

## Management

**Sanitation of maggot infested fruits:** Collect every day infested and dropped fruit and bury at least 30 cm depth pit or feed to livestock/fish pond or dip in pond or use for biogas or kill in sealed plastic bag to break life cycle.

Collect all fallen and maggots infested fruits regularly, place it in 3'x3'x3' pits, and treat with any insecticide. Such rotting fruit attracts female fruit flies, which are then killed in the pit. To prevent non-target animals from falling into the pit, cover the sides of the pit with mesh nets. Pix Pits should be covered with soil once the harvest is complete because they provide soil nutrient enrichment.

**Male annihilation technique:** For the management and monitoring of fruit flies, the use of male annihilation techniques using parapheromone (methyl eugenol and cue lure as per the target species) traps has been recommended.

**Application of protein bait (food lure):** Spraying protein hydrolysate-based bait, such as GREAT Fruit Fly Bait (25% protein hydrolysate + 0.1% abamectin), which is used as 1 part bait in 2 parts water, on 0.5 to 1 square meters of citrus tree leaf undersides (spot application) among 3 productive citrus trees ten times in weekly intervals. Start spraying 10-15 days after adult emergence. Orchard sanitation measures should be applied at the community level. Area Wide Control Program (AWCP) of fruit fly in community level has shown to be effective for managing Chinese citrus fly (*B. minax*) in citrus orchards.

**Crop/orchard management practices:** Follow recommended orchard management practices including regular pruning, optimum manuring and fertilization, etc. Late maturing varieties such as Valencia Late of sweet orange escape oviposition by *B. minax*. It's critical to maintain weed-free and clean fields (without rotting fruits).

**Tillage:** The maggots of fruit fly pupate in the soil. Tilt the soil under the tree canopies to kill larvae and/or pupae.

**Quarantine measure:** Do not throw the infested fruit anywhere to prevent regeneration of fruit fly adults. Follow quarantine measures strictly (do not take infected citrus fruit where there is no problem of this pest) to prevent entry and spread of pest.

**Exclusion measure:** Bagging of fruit by wax paper or oiled newspaper when flower petals drop after fertilization can prevent egg laying. It is advised in low-height, high-density orchards.

**Botanicals spray:** Spray Neem based (Azadirachtin) product 3-5 ml/lit water in the field/orchard at 15 days interval to deter egg laying.

**Soil treatment:** Soil treatment with crushed neem seed cake 50-60 Kg/ha or Malathion 5 DP 20 kg/ha. to kill maggots after fruit harvest (Jan.-Feb.). Avoid grazing of poultry or other animals inside the orchard for minimum 2 weeks after Malathion application.

**Chemical measures:** Direct spray Dimethoate 30% EC 2 ml per lit water or Abamectin based insecticide like 1.80% EC 1-1.5 gm per lit during May-July in 15 days interval.

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## Identification of common FRUIT FLIES OF CITRUS ECOSYSTEM in Nepal and management measures



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## Identification of common fruit flies of citrus ecosystem in Nepal and management measures

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### Introduction

Fruit fly is a serious pest of fruits and fruit vegetables which is a member of the Diptera: Tephritidae. It lowers fruit yields as well as limits trade in agricultural products. Because fruit flies have a definite preference for parapheromones, accurate identification is essential for the application of effective management techniques. In this folder, the diagnostic features of the common fruit flies prevalent in citrus ecosystem of Nepal and their management measures are presented.

*Bactrocera dorsalis*, *B. zonata*, *Zeugodacus cucurbitae*, *Z. tau* and *Z. scutellaris* are trapped in parapheromone lure traps in citrus orchards. Whereas, *Bactrocera minax* adult fly emerged from reared pupae by the maggots from infested citrus fruits.

### Monitoring

Monitoring of adult fruit flies can be done using parapheromone lures (methyl eugenol and cue lure) 1 trap per ha. whereas *B. minax*, can be trapped by using trap of protein bait (1 trap per ha). Similarly, monitoring of the eggs can be performed by checking egg laying site on the fruit-rind. Punctures with some sticky gum can also be observed. For maggots, the fallen fruits in orchard and maggots inside an opened fruit need to be inspected. Infested fruits are lighter in weight and have holes in the outer rind of the fruit.

### 1. *Bactrocera minax* (Enderlein)

Large sized fruit fly (length: 10-12 mm) with reddish-brown color. This fruit fly species has 3 yellow vittae (2 lateral and 1 medial) present in the scutum, hyaline wing with broad costal band confluent with vein  $R_{4+5}$ , elongated abdomen with bulb shaped ovicape in females.



It is one of the major pests of citrus (lemon, sweet orange and mandarin) in Nepal. It is a univoltine species with longer (5-7 months) diapause period inside soil. Parapheromone lure for attraction: not available, attracted to protein bait.

### 2. *Bactrocera dorsalis* (Hendel)



Medium sized fruit fly (length: 6-7 mm) having reddish-brown/black colored thorax. Two yellow lateral vittae present in the scutum, hyaline wing with narrow, continuous costal band confluent with vein  $R_{2+3}$ , prominent T shaped mark in abdomen. It is widely distributed in Nepal damaging several species of fruit crops. Parapheromone lure for male attraction: methyl eugenol.

### 3. *Bactrocera zonata* (Saunders)

This is smaller sized fruit fly species (length: 5-6 mm) having reddish-brown colored thorax and abdomen. It has two yellow lateral vittae present in the scutum, discontinuous costal band beyond vein  $R_1$  with an apical spot in wing. Parapheromone lure for male attraction: methyl eugenol.



### 4. *Zeugodacus cucurbitae* (Coquillett)

Medium sized (length: 6-7 mm) reddish-brown colored fruit fly having 3 yellow (1 medial and 2 lateral) vittae in the scutum. It has hyaline wing with broad costal band expanded into an apical spot, subapical band present. It is a cosmopolitan and polyphagous species in Nepal damaging several fruit vegetable crops. Parapheromone lure for male attraction: cue lure.



### 5. *Zeugodacus tau* (Walker)

This is medium sized fruit fly (length: 7-8 mm) having brown to black colored thorax. It has 3 yellow vittae (1 medial and 2 lateral), and hyaline wing with broad costal band expanded into an apical spot, subapical band absent. Prominent T shaped mark present in abdomen. It is one of the widely distributed species in Nepal damaging several fruit vegetables crops including cucurbits. Parapheromone lure for male attraction: cue lure.



### 6. *Zeugodacus scutellaris* (Bezzi)

This is medium sized fruit fly (length: 5-6 mm) with black colored body. It has 3 vittae (2 narrow lateral and 1 medial) in the scutum and scutellum with an apical black spot, costal band narrow and apical spot near  $R_{4+5}$  in wing. It is the pest of several fruit vegetables crops including cucurbits in Nepal. Parapheromone lure for male attraction: cue lure.

