

## Queensland Fruit fly *Bactrocera tryoni* (Froggatt): A Destructive Pest of Horticultural Crops

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### SUMMARY

Fruit flies are widely distributed in different regions of the world causing handsome amount of losses in both quality as well as quantity of horticultural crops. They are of quarantine importance and may be monophagous, polyphagous or oligophagous. Queensland fruit fly *Bactrocera tryoni* (Froggatt) (Diptera: Tephritidae) is a wellknown example of polyphagous pest infesting many fruits and vegetable crops but prefers apple the most. It is the most serious and economically damaging tephritid in eastern Australia. It is adapted to wide range of environmental conditions. It overwinters in the adult stage. It is multivoltine in nature. The larva is the damaging stage that feed on the pulp of the fruit remaining inside the fruit. The adult *B. tryoni* flies disperse long distances in the absence of food sources. They are responsive to cue lure traps and thus these traps widely used to manage this pest. The protein bait sprays, parasitoids and entomopathogenic nematodes etc. can be used to manage the pest. The host range, biology, distribution, damage symptoms and management strategies are briefly discussed in this chapter.

### INTRODUCTION

The family Tephritidae is one of the largest families of Diptera and highly diverse with more than 4200 known species in 471 genera (Norrbom *et al.* 1998). The fruit flies are distributed throughout the tropical, subtropical and temperate regions of the world (Christenson and Foote, 1960). Larvae of the subfamilies Dacinae and Trypetinae are frugivorous and feed on fruit pulp of both wild and cultivated plants, hence bearing the name 'fruit flies'. Sometimes these are called Peacock flies due to their habit of strutting about, vibrating their wings and displaying their elaborate wing and body markings (Jena and Sahoo, 2022). Fruit flies exhibit a diverse array of host use patterns that range from strict monophagy to extreme polyphagy. Females of some fruit fly species such as Queensland fruit fly *B. tryoni* oviposit in fruits (Fitt, 1990) and are polyphagous. The fruit fly *B. tryoni* is the major fruit fly pest in Australian horticulture, attacking most fruit and many vegetable crops bananas *Musa spp.*, citrus *Citrus spp.*, coffee *Coffea spp.*, tomato *Solanum lycopersicum* (L.), pome fruit, stone fruit and pepper *Capsicum spp.* (Hancock *et al.* 2000; Clarke *et al.* 2011). It is an Australian native and is currently found only in eastern Australia and on some Pacific islands (Dominiak and Daniels, 2012). The *B. tryoni* has higher fecundity and net reproductive rate, and shorter generation time.

### Synonyms

*Tephritis tryoni*

*Chaetodacus tryoni* var. *sarcocephali*

*Chaetodacus tryoni* var. *juglandis*

### Complex/Sister Species of *B. tryoni*

Sister species are a part of a complex or a group of morphologically similar but biologically distinct species. These are called sibling species. *B. tryoni* has three sibling species, *B. neohumeralis*, *B. aquilonis* and *B. melas*. All of these flies are sympatric i.e. they inhabit the same territory except *B. aquilonas* which inhabits a different geographical area. *B. aquilonas* is an allopatric population of *B. tryoni*. *B. aquilonas* mate during the day and are not pests but *B. tryoni* are pests and mate at night. *B. neohumeralis* and *B. tryoni* are genetically identical.

### Taxonomic position

**Kingdom:** Animalia

**Phylum:** Arthropoda

**Sub-phylum:** Uniramia

**Class:** Insecta  
**Order:** Diptera  
**Family:** Tephritidae  
**Genus:** *Bactrocera*  
**Species:** *B. tryoni*

### Distribution

*Bactrocera tryoni* prefers warm and humid climates. It is distributed in eastern Australia, New Caledonia, French Polynesia, the Pitcairn Islands and the Cook Islands *etc.*

### Host Range

*Bactrocera tryoni* infests plant species belonging to the families Rosaceae apple *Malus domestica* (Borkh), plum *Prunus domestica* (L.), pear *Pyrus communis* (L.), Myrtaceae guava *Psidium guajava* (L.), Solanaceae tomato *Lycopersicon esculentum* (L.) and Cucurbitaceae zucchini *Cucurbita pepo* (L.), cucumber *Cucumis sativus* (L.) *etc.*

### Biology

#### Egg

The adult female of two week old age deposits 6-10 eggs just below the rind of the fruits. Fruits that are sweet, juicy and not acidic preferred the most. It may deposit eggs in the punctures made by other fruit flies. *B. tryoni* females are more likely to bore in to a piece of fruit that other female flies were currently ovipositing in to. Thus, it shows reciprocal altruism as larvae are at an advantage at higher densities. *B. tryoni* strongly prefer to oviposit in to rotting fruit as well as under-ripe fruit. It selects fruits that have an outer layer that is able to be punctured or has already been lesioned. An adult female may lay 100 eggs per day. The incubation period of eggs varies from 2 to 4 days.

#### Maggot

The maggots emerged feed on the pulp of the fruits causing rotting of the fruit finally. The maggots increase in size and reach up to 9 mm in length. The development period of larvae varies from 10 to 31 days depending on the texture of the fruit, nutrient content, type of fruit and the prevailing environmental conditions.

#### Pupae

The mature maggot enters into the soil for pupation. The duration of pupal development varies from one week to one month depending upon the prevailing temperature.

#### Adult

Adults emerge from the soil near the end of the summer season. They are reddish brown in colour, have distinct yellow markings and are typically 5-8 mm in length. They hold their wings horizontally when walking and flick them in a specific, characteristic manner. The wing span of *B. tryoni* ranges from 4.8 to 6.3 mm. They feed on the leaf surface bacteria as a major source of protein. Some evidence suggests that the bacteria and flies are co-evolved. The flies generally mate at dusk. *B. tryoni* does not breed continuously but spend the winter in adult stage. Adult females live many months and up to four to five overlapping generations may occur annually. Adults may live for a year or longer.

#### Dispersal of *B. tryoni*

The majority of *B. tryoni* adults are believed to disperse up to 1 km, although larvae are readily transported in vehicles within infested fruit that pose a threat to many quarantined production areas within suitable climatic zones. Adults can disperse up to 84 km of their own accord. *B. tryoni* also has the potential to spread internationally because of its tolerance of a wide range of climatic conditions and large host range, as well as its tendency to be dispersed by humans at the larval stage inside infested fruit.

Fig 1. *B. tryoni* maleFig 2. *B. tryoni* female

### Nature of Damage

Adult females of *B. tryoni* lay their eggs in to fruit with the help of pointed ovipositor. The larvae emerged from the eggs feed on the pulp of the fruit and undergo several instars. The mature maggots leave the infested fruit and enter in the soil for pupation. The presence of fruit fly larvae causes significant damage to the fruit, often inducing decay and premature fruit drop.

Fig 3. *B. tryoni* larvae in fruit pulp

### Management

- Use of either cue lure or Willson's lure or zingerone pheromone lure trap that attract sexually mature males. *B. tryoni* responds strongly to cue lure/raspberry-ketone and very weakly to zingerone
- Protein bait sprays (PBS) in which proteins are mixed with insecticides and sprayed that attract both males and females of *B. tryoni*
- Use of parasitoids *Fopius arisanus* (Sonan), egg-pupal parasitoid; *Diachasmimorpha kraussii* (Fullaway) and *Diachasmimorpha tryoni* (Cameron) that target late second to early third instar larvae, while *D. longicaudata* (Ashmead) target third instar larvae; *Tetrastichus giffardianus* (Silv.), *Opius humilis* (Silv.), *O. fullawayi* (Silv.), *Melitobia (Syntomosphyrum) indicum* (Silv.) etc.
- Use of EPNs *Steinernema feltiae* (Filipjev), *Steinernema carpocapsae* (Weiser) and *Heterorhabditis bacteriophora* (Poinar).
- Sterile insect technique by releasing irradiated individuals (SIT)
- The release of parasitoids together with SIT
- The combined use of GF-120 bait sprays and biological control using *D. tryoni*
- Use of insecticides such as Permethrin and Malathion

## CONCLUSION

The Queensland fruit fly *B. tryoni* is widely distributed in different regions in Australia. It attacks a wide range of horticultural crops. The maggots of *B. tryoni* feed on the pulp of the fruits remaining inside the fruit. *B. tryoni* generally overwinters in the adult stage and multivoltine completing 3 to 5 generations in a year. It can be managed by the use of cue lure, protein bait spray, use of parasitoids, entomopathogenic nematodes and use of insecticides etc.

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