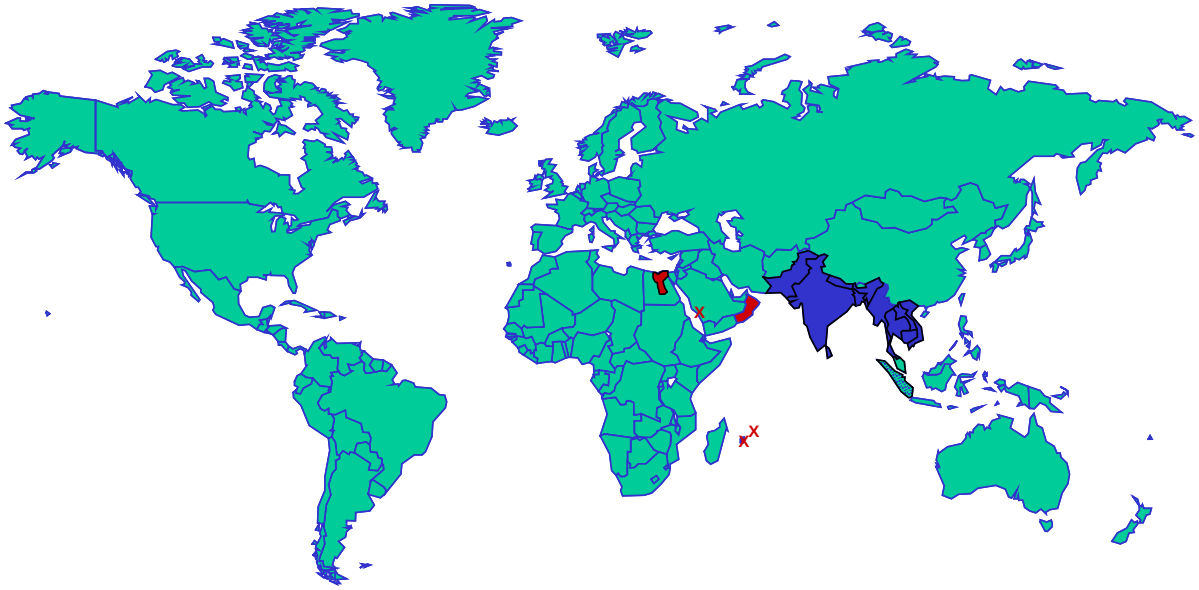
## III. Global Distribution

The probable origin of this pest is India. PFF is known to occur in the following countries:

| | | |
|---|---|---|
| Bangladesh | Mauritius | Saudi Arabia |
| Egypt | Myanmar | Sri Lanka |
| Reunion (France) | Nepal | Thailand |
| India | Oman | Vietnam |
| Laos | Pakistan | |

A report that the pest occurs in the western portion of Indonesia (Sumatra) needs further confirmation.

**Peach Fruit Fly, *Bactrocera zonata* (Saunders)**



**Indigenous range of this pest.**

**Newly invaded areas by this pest.**

**Source: CAB International 1997**

**Sources:**


a.) CABI. 1996. Distribution Maps of Pests. Series A. Map No. 125 June 1996. First revision. *Bactrocera zonata* (Saunders).

b.) Kapoor, V.C. 1993. Indian Fruit Flies. International Science Publisher, New York, USA. 228 pp.

b.) White, I.; Hancock, D.L. 1997. CABI Key: Indo-Australasian Dacini Fruit Flies. CD-ROM

c.) White, I.; Elson-Harris, M. M. 1992. Fruit Flies of Economic Significance: Their Identification and Bionomics. CAB International, Wallingford, UK. 601 pp.

**Addendum F - Identification of Specimen(s)**

As many specimens as possible of the pest are to be collected for screening/identification by the local designated identifier. Suspect adult specimens collected from McPhail traps and other insect stages should be forwarded to the MOA in vials of alcohol for confirmation.

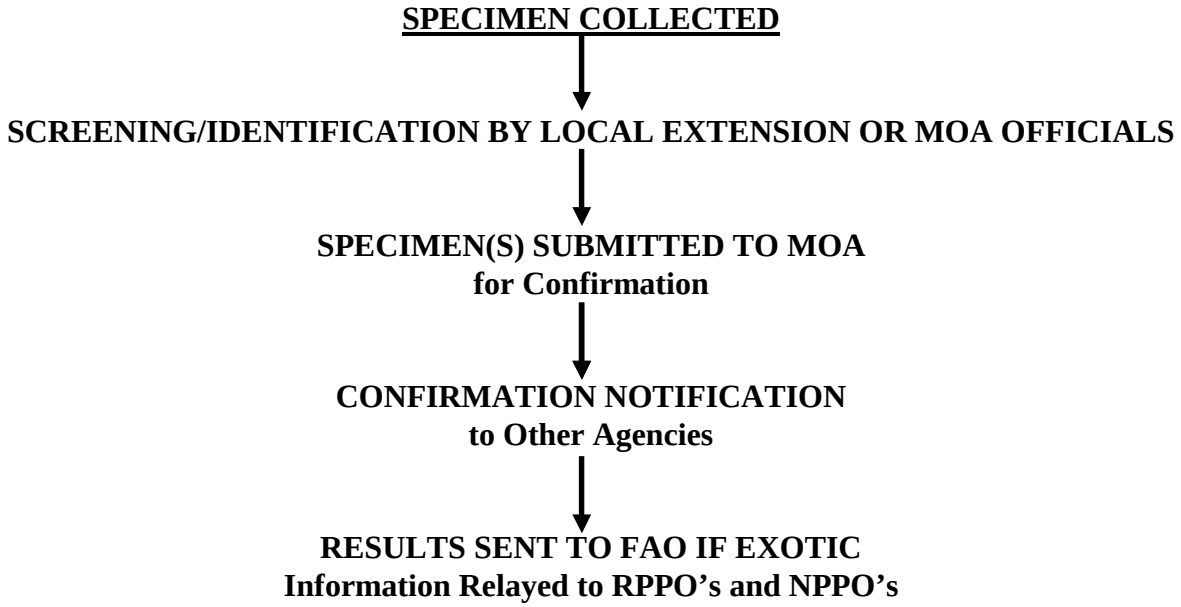
Suspect adult specimens collected from Jackson traps should be handled carefully. To insure that specimens caught in sticky material can be accurately identified, the following procedures are recommended.

- Cut out a portion of the insert surrounding the specimen. This will leave you with the specimen imbedded in sticky material on a small piece of cardboard. Put an insect pin (number 2 size) through the cardboard and pin the cardboard (with specimens attached) in a mail master-type pinning box. You are thus treating the specimen as a pinned specimen and do not need to use alcohol or other liquids. To ship the pinning box for identification place it inside a second shipping box and put padding between the two boxes.

- You may find it easier to submit the entire trap insert to the MOA. This eliminates the risk of breaking off critical body parts while removing a specimen from the insert.

Suspect larvae should be killed by placing in water, bringing to the boiling point, cooling, and then preserved in 70-75 percent ethyl alcohol. Suspect adult specimens collected from McPhail and Jackson traps and other insect stages should all be forwarded in vials of alcohol for confirmation to the nearest MOA office. Telephone the MOA prior to shipping specimens to alert them of the shipment.

## INFORMATION FLOW FOR THE IDENTIFICATION OF SPECIMENS



**Addendum G - Sources of Methyl Eugenol Attractant**

Methyl eugenol is a clear, colorless to yellowish liquid with a clove-like spicy aroma with a herbal and tea-like nuance. It tastes spicy and dry like herbal cloves. The chemical formula for methyl eugenol is $\mathbf{C_{11}H_{14}O_2}$. Its CAS registration number is: 93-15-2; the G.R.A.S./F.E.M.A. number is 2475, the FDA No.: 121.1164; and the Brussels Tariff No. is 2908-1800.

The molecular weight is 178.23 and its boiling point is 244-245ºC. The level of purity typically is a minimum of 98%. The specific gravity (D 25/25) is: 1.032-1.035, and the refractive index (n 20/D) is: 1.532-1.535. Its solubility at 20ºC in ethanol 80 vol. % is 1:1 v/v, 1:2 v/v in 70% alcohol, and 1:4 v/v in 60% alcohol. Its solubility in 1,2 -Propanediol is 1:5 v/v. Methyl eugenol is almost insoluble in water. Limits of impurities: a.) no more than 1% Eugenol (maximum); b.) Arsenic (as As): not more than 3 parts per million (0.0003%); c.) Heavy metals (as Pb): not more than 40 parts per million (0.004%); and d.) Lead: not more than 1-part per million (0.001%).

Eugenol is a principal ingredient of oil of cloves. It is used in perfumes and flavorings, and it is used in dentistry as an antiseptic, an analgesic, and component of dental cement.

The product used for detection and control should be of the highest possible purity. SGS can sample and certify purity in accordance with the specifications noted above. Typical levels of purity for commercial forms of methyl eugenol are >98% and not more than 1% Eugenol.

Other chemical names for methyl eugenol are:
Benzene, 1,2-dimethoxy-4-(2-propenyl) **IUPAC Name**
1,2-Dimethoxyl-4-allylbenzene
3, 4-dimethoxy-1-(2 propanyl) benzene
4-Allyl-1,2-dimethoxybenzene
4-Allyl veratrole
Ent 21040
Eugenol methyl ether
Eugenyl methyl ester
Methyleugenol
Veratrole methyl ether

1.) Haarman & Reimer GmbH
Postfach 12 53
D-37601 Holzminden
Germany
Tel: +49-553-190-1230
FAX: +49-553-190-1845
Contact: Ms. Alexandra Bolte

Product number 608 029 Eugenol methyl ether. Price is approximately US$16.75/kg. Price will vary based on the volume ordered. Material can be delivered in various sizes of containers including steel drums.

2) Elan Chemical
268 Doremus Avenue
Newark, New Jersey 07105
USA
Tel.: 215-369-2926
FAX.: 215-369-2936
Cell.: 973-615-2228
Contact: Mike Schrager
E-mail: Ftwmail@aol.com

3.) Agrisense BCS Ltd (A subsidiary of Thermo Trilogy Corporation)
Agricultural Products
Treforest Industrial Estate
PONTYPRIDD CF37 5SU
U.K.
Tel: +44-1443-841155 Ext 108
Fax: +44 1443 841152
Contact: Nick Brown, Marketing & Sales Manager
Direct e-mail: nickb@agrisense.demon.co.uk

4.) International Pheromones Inc.
60 Commerce Way
Hackensack, New Jersey 07601
Tel: 001-201-487-1332/1672

5.) Polarome International Inc.
200 Theodore Conrad Drive
Jersey City , NJ 07305
USA
Tel 201-333-8700
Fax 201-433-06384
Contact: Mr. Jon Dunn
e-mail jdunn@polarome.com
Price: US$ 20.75 per kilo FOB New Jersey
Packaging: Standard packaging - 400 lb drum ( 181.4 kilos)

6.) Diverstech Co.
15515 Sunset Blvd., Suite 115
Pacific Palisades, CA 90272-3530 USA
Phone 310-355-6046
FAX 310-454-9592
Contact: Barry Sugarman, B.S.ENGR., President
mailto:barry@diverstech.com

Methyl Eugenol is available. They manufacture the product for each order and quote individual competitive quotes. Experience on numerous USDA projects for over 20 years.

**Addendum H - Suppliers of Protein Bait**

Ranking or listing does not imply that the product is efficacious. You should contact the persons listed for data on efficacy and use for a given species. Contact companies directly for current price and availability.

1. Product Name: Dacus Bait
   Alesis Co.
   Street A5 - Industrial Zone of Thessaloniki
   57022 Sindos, Greece
   Tel.: +30-31-798440
   Company Contact: Mr. Tselios

   Used for Medfly, *Ceratitis capitata,* and Olive Fly, *Bactrocera olea,* in Greece with excellent results. For information regarding efficacy contact Dr. Aris Economopoulos, University of Crete (economop@nefeli.imbb.forth.gr)

2. Product Name: Nasiman Protein Bait
   TAMOGAN (a subsidiary of OSEM)
   State of Israel
   FAX: +972-3-9265734
   Company Contact: Dr. Rafi Wilmersdorf, General Manager

   Used for Medfly (*Ceratitis capitata*) control in Israel since 1960's. For information regarding efficacy, contact Dr. Yoram Roessler, Head, Israel Cohen Institute for Bio Control (rossler@netvision.net.il)

3. Product Name: Buminal
   Bayer Co. of Germany
   Lidor Chemicals, Ltd (Authorized Sales Agent in Israel)
   State of Israel
   FAX: +972-3-5400368

   Used for Medfly *(Ceratitis capitata)* control in Israel. Available in 1,000 liter capacity stackable, wire-reinforced, polycarb tanks with built-in pallets. For information regarding efficacy, contact Dr. Yoram Roessler, Head, Israel Cohen Institute for Bio Control (rossler@netvision.net.il).

4. Product Name: Endosomyl or Entosomyl (Dacus Attractant)
   Agrevo (=Hoest)
   Ave. Sidonia Pais 391 (Apartado Postal 6041)
   P-4101 Porto, Portugal
   Tel: +351-2-606-7051/606-3161
   Fax: +351-2-609-0570

   Used for Medfly *(Ceratitis capitata)* and Olive *(Bactrocera olea)* Fly control in Portugal. For information regarding efficacy, contact Rui Pereira, Director, MadeiraMed (rpereira.sra@gov-madeira.pt)

**Addendum H - Suppliers of Protein Bait - Continued**

5. Product Name: Nu-Lure Protein Insect Bait (previously Staley's Protein Insect Bait No. 7)
Miller Chemical & Fertilizer Corporation
P.O. Box 333, Radio Road
Hanover, Pennsylvania 17331
United States of America
Tel: +717-632-8921
Contact: Charles Svec/Barbara Klung

Used by United States Department of Agriculture (USDA) for exotic fruit fly control since 1957 against Medfly *(Ceratitis capitata)*, Mexican fruit fly *(Anastrepha ludens)*, Oriental fruit fly *(Bactrocera dorsalis)*, Melon fly *(Bactrocera cucurbitae)*, Caribbean fruit fly *(Anastrepha suspensa)*, and others. For information on rates of application and use, refer to USEPA Section 18 Crisis Exemption at the following URL:
http://www.cdpr.ca.gov/docs/sec18/pdf/96-01.htm
For information regarding efficacy, contact David Lance, USDA/APHIS/PPQ, David.R.Lance@usda.gov

6. Product Name: Mazoferm E802(Corn Steepwater)
Corn Products
6500 Archer Road/Box 345
Summit-Argo, Illinois 60501-0345
Tel: +708-563-2400
FAX: +708-563-6770
Contact Person: Henry Nonaka

Used in large-scale field trials of SureDye in Guatemala for control of Medfly and Anastrepha species. Small research tests also run in Hawaii, California, and Texas. For information regarding efficacy, contact David Lance, USDA/APHIS/PPQ, David.R.Lance@usda.gov

7. Product Name: HYM-LURE
ROBERTSONS (PTY) LTD
5 Walnut Road (P.O. Box 1956)
Durban 4000
South Africa
Tel.: (031) 3699600
FAX.: (031) 3699634

HYM LURE is sold as a protein hydrolysate paste. MARDI tested the product and found it quite similar to NU-LURE and other hydrolysed proteins. Further information is available from the manufacturer.

**Addendum H - Suppliers of Protein Bait - Continued**

8. Product Name: PROMAR
NAFAS
Lot 9, Jalan 241
Seksyen 51A
46100 Petaling Jaya
MALAYSIA
Tel: 603 - 7766622
Fax: 603 - 7775533

9. Product Name: Mauri Pinnacle Protein Insect Lure (420g/litre protein, Low Salt)
Mauri Yeast Australia Pty. Ltd
P.O. Box 450 or Stephens Street
Toowoomba, Queensland, Australia 4350
Tel.: +61 7 4632 3500
FAX: +61 7 4639 2031
E-mail: mauritmba@hotmail.com

This product is used widely in Australia and the Pacific. Much of the bait spray development work done in the Pacific and Australia has used this product as a standard.

10. Product Name: Royal Tongalure
Royal Beer Company
Tongatapu
Kingdom of Tonga
Contact: Mr John Sullivan
Tel.: +676 21157/22155
FAX: +676 21552

## Addendum I - Fruit Flies That Respond or Do Not Respond to Known Attractants

### SPECIES THAT DO NOT RESPOND TO KNOWN ATTRACTANTS

*Bactrocera (Afrodacus) montyanus (Munro)*
*Bactrocera (Austrodacus) cucumis (French)*
*Bactrocera (Bactrocera) arecae (Hardy and Adachi)*
*Bactrocera (Bactrocera) barringtoniae (Tryon)*[1]
*Bactrocera (Bactrocera) halfordiae (Tryon)*
*Bactrocera (Bactrocera) latifrons (Hendel)*
*Bactrocera (Bactrocera) quadrisetosa (Bezzi)*
*Bactrocera (Bactrocera) samoae Drew*
*Bactrocera (Bulladacus) aenigmatica (Malloch)*
*Bactrocera (Bulladacus) bullata Drew*
*Bactrocera (Bulladacus) bullifera (Hardy)*
*Bactrocera (Bulladacus) eximia Drew*
*Bactrocera (Bulladacus) gnetum Drew and Hancock*
*Bactrocera (Bulladacus) mcgregori (Bezzi)*
*Bactrocera (Bulladacus) neotigrina Drew & Hancock*
*Bactrocera (Bulladacus) penefurva Drew*
*Bactrocera (Bulladacus) peterseni (Hardy)*
*Bactrocera (Bulladacus) tigrina (May)*
*Bactrocera (Daculus) olea (Rossi)*
*Bactrocera (Gymnodacus) calophylli (Perkins and May)*
*Bactrocera (Paradacus) decipiens (Drew)*
*Bactrocera (Paratridacus) expandens (Walker)*
*Bactrocera (Paratridacus) garciniae (Bezzi)*
*Bactrocera (Tetradacus) minax (Enderlein)*
*Bactrocera (Tetradacus) tsuneonis (Miyake)*
*Bactrocera (Zeugodacus) depressa (Shiraki)*
*Dacus (Didacus) amphoratus (Munro)*
*Dacus (Didacus) binotatus* Loew[2]
*Dacus (Didacus) botianus (Munro)*
*Dacus (Didacus) brevis Coquillett*
*Dacus (Didacus) ciliatus Loew*
*Dacus (Didacus) plagiatus Collart*
*Dacus (Didacus) umbeluzinus (Munro)*

[1] Records of cuelure attraction in error
[2] Needs confirmation.

### SPECIES THAT RESPOND TO CUELURE - 1 of 3

*Bactrocera (Afrodacus) hypomelaina* Drew
*Bactrocera (Afrodacus) jarvisi* (Tryon)
*Bactrocera (Afrodacus) minuta (*Drew*)*
*Bactrocera (Afrodacus) ochracea* Drew
*Bactrocera (Asiadacus) apicalis* (Meijere)
*Bactrocera (Asiadacus) maculifacies* (Hardy)
*Bactrocera (Asiadacus) melanopsis* (Hardy)
*Bactrocera (Bactrocera) abdonigella* (Drew)
*Bactrocera (Bactrocera) abscondita* (Drew & Hancock)
*Bactrocera (Bactrocera) abundans* Drew
*Bactrocera (Bactrocera) aemula* Drew
*Bactrocera (Bactrocera) aeroginosa* (Drew & Hancock)
*Bactrocera (Bactrocera) affinidorsalis* (Hardy)
*Bactrocera (Bactrocera) albistrigata* (Meijere)
*Bactrocera (Bactrocera) allwoodi* (Drew)
*Bactrocera (Bactrocera) alyxiae*(May)
*Bactrocera (Bactrocera) ampla* (Drew)
*Bactrocera (Bactrocera) andamanensis* (Kapoor)
*Bactrocera (Bactrocera) anfracta* Drew
*Bactrocera (Bactrocera) anomala* (Drew)
*Bactrocera (Bactrocera) anthracina* (Drew)
*Bactrocera (Bactrocera) antigone* (Drew & Hancock)
*Bactrocera (Bactrocera) aquilonis* (May)
*Bactrocera (Bactrocera) assita* Drew
*Bactrocera (Bactrocera) aterrima* (Drew)
*Bactrocera (Bactrocera) atriliniellata* Drew
*Bactrocera (Bactrocera) aurantiaca* (Drew & Hancock)
*Bactrocera (Bactrocera) beckerae* (Hardy)
*Bactrocera (Bactrocera) bimaculata* Drew & Hancock
*Bactrocera (Bactrocera) breviaculeus* (Hardy)
*Bactrocera (Bactrocera) brevistriata* (Drew)
*Bactrocera (Bactrocera) bryoniae* (Tryon)
*Bactrocera (Bactrocera) caledoniensis* Drew
*Bactrocera (Bactrocera) carbonaria* (Hendel)[1]
*Bactrocera (Bactrocera) cibodasae* Drew & Hancock
*Bactrocera (Bactrocera) cinnamea* Drew
*Bactrocera (Bactrocera) circamusae* Drew
*Bactrocera (Bactrocera) cognata* (Hardy & Adachi)
*Bactrocera (Bactrocera) congener* Drew
*Bactrocera (Bactrocera) curreyi* Drew
*Bactrocera (Bactrocera) curvipennis* (Froggatt)
*Bactrocera (Bactrocera) decumana (*Drew*)*
*Bactrocera (Bactrocera) distincta* (Malloch)
*Bactrocera (Bactrocera) dyscrita* (Drew)
*Bactrocera (Bactrocera) enochra* (Drew)
*Bactrocera (Bactrocera) epicharis* (Hardy)
*Bactrocera (Bactrocera) erubescentis* (Drew &Hancock)
*Bactrocera (Bactrocera) facialis* (Coquillett)
*Bactrocera (Bactrocera) fagraea* (Tryon)
*Bactrocera (Bactrocera) frauenfeldi* (Schiner)
*Bactrocera (Bactrocera) fuliginus* (Drew & Hancock)
*Bactrocera (Bactrocera) fulvicauda* (Perkins)
*Bactrocera (Bactrocera) fulvifemur* Drew & Hancock
*Bactrocera (Bactrocera) furfurosa* Drew
*Bactrocera (Bactrocera) furvescens* Drew
*Bactrocera (Bactrocera) furvilineata* Drew
*Bactrocera (Bactrocera) fuscitibia* Drew & Hancock

## SPECIES THAT RESPOND TO CUELURE (continued - 2 of 3)

*Bactrocera (Bactrocera) gombokensis* Drew & Hancock
*Bactrocera (Bactrocera) holtmanni* (Hardy)
*Bactrocera (Bactrocera) inconstans* Drew
*Bactrocera (Bactrocera) indecora* (Drew)
*Bactrocera (Bactrocera) kinabalu* Drew & Hancock
*Bactrocera (Bactrocera) kirki* (Froggatt)
*Bactrocera (Bactrocera) kraussi* (Hardy)
*Bactrocera (Bactrocera) lata* (Perkins)
*Bactrocera (Bactrocera) lateritaenia* Drew & Hancock
*Bactrocera (Bactrocera) laticosta* Drew
*Bactrocera (Bactrocera) latissima* Drew
*Bactrocera (Bactrocera) limbifera* (Bezzi)
*Bactrocera (Bactrocera) lineata* (Perkins)
*Bactrocera (Bactrocera) lombokensis* Drew & Hancock
*Bactrocera (Bactrocera) longicornis* Macquart
*Bactrocera (Bactrocera) luzonae* (Hardy & Adachi)
*Bactrocera (Bactrocera) makilingensis* Drew & Hancock
*Bactrocera (Bactrocera) malaysiensis* Drew & Hancock
*Bactrocera (Bactrocera) manskii* (Perkins & May)
*Bactrocera (Bactrocera) melanotus* (Coquillett)
*Bactrocera (Bactrocera) melastomatos* Drew & Hancock
*Bactrocera (Bactrocera) merapiensis* Drew & Hancock
*Bactrocera (Bactrocera) moluccensis* (Perkins)
*Bactrocera (Bactrocera) morobiensis* Drew
*Bactrocera (Bactrocera) morula* Drew
*Bactrocera (Bactrocera) mucronis* (Drew)
*Bactrocera (Bactrocera) mulyonoi* (Hardy)
*Bactrocera (Bactrocera) neocognata* Drew & Hancock
*Bactrocera (Bactrocera) neohumeralis* (Hardy)
*Bactrocera (Bactrocera) nigrescentis* (Drew)
*Bactrocera (Bactrocera) nigrotibialis* (Perkins)
*Bactrocera (Bactrocera) obfuscata* Drew
*Bactrocera (Bactrocera) oblineata* Drew
*Bactrocera (Bactrocera) obscura* (Malloch)
*Bactrocera (Bactrocera) parafrauenfeldi* Drew
*Bactrocera (Bactrocera) paramusae* Drew
*Bactrocera (Bactrocera) passiflorae* (Froggatt)
*Bactrocera (Bactrocera) pedestris* (Bezzi)
*Bactrocera (Bactrocera) penecognata* Drew & Hancock
*Bactrocera (Bactrocera) peninsularis* (Drew & Hancock)
*Bactrocera (Bactrocera) perkinsi* (Drew & Hancock)
*Bactrocera (Bactrocera) phaea* (Drew)
*Bactrocera (Bactrocera) pisinna* Drew
*Bactrocera (Bactrocera) propinqua* (Hardy & Adachi)
*Bactrocera (Bactrocera) pseudocucurbitae* White
*Bactrocera (Bactrocera) pseudodistincta* (Drew)
*Bactrocera (Bactrocera) psidii* (Froggatt)
*Bactrocera (Bactrocera) pusilla* (Hardy)
*Bactrocera (Bactrocera) quadrata* (May)
*Bactrocera (Bactrocera) quasisilvicola* Drew
*Bactrocera (Bactrocera) recurrens* (Hering)
*Bactrocera (Bactrocera) reduncа* (Drew)
*Bactrocera (Bactrocera) rhabdota* Drew
*Bactrocera (Bactrocera) robertsi* Drew
*Bactrocera (Bactrocera) robiginosa* (May)
*Bactrocera (Bactrocera) rubigina* (Wang and Zhao)
*Bactrocera (Bactrocera) rufescens* (May)
*Bactrocera (Bactrocera) rufofuscula* (Drew & Hancock)
*Bactrocera (Bactrocera) rufula* (Hardy)
*Bactrocera (Bactrocera) russeola* (Drew & Hancock)
*Bactrocera (Bactrocera) sembaliensis* Drew & Hancock
*Bactrocera (Bactrocera) silvicola* (May)
*Bactrocera (Bactrocera) simulata* (Malloch)
*Bactrocera (Bactrocera) sumbawaensis* Drew & Hancock
*Bactrocera (Bactrocera) thistletoni* Drew
*Bactrocera (Bactrocera) tinomiscii* Drew
*Bactrocera (Bactrocera) trifaria* (Drew)
*Bactrocera (Bactrocera) trifasciata* (Hardy)
*Bactrocera (Bactrocera) trilineola* Drew
*Bactrocera (Bactrocera) trivialis* (Drew)
*Bactrocera (Bactrocera) tryoni* (Froggatt)
*Bactrocera (Bactrocera) turneri* Drew
*Bactrocera (Bactrocera) unifasciata* (Malloch)
*Bactrocera (Bactrocera) unilineata* Drew
*Bactrocera (Bactrocera) usitata* Drew & Hancock
*Bactrocera (Bactrocera) ustulata* Drew
*Bactrocera (Bactrocera) varipes* (Malloch)
*Bactrocera (Bactrocera) vishnu* Drew & Hancock
*Bactrocera (Bactrocera) vulgaris* (Drew)
*Bactrocera (Gymnodacus) petila* Drew
*Bactrocera (Javadacus) scutellaria* (Bezzi)
*Bactrocera (Javadacus) trilineata* (Hardy)
*Bactrocera (Niuginidacus) singularis* Drew
*Bactrocera (Papuodacus) neopallescentis* Drew
*Bactrocera (Paradacus) abdopallescens* (Drew)
*Bactrocera (Paradacus) angustifinis* (Hardy)
*Bactrocera (Paradacus) aurantiventer* Drew
*Bactrocera (Paradacus) citroides* Drew
*Bactrocera (Paradacus) longicaudata* (Perkins)[2]
*Bactrocera (Semicallantra) aquila* Drew
*Bactrocera (Sinodacus) angusticostata* Drew
*Bactrocera (Sinodacus) buvittata* Drew
*Bactrocera (Sinodacus) chonglui* (Chao & Lin)
*Bactrocera (Sinodacus) hochii* (Zia)
*Bactrocera (Sinodacus) infesta* (Enderlein)
*Bactrocera (Sinodacus) paulula* Drew
*Bactrocera (Sinodacus) perpusilla* (Drew)
*Bactrocera (Sinodacus) qiongana* (Chao & Lin)
*Bactrocera (Sinodacus) quaterna* (Wang)
*Bactrocera (Sinodacus) salamander* (Drew & Hancock)
*Bactrocera (Sinodacus) strigifinis* (Walker)
*Bactrocera (Sinodacus) surrufula* Drew
*Bactrocera (Sinodacus) transversa* (Hardy)
*Bactrocera (Sinodacus) triangularis* (Drew)
*Bactrocera (Sinodacus) univittata* (Drew)
*Bactrocera (Zeugodacus) abdoangusta* (Drew)

## SPECIES THAT RESPOND TO CUELURE (continued - 3 of 3)

*Bactrocera (Zeugodacus) abnormis* (Hardy)
*Bactrocera (Zeugodacus) amoena* (Drew)
*Bactrocera (Zeugodacus) atrifacies* (Perkins)
*Bactrocera (Zeugodacus) bogorensis* (Hardy)
*Bactrocera (Zeugodacus) brachus* (Drew)
*Bactrocera (Zeugodacus) caudata* (Fabricius)
*Bactrocera (Zeugodacus) chorista* (May)
*Bactrocera (Zeugodacus) cilifera* (Hendel)
*Bactrocera (Zeugodacus) cucurbitae* (Coquillett)
*Bactrocera (Zeugodacus) curta* (Drew)
*Bactrocera (Zeugodacus) daula* Drew
*Bactrocera (Zeugodacus) diaphora* (Hendel)
*Bactrocera (Zeugodacus) dubiosa* (Hardy)
*Bactrocera (Zeugodacus) elegantula* (Hardy)
*Bactrocera (Zeugodacus) emittens* (Walker)
*Bactrocera (Zeugodacus) fallacis* (Drew)
*Bactrocera (Zeugodacus) gracilis* (Drew)
*Bactrocera (Zeugodacus) heinrichi* (Hering)
*Bactrocera (Zeugodacus) incisa* (Walker)
*Bactrocera (Zeugodacus) ishigakiensis* (Shiraki)
*Bactrocera (Zeugodacus) isolata* (Hardy)
*Bactrocera (Zeugodacus) macrovittata* Drew
*Bactrocera (Zeugodacus) persignata* (Hardy)
*Bactrocera (Zeugodacus) reflexa* (Drew)
*Bactrocera (Zeugodacus) scutellaris* (Bezzi)
*Bactrocera (Zeugodacus) scutellata* (Hendel)
*Bactrocera (Zeugodacus) sicieni* (Chao and Lin)
*Bactrocera (Zeugodacus) synnephes* (Hendel)[3]
*Bactrocera (Zeugodacus) tau* (Walker)
*Bactrocera (Zeugodacus) trichota* (May)
*Bactrocera (Zeugodacus) vultus* (Hardy)
*Bactrocera (Zeugodacus) yoshimotoi* (Hardy)[4]
*Dacus (Callantra) ambonensis* Drew & Hancock
*Dacus (Callantra) axanus* (Hering)
*Dacus (Callantra) calirayae* Drew & Hancock
*Dacus (Callantra) capillaris* (Drew)
*Dacus (Callantra) discors* (Drew)
*Dacus (Callantra) formosanus* (Tseng and Chu)
*Dacus (Callantra) lagunae* Drew & Hancock
*Dacus (Callantra) leongi* Drew & Hancock
*Dacus (Callantra) longicornis* (Wiedemann)
*Dacus (Callantra) mayi* (Drew)
*Dacus (Callantra) nanggalae* Drew & Hancock
*Dacus (Callantra) ooii* Drew & Hancock
*Dacus (Callantra) ramanii* Drew & Hancock
*Dacus (Callantra) siamensis* Drew & Hancock
*Dacus (Callantra) solomonensis* (Malloch)
*Dacus (Callantra) sphaeroidalis* (Bezzi)
*Dacus (Callantra) tenebrosus* Drew & Hancock
*Dacus (Callantra) trimacula* (Wang)
*Dacus (Callantra) vijaysegarani* Drew & Hancock
*Dacus (Dacus) absonifacies* (May)
*Dacus (Dacus) alarifumidus* Drew
*Dacus (Dacus) badius* Drew
*Dacus (Dacus) bakingiliensis* Hancock
*Dacus (Dacus) bellulus* Drew *and* Hancock
*Dacus (Dacus) bivittatus* (Bigot)
*Dacus (Dacus) concolor* Drew
*Dacus (Dacus) demmerezi* (Bezzi)
*Dacus (Dacus) diastatus* Munro
*Dacus (Dacus) durbanensis* Munro
*Dacus (Dacus) eclipsus* (Bezzi)
*Dacus (Dacus) humeralis* (Bezzi)
*Dacus (Dacus) ikelenge* Hancock
*Dacus (Dacus) newmani* (Perkins)
*Dacus (Dacus) pecropsis* Munro
*Dacus (Dacus) pleuralis* Collart[5]
*Dacus (Dacus) punctatifrons* Karsch
*Dacus (Dacus) sakeji* Hancock
*Dacus (Dacus) santongae* Drew & Hancock
*Dacus (Dacus) secamoneae* Drew
*Dacus (Dacus) signatifrons* (May)
*Dacus (Dacus) telfaireae* (Bezzi)
*Dacus (Dacus) xanthopterus* (Bezzi)
*Dacus (Didacus) aequalis* Coquillett
*Dacus (Didacus) africanus* Adams
*Dacus (Didacus) chiwira* Hancock
*Dacus (Didacus) devure* Hancock
*Dacus (Didacus) dissimilis* Drew
*Dacus (Didacus) eminus* Munro
*Dacus (Didacus) famona* Hancock
*Dacus (Didacus) frontalis* Becker
*Dacus (Didacus) hardyi* Drew
*Dacus (Didacus) kariba* Hancock
*Dacus (Didacus) langi* Curran
*Dacus (Didacus) pallidilatus* Munro
*Dacus (Didacus) palmerensis* Drew

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[1] *B. atramentata* (Hering) is a synonym.
[2] *D. vinnulus* Hardy is a synonym.
[3] *D. ubiquitus* Hardy is a synonym.
[4] Needs confirmation.
[5] *D. masaicus* Munro is a synonym.

## SPECIES ATTRACTED TO VERT-LURE (methy-p-hydroxybenzoate)

*Dacus (Didacus) vertebratus* Bezzi

## SPECIES THAT ARE ATTRACTED TO METHYL EUGENOL

*Bactrocera (Apodacus) cheesmanae* (Perkins)
*Bactrocera (Apodacus) neocheesmanae* Drew
*Bactrocera (Apodacus) visenda* (Hardy)
*Bactrocera (Bactrocera) abdolonginqua* (Drew)
*Bactrocera (Bactrocera) aethriobasis* (Hardy)
*Bactrocera (Bactrocera) affinis* (Hardy)
*Bactrocera (Bactrocera) amplexiseta* (May)
*Bactrocera (Bactrocera) atrifemur* Drew & Hancock
*Bactrocera (Bactrocera) bancroftii* (Tryon)
*Bactrocera (Bactrocera) batemani* Drew
*Bactrocera (Bactrocera) biarcuata* (Walker)
*Bactrocera (Bactrocera) cacuminata* (Hering)
*Bactrocera (Bactrocera) carambolae* Drew & Hancock
*Bactrocera (Bactrocera) caryeae* (Kapoor)
*Bactrocera (Bactrocera) collita* Drew & Hancock
*Bactrocera (Bactrocera) confluens* (Drew)
*Bactrocera (Bactrocera) correcta* (Bezzi)
*Bactrocera (Bactrocera) curvifera* (Walker)
*Bactrocera (Bactrocera) dapsiles* Drew
*Bactrocera (Bactrocera) decurtans* (May)
*Bactrocera (Bactrocera) diallagma* Drew[1]
*Bactrocera (Bactrocera) diospyri* Drew
*Bactrocera (Bactrocera) dorsalis* (Hendel)
*Bactrocera (Bactrocera) ebenea* (Drew)
*Bactrocera (Bactrocera) endiandrae* (Perkins and May)
*Bactrocera (Bactrocera) floresiae* Drew & Hancock
*Bactrocera (Bactrocera) froggatti* (Bezzi)
*Bactrocera (Bactrocera) fuscalata* Drew
*Bactrocera (Bactrocera) honiarae* Drew
*Bactrocera (Bactrocera) humilis (*Drew & Hancock*)*
*Bactrocera (Bactrocera) impunctata* (Meijere)
*Bactrocera (Bactrocera) indonesiae* Drew & Hancock
*Bactrocera (Bactrocera) infulata* Drew & Hancock
*Bactrocera (Bactrocera) kandiensis* Drew & Hancock
*Bactrocera (Bactrocera) kelaena* Drew
*Bactrocera (Bactrocera) lampabilis* (Drew)
*Bactrocera (Bactrocera) laticaudus* (Hardy)
*Bactrocera (Bactrocera) latilineola* Drew & Hancock
*Bactrocera (Bactrocera) mayi* (Hardy)
*Bactrocera (Bactrocera) melanogaster* Drew
*Bactrocera (Bactrocera) mimulus* Drew
*Bactrocera (Bactrocera) minuscula* Drew & Hancock
*Bactrocera (Bactrocera) musae* (Tryon)
*Bactrocera (Bactrocera) neonigritus* (Drew)
*Bactrocera (Bactrocera) nigella* (Drew)
*Bactrocera (Bactrocera) nigrescens* (Drew)
*Bactrocera (Bactrocera) occipitalis* (Bezzi)
*Bactrocera (Bactrocera) ochromarginis* (Drew)
*Bactrocera (Bactrocera) ochromarginis* (Drew)
*Bactrocera (Bactrocera) opiliae* (Drew & Hardy)
*Bactrocera (Bactrocera) pallida* (Perkins and May)
*Bactrocera (Bactrocera) papayae* Drew & Hancock
*Bactrocera (Bactrocera) parabarringtoniae* Drew & Hancock
*Bactrocera (Bactrocera) pepisalae* (Froggatt)
*Bactrocera (Bactrocera) philippinensis* Drew & Hancock
*Bactrocera (Bactrocera) picea* (Drew)
*Bactrocera (Bactrocera) prolixa* Drew
*Bactrocera (Bactrocera) reclinata* Drew
*Bactrocera (Bactrocera) retrorsa* Drew
*Bactrocera (Bactrocera) ritsemai* (Weyenbergh)
*Bactrocera (Bactrocera) romigae (*Drew & Hancock*)*
*Bactrocera (Bactrocera) seguyi* (Hering)
*Bactrocera (Bactrocera) sulawesiae* Drew & Hancock
*Bactrocera (Bactrocera) tenuifascia* (May)
*Bactrocera (Bactrocera) tuberculata* (Bezzi)
*Bactrocera (Bactrocera) umbrosa* (Fabricius)
*Bactrocera (Bactrocera) unimacula* Drew & Hancock
*Bactrocera (Bactrocera) unistriata* (Drew)
*Bactrocera (Bactrocera) verbascifoliae* Drew & Hancock
*Bactrocera (Bactrocera) versicolor* (Bezzi)
*Bactrocera (Bactrocera) zonata* (Saunders)
*Bactrocera (Hemigymnodacus) diversa* (Coquillett)
*Bactrocera (Javadacus) melanothoracica* Drew
*Bactrocera (Javadacus) montana* (Hardy)
*Bactrocera (Javadacus) unirufa* Drew
*Bactrocera (Notodacus) xanthodes* (Broun)
*Bactrocera (Paratridacus) alampeta* Drew
*Bactrocera (Paratridacus) atrisetosa* (Perkins)
*Bactrocera (Semicallantra) memnonius* Drew
*Bactrocera (Trypetidacus) invisitata* Drew
*Bactrocera (Zeugodacus) pubescens* (Bezzi)[2]
*Dacus (Callantra) melanohumeralis* Drew
*Dacus (Callantra) pusillus* (May)

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[1] Questionable (see Drew et al 1999).
[2] Two records show it is attracted to ME, but still needs confirming as this is the only *Zeugodacus* to respond to it.

## ATTRACTION TO LURES UNKNOWN - 1 of 4

*Bactrocera (Afrodacus) biguttulus* (Bezzi)
*Bactrocera (Afrodacus) brunnea* (Perkins and May)
*Bactrocera (Afrodacus) grandistylus* Drew & Hancock
*Bactrocera (Afrodacus) lucidus* (Munro)
*Bactrocera (Afrodacus) menanus* (Munro)
*Bactrocera (Afrodacus) nigrivenatus* (Munro)
*Bactrocera (Asiadacus) absoluta* (Walker)
*Bactrocera (Asiadacus) atypica* White & Evenhuis
*Bactrocera (Asiadacus) brachycera* (Bezzi)
*Bactrocera (Bactrocera) abdofuscata* (Drew)
*Bactrocera (Bactrocera) absidata* Drew
*Bactrocera (Bactrocera) aithogaster* Drew
*Bactrocera (Bactrocera) angustifasciata* Drew
*Bactrocera (Bactrocera) armillata* (Hering)
*Bactrocera (Bactrocera) atra* (Malloch)
*Bactrocera (Bactrocera) bidentata* (May)
*Bactrocera (Bactrocera) bifasciata* (Hardy)
*Bactrocera (Bactrocera) buinensis* Drew
*Bactrocera (Bactrocera) buloloensis* Drew
*Bactrocera (Bactrocera) caliginosa* (Hardy)
*Bactrocera (Bactrocera) citima* (Hardy)
*Bactrocera (Bactrocera) commina* Drew
*Bactrocera (Bactrocera) consectorata* Drew
*Bactrocera (Bactrocera) contermina* Drew
*Bactrocera (Bactrocera) contigua* Drew
*Bactrocera (Bactrocera) costalis* (Shiraki)
*Bactrocera (Bactrocera) daruensis* Drew
*Bactrocera (Bactrocera) diaphana* (Hering)
*Bactrocera (Bactrocera) dispar* (Hardy)
*Bactrocera (Bactrocera) dorsaloides* (Hardy and Adachi)
*Bactrocera (Bactrocera) enigmatica* (Hardy)
*Bactrocera (Bactrocera) exspoliata* (Hering)
*Bactrocera (Bactrocera) fergussoniensis* Drew
*Bactrocera (Bactrocera) finitima* Drew
*Bactrocera (Bactrocera) flavipennis* (Hardy)
*Bactrocera (Bactrocera) fuscohumeralis* White & Evenhuis
*Bactrocera (Bactrocera) grandifasciata* White & Evenhuis
*Bactrocera (Bactrocera) heppneri* White
*Bactrocera (Bactrocera) hispidula* (May)
*Bactrocera (Bactrocera) hyalina* (Shiraki)
*Bactrocera (Bactrocera) involuta* (Hardy)
*Bactrocera (Bactrocera) irvingiae* Drew & Hancock
*Bactrocera (Bactrocera) ismayi* Drew
*Bactrocera (Bactrocera) kanchanaburi* Drew & Hancock
*Bactrocera (Bactrocera) lacerata* White & Evenhuis
*Bactrocera (Bactrocera) latilineata* Drew
*Bactrocera (Bactrocera) luteola* (Malloch)
*Bactrocera (Bactrocera) maculigera* Doleschall
*Bactrocera (Bactrocera) megaspilus* (Hardy)
*Bactrocera (Bactrocera) mendosa* (May)
*Bactrocera (Bactrocera) muiri* (Hardy & Adachi)
*Bactrocera (Bactrocera) murrayi* (Perkins)
*Bactrocera (Bactrocera) mutabilis* (May)
*Bactrocera (Bactrocera) neopropinqua* Drew & Hancock
*Bactrocera (Bactrocera) nesiotes* (Munro)
*Bactrocera (Bactrocera) nigroscutata* White & Evenhuis
*Bactrocera (Bactrocera) nigrovittata* Drew
*Bactrocera (Bactrocera) notatagena* (May)
*Bactrocera (Bactrocera) obliqua* (Malloch)
*Bactrocera (Bactrocera) obscurata* (Meijere)
*Bactrocera (Bactrocera) ochrosiae* (Malloch)[1]
*Bactrocera (Bactrocera) osbeckiae* Drew & Hancock
*Bactrocera (Bactrocera) pectoralis* (Walker)
*Bactrocera (Bactrocera) perfusca* (Aubertin)
*Bactrocera (Bactrocera) pernigra* (Ito)
*Bactrocera (Bactrocera) phaleriae* (May)
*Bactrocera (Bactrocera) popondettiensis* Drew
*Bactrocera (Bactrocera) propedistincta* Drew
*Bactrocera (Bactrocera) pulchra* (Tryon)
*Bactrocera (Bactrocera) pyrifoliae* Drew & Hancock
*Bactrocera (Bactrocera) quasipropinqua* Drew & Hancock
*Bactrocera (Bactrocera) raiensis* Drew & Hancock
*Bactrocera (Bactrocera) repanda* Drew
*Bactrocera (Bactrocera) resima* (Drew)
*Bactrocera (Bactrocera) rutila* (Hering)
*Bactrocera (Bactrocera) setinervis* (Malloch)
*Bactrocera (Bactrocera) strigata* (Perkins)
*Bactrocera (Bactrocera) terminaliae* Drew
*Bactrocera (Bactrocera) thailandica* Drew & Hancock
*Bactrocera (Bactrocera) tortuosa* White & Evenhuis
*Bactrocera (Bactrocera) toxopeusi* (Hering)
*Bactrocera (Bactrocera) venefica* (Hering)
*Bactrocera (Bulladacus) aceraglans* White & Evenhuis
*Bactrocera (Bulladacus) aceromata* White & Evenhuis
*Bactrocera (Bulladacus) obtrullata* White & Evenhuis
*Bactrocera (Bulladacus) warisensis* White & Evenhuis
*Bactrocera (Diplodacus) signatifera* (Tryon)
*Bactrocera (Gymnodacus) absona* (Hering)
*Bactrocera (Gymnodacus) amplexus* (Munro)
*Bactrocera (Gymnodacus) continua* (Bezzi)
*Bactrocera (Gymnodacus) hastigerina* (Hardy)
*Bactrocera (Gymnodacus) mesomelas* (Bezzi)
*Bactrocera (Gymnodacus) tillyardi* (Perkins)
*Bactrocera (Gymnodacus) unipunctata* (Malloch)
*Bactrocera (Heminotodacus) dissidens* Drew
*Bactrocera (Hemiparatridacus) abdoaurantiaca* Drew
*Bactrocera (Hemisurstylus) melanoscutata* Drew
*Bactrocera (Hemizeugodacus) abdomininigra* Drew
*Bactrocera (Hemizeugodacus) aglaiae* (Hardy)
*Bactrocera (Hemizeugodacus) arisanica* (Shiraki)
*Bactrocera (Hemizeugodacus) aurea* (May)
*Bactrocera (Hemizeugodacus) ektoalangiae* Drew & Hancock
*Bactrocera (Hemizeugodacus) tetrachaetus* (Bezzi)
*Bactrocera (Javadacus) aberrans* (Hardy)
*Bactrocera (Javadacus) javanensis* (Perkins)
*Bactrocera (Javadacus) maculifemur* (Hering)

## ATTRACTION TO LURES UNKNOWN (continued - 2 of 4)

*Bactrocera (Javadacus) nigrita* (Hardy)
*Bactrocera (Javadacus) pallescentis* (Hardy)
*Bactrocera (Melanodacus) nigra* (Tryon)
*Bactrocera (Melanodacus) satanellus* (Hering)
*Bactrocera (Melanodacus) terminifera* (Walker)
*Bactrocera (Nesodacus) atrichus* (Bezzi)
*Bactrocera (Notodacus) paraxanthodes* Drew & Hancock
*Bactrocera (Papuodacus) complicata* White
*Bactrocera (Paradacus) areolata* (Walker)
*Bactrocera (Paradacus) fulvipes* (Perkins)
*Bactrocera (Paradacus) magnicauda* White & Evenhuis
*Bactrocera (Paradacus) mindanaus* (Bezzi)
*Bactrocera (Paradacus) minima* (Hering)
*Bactrocera (Paradacus) perplexa* (Walker)
*Bactrocera (Paradacus) urens* White
*Bactrocera (Paratridacus) banneri* White
*Bactrocera (Paratridacus) coracina* (Drew)
*Bactrocera (Paratridacus) icelus* (Hardy)
*Bactrocera (Paratridacus) mesonotaitha* Drew
*Bactrocera (Parazeugodacus) abbreviata* (Hardy)
*Bactrocera (Parazeugodacus) bipustulata* (Bezzi)
*Bactrocera (Parazeugodacus) fulvifacies* (Perkins)
*Bactrocera (Parazeugodacus) matsumurai* (Shiraki)
*Bactrocera (Parazeugodacus) pendleburyi* (Perkins)
*Bactrocera (Queenslandacus) exigua* (May)
*Bactrocera (Semicallantra) nigricula* Drew
*Bactrocera (Sinodacus) emarginata* (Perkins)
*Bactrocera (Sinodacus) eurylomata* (Hardy)
*Bactrocera (Sinodacus) jiannana* (Chao & Lin)
*Bactrocera (Sinodacus) sepikae* Drew
*Bactrocera (Sinodacus) watersi* (Hardy)
*Bactrocera (Tetradacus) discipennis* (Walker)
*Bactrocera (Tetradacus) mesonotochra* Drew
*Bactrocera (Tetradacus) neopagdeni* Drew
*Bactrocera (Tetradacus) pagdeni* (Malloch)
*Bactrocera (Tetradacus) splendida* (Perkins)
*Bactrocera (Zeugodacus) ablepharus* (Bezzi)
*Bactrocera (Zeugodacus) ambigua* (Shiraki)
*Bactrocera (Zeugodacus) anchitrichota* Drew
*Bactrocera (Zeugodacus) assamensis* White
*Bactrocera (Zeugodacus) bezziana* (Hering)
*Bactrocera (Zeugodacus) biguttata* (Bezzi)
*Bactrocera (Zeugodacus) buruensis* White
*Bactrocera (Zeugodacus) calumniata* (Hardy)
*Bactrocera (Zeugodacus) connexa* (Hardy)
*Bactrocera (Zeugodacus) diaphoropsis* (Hering)
*Bactrocera (Zeugodacus) duplicata* (Bezzi)
*Bactrocera (Zeugodacus) exornata* (Hering)
*Bactrocera (Zeugodacus) flavipilosa* (Hardy)
*Bactrocera (Zeugodacus) flavopectoralis* (Hering)
*Bactrocera (Zeugodacus) freidbergi* White
*Bactrocera (Zeugodacus) fulvoabdominalis* White & Evenhuis
*Bactrocera (Zeugodacus) gavisa* (Munro)
*Bactrocera (Zeugodacus) hoedi* White
*Bactrocera (Zeugodacus) indentus* (Hardy)
*Bactrocera (Zeugodacus) lipsanus* (Hendel)
*Bactrocera (Zeugodacus) munda* (Bezzi)
*Bactrocera (Zeugodacus) neoelegantula* White
*Bactrocera (Zeugodacus) nigrifacies* (Shiraki)
*Bactrocera (Zeugodacus) okunii* (Shiraki)
*Bactrocera (Zeugodacus) platamus* (Hardy)
*Bactrocera (Zeugodacus) pura* White
*Bactrocera (Zeugodacus) rubella* (Hardy)
*Bactrocera (Zeugodacus) sandaracina* Drew
*Bactrocera (Zeugodacus) scutellina* (Bezzi)
*Bactrocera (Zeugodacus) signata* (Hering)
*Bactrocera (Zeugodacus) sumbensis* (Hering)
*Bactrocera (Zeugodacus) tappanus* (Shiraki)
*Bactrocera (Zeugodacus) timorensis* (Perkins)
*Bactrocera (Zeugodacus) trimaculata* (Hardy)
*Bactrocera (Zeugodacus) unilateralis* Drew
*Bactrocera (Zeugodacus) vargus* (Hardy)
*Dacus (Callantra) atrimarginatus* White
*Dacus (Callantra) axanthinus* White & Evenhuis
*Dacus (Callantra) bannatus* (Wang)
*Dacus (Callantra) bispinosa* (Wang)
*Dacus (Callantra) conopsoides* (Meijere)
*Dacus (Callantra) crabroniformis* (Bezzi)
*Dacus (Callantra) discophorus* (Hering)
*Dacus (Callantra) esakii* (Shiraki)
*Dacus (Callantra) feijeni* White
*Dacus (Callantra) icariiformis* (Enderlein)
*Dacus (Callantra) impar* (Drew)
*Dacus (Callantra) indecorus* (Hardy)
*Dacus (Callantra) infernus* (Hardy)
*Dacus (Callantra) insulosus* Drew & Hancock
*Dacus (Callantra) maculipterus* White
*Dacus (Callantra) murphyi* White
*Dacus (Callantra) nummularius* (Bezzi)
*Dacus (Callantra) pedunculatus* (Bezzi)
*Dacus (Callantra) petioliformus* (May)
*Dacus (Callantra) pictus* (Hardy)
*Dacus (Callantra) polistiformis* (Senior-White)
*Dacus (Callantra) pullus* (Hardy)
*Dacus (Callantra) satanas* (Hering)
*Dacus (Callantra) sinensis* (Wang)
*Dacus (Callantra) subsessilis* (Bezzi)
*Dacus (Callantra) vittatus* (Hardy)
*Dacus (Callantra) wallacei* White
*Dacus (Dacus) adustus* Munro
*Dacus (Dacus) alulapictus* Drew
*Dacus (Dacus) ambliquus* Munro
*Dacus (Dacus) aneuvittata* (Drew)
*Dacus (Dacus) armatus* Fabricius
*Dacus (Dacus) bequaeti* Collart
*Dacus (Dacus) bombastus* Hering
*Dacus (Dacus) chrysomphalus* (Bezzi)
*Dacus (Dacus) claricognatus* (Munro)

## ATTRACTION TO LURES UNKNOWN (continued - 3 of 4)

*Dacus (Dacus) clinophlebs* Hendel
*Dacus (Dacus)* Collarti Munro
*Dacus (Dacus) croceus* Munro
*Dacus (Dacus) cyathus* (Munro)
*Dacus (Dacus) disjunctus* (Bezzi)
*Dacus (Dacus) dubisitatus* Munro
*Dacus (Dacus) etiennellus* Munro
*Dacus (Dacus) flavicrus* Graham
*Dacus (Dacus) fumosus* Collart
*Dacus (Dacus) fuscinervis* Malloch
*Dacus (Dacus) ghesquierei* Collart
*Dacus (Dacus) guineensis* Hering
*Dacus (Dacus) hargreavesi* Munro
*Dacus (Dacus) kampalensis* (Munro)
*Dacus (Dacus) linearis* Collart
*Dacus (Dacus) melanaspis* (Munro)
*Dacus (Dacus) momordicae* (Bezzi)
*Dacus (Dacus) notalaxus* Munro
*Dacus (Dacus) phantoma* Hering
*Dacus (Dacus) schoutedeni* Collart
*Dacus (Dacus) setilatens* Munro
*Dacus (Dacus) sphaerostigma* (Bezzi)
*Dacus (Dacus) spissus* Munro
*Dacus (Dacus) stentor* Munro
*Dacus (Dacus) taurus* Munro
*Dacus (Dacus) theophrastus* Hering
*Dacus (Dacus) transitorius* Collart
*Dacus (Dacus) veracundus* Collart
*Dacus (Dacus) yangambinus* Munro
*Dacus (Didacus) abbabae* Munro
*Dacus (Didacus) abditus* (Munro)
*Dacus (Didacus) adenionis* (Munro)
*Dacus (Didacus) ancisus* (Munro)
*Dacus (Didacus) andriae* (Munro)
*Dacus (Didacus) arcuatus* Munro
*Dacus (Didacus) aspilus* Bezzi
*Dacus (Didacus) attenuatus* Collart
*Dacus (Didacus) bistrigulatus* Bezzi
*Dacus (Didacus) blepharogaster* Bezzi
*Dacus (Didacus) brevistriga* Walker
*Dacus (Didacus) carnesi* (Munro)
*Dacus (Didacus) cavalhoi* (Munro)
*Dacus (Didacus) ceropegiae* (Munro)
*Dacus (Didacus) cuspidatus* (Munro)
*Dacus (Didacus) elegans* (Munro)
*Dacus (Didacus) elutissimus* Bezzi
*Dacus (Didacus) engoninus* (Munro)
*Dacus (Didacus) fasciolatus* Collart
*Dacus (Didacus) ficicola* Bezzi
*Dacus (Didacus) fonsicanus* (Munro)
*Dacus (Didacus) fuscatus* Wiedemann
*Dacus (Didacus) fuscovittatus* Graham
*Dacus (Didacus) gypsoides* Munro
*Dacus (Didacus) hainanus* (Wang and Zhao)
*Dacus (Didacus) inclytus* (Munro)
*Dacus (Didacus) inopinus* Munro
*Dacus (Didacus) jubatus* (Munro)
*Dacus (Didacus) keiseri* (Hering)
*Dacus (Didacus) lounsburyi* Coquillett
*Dacus (Didacus) maprikensis* Drew
*Dacus (Didacus) mirificus* (Munro)
*Dacus (Didacus) mulgens* Munro
*Dacus (Didacus) nanus* Collart
*Dacus (Didacus) opacatus* Munro
*Dacus (Didacus) opinatus* Munro
*Dacus (Didacus) ortholomatus* (Hardy)
*Dacus (Didacus) ostiofaciens* Munro
*Dacus (Didacus) pamelae* (Munro)
*Dacus (Didacus) panpyrrhus* (Munro)
*Dacus (Didacus) pintadus* (Munro)
*Dacus (Didacus) pullescens* Munro
*Dacus (Didacus) rugatus* Munro
*Dacus (Didacus) serratus* (Munro)
*Dacus (Didacus) siliqualactis* Munro
*Dacus (Didacus) sphaeristicus* Speiser
*Dacus (Didacus) tenebricus* Munro
*Dacus (Didacus) trigonus* Bezzi
*Dacus (Didacus) tubatus* Munro
*Dacus (Didacus) umbrilatus* Munro
*Dacus (Didacus) vansomereni* Munro
*Dacus (Didacus) venetatus* Munro
*Dacus (Didacus) viator* Munro
*Dacus (Didacus) xanthaspis* (Munro)
*Dacus (Didacus) zavattarianus* (Hering)
*Dacus (Leptoxyda) annulatus* Becker
*Dacus (Leptoxyda) apostator* (Hering)
*Dacus (Leptoxyda) apoxanthus* Bezzi
*Dacus (Leptoxyda) bifasciatus* (Hering)
*Dacus (Leptoxyda) chamun* (Munro)
*Dacus (Leptoxyda) chapini* Curran
*Dacus (Leptoxyda) erythraeus* Bezzi
*Dacus (Leptoxyda) externellus* (Munro)
*Dacus (Leptoxyda) freidbergi* (Munro)
*Dacus (Leptoxyda) hamatus* Bezzi
*Dacus (Leptoxyda) hapalus* (Munro)
*Dacus (Leptoxyda) hyalobasis* Bezzi
*Dacus (Leptoxyda) iaspideus* Munro
*Dacus (Leptoxyda) inflatus* Munro
*Dacus (Leptoxyda) inornatus* Bezzi
*Dacus (Leptoxyda) interjectus* (Munro)
*Dacus (Leptoxyda) longistylus* Wiedemann
*Dacus (Leptoxyda) macer* Bezzi
*Dacus (Leptoxyda) marshalli* Bezzi
*Dacus (Leptoxyda) maynei* Bezzi
*Dacus (Leptoxyda) meladassus* (Munro)
*Dacus (Leptoxyda) mochii* Bezzi
*Dacus (Leptoxyda) obesus* Munro
*Dacus (Leptoxyda) persicus* Hendel

## ATTRACTION TO LURES UNKNOWN (continued - 4 of 4)

*Dacus (Leptoxyda) phloginus* (Munro)
*Dacus (Leptoxyda) purpurifrons* Bezzi
*Dacus (Leptoxyda) pusillator* (Munro)
*Dacus (Leptoxyda) retextus* Munro
*Dacus (Leptoxyda) rubicundus* Bezzi
*Dacus (Leptoxyda) rufoscutellatus* (Hering)
*Dacus (Leptoxyda) rufus* Bezzi
*Dacus (Leptoxyda) ruslan* (Hering)
*Dacus (Leptoxyda) scaber* Loew
*Dacus (Leptoxyda) seguyi* (Munro)
*Dacus (Leptoxyda) semisphaerus* Becker
*Dacus (Leptoxyda) sicatoluteus* (Munro)
*Dacus (Leptoxyda) temnopterus* Bezzi
*Dacus (Leptoxyda) triater* Munro
*Dacus (Leptoxyda) woodi* Bezzi
*Dacus (Leptoxyda) xanthopus* Bezzi
*Dacus (Leptoxyda) zavattarii* (Hering)
*Dacus (Metidacus) adenae* (Hering)
*Dacus (Metidacus) amberiens* (Munro)
*Dacus (Metidacus) bidens (*Curran*)*
*Dacus (Metidacus) delicatus* Munro
*Dacus (Metidacus) herensis* (Munro)
*Dacus (Metidacus) lotus* (Bezzi)
*Dacus (Metidacus) partus* (Munro)
*Dacus (Metidacus) pergulariae* Munro
*Dacus (Metidacus) phimis* (Munro)
*Dacus (Metidacus) purus (*Curran*)*
*Dacus (Metidacus) radmirus* Hering
*Dacus (Metidacus) rutilus* Munro
*Dacus (Metidacus) stylifer* (Bezzi)
*Ichneumonopsis burmensis* Hardy
*Monacrostichus citricola* Bezzi
*Monacrostichus malaysiae* Drew & Hancock

[1] Cunningham 1989 and Drew 1974 both cite that *B. ochrosiae* (Malloch) is attracted to cuelure, but Drew (personal communication) expresses his doubts that the earlier citations are accurate.

**Note:** Although the literature may indicated that a given species is attracted to one or several known lures or attractants, quite often there is no indication to what degree that species may be attracted. It should not be assumed that all species listed above respond in the same fashion to the lure. In fact, it would be safer to assume that the response can be quite varied in relation to the actual population that exists. Lure or attractants can be extremely powerful in attracting certain species. Those species that are not attracted to any known lure would be candidates for area-wide control using the SIT.

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