

# EPPO Datasheet: *Bactrocera zonata*

Last updated: 2021-04-28

## IDENTITY

**Preferred name:** *Bactrocera zonata*

**Authority:** (Saunders)

**Taxonomic position:** Animalia: Arthropoda: Hexapoda: Insecta:  
Diptera: Tephritidae

**Other scientific names:** *Dacus zonatus* (Saunders), *Dasyneura zonata* Saunders, *Rivellia persicae* Bigot, *Strumeta zonata* (Saunders)

**Common names:** guava fruit fly, peach fruit fly

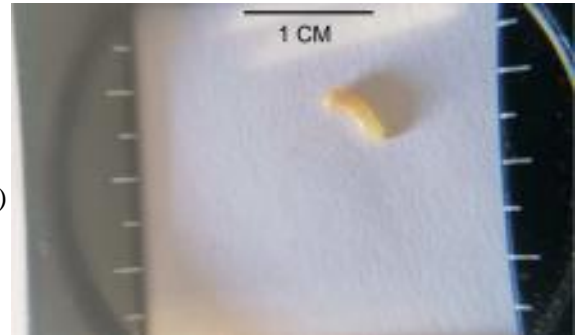
[view more common names online...](#)

**EPPO Categorization:** A2 list

[view more categorizations online...](#)

**EU Categorization:** A1 Quarantine pest (Annex II A)

**EPPO Code:** DACUZO



[more photos...](#)

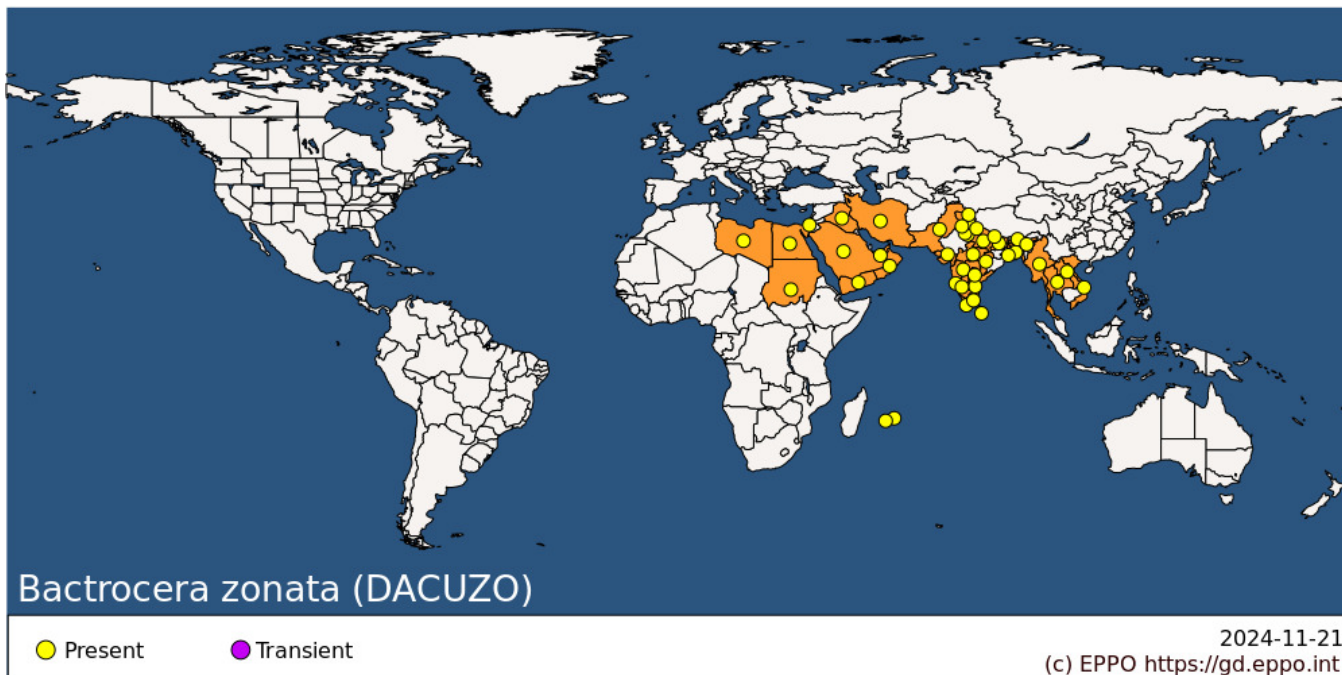
## HOSTS

*Bactrocera zonata* is a polyphagous species reported from a large range of commercial and wild hosts (Allwood *et al.*, 1999). The range of *B. zonata* in Africa, where it was introduced, is much more restricted than in its native area but includes a number of commercially important fruits. The USDA Compendium of Fruit Fly Host Information (CoFFHI) (Culliney *et al.*, 2017) provides an extensive host list with detailed references.

**Host list:** *Abelmoschus esculentus*, *Aegle marmelos*, *Azalia xylocarpa*, *Annona reticulata*, *Annona squamosa*, *Careya arborea*, *Carica papaya*, *Citrullus lanatus*, *Citrus reticulata*, *Citrus x aurantium* var. *paradisi*, *Citrus x aurantium* var. *sinensis*, *Citrus x aurantium*, *Citrus x limon*, *Coccinia grandis*, *Cucumis sativus*, *Cucurbita* sp., *Cydonia oblonga*, *Diospyros* sp., *Elaeocarpus hygrophilus*, *Eriobotrya japonica*, *Ficus carica*, *Grewia asiatica*, *Lagenaria siceraria*, *Luffa acutangula*, *Malpighia emarginata*, *Malus domestica*, *Mangifera indica*, *Manilkara zapota*, *Mimusops elengi*, *Momordica charantia*, *Persea americana*, *Phoenix dactylifera*, *Prunus armeniaca*, *Prunus persica*, *Psidium cattleianum*, *Psidium guajava*, *Punica granatum*, *Putranjiva roxburghii*, *Pyrus communis*, *Pyrus ussuriensis*, *Syzygium jambos*, *Syzygium samarangense*, *Terminalia catappa*, *Ziziphus jujuba*, *Ziziphus mauritiana*

## GEOGRAPHICAL DISTRIBUTION

*Bactrocera zonata* is an Asian species widespread on the Indian subcontinent and into Southeast Asia. It is also widely distributed in the Middle East (Iran, Iraq) and on the Arabian Peninsula. It was introduced to Africa where it is currently limited to Egypt, Libya and Sudan in the northeast of mainland Africa, as well as on the islands of Mauritius and Reunion in the Western Indian Ocean. The occurrence in Israel is in isolated areas.



**EPPO Region:** Israel

**Africa:** Egypt, Libya, Mauritius, Reunion, Sudan

**Asia:** Bangladesh, Bhutan, India (Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Telangana, Uttarakhand, Uttar Pradesh, West Bengal), Iran, Iraq, Israel, Laos, Myanmar, Nepal, Oman, Pakistan, Saudi Arabia, Sri Lanka, Thailand, United Arab Emirates, Vietnam, Yemen

**BIOLOGY**

The general life cycle is similar to those of other *Bactrocera* species infesting fruits: eggs are laid below the skin of the host fruit. Three larval stages develop inside the fruit, feeding on the plant tissue. Once mature the third instar larva will leave the fruit, dig down into the soil and turn into a pupa enclosed in a puparium. The adult fly will emerge from the puparium. Based on experiments conducted in La Réunion *Bactrocera zonata* can complete its life cycle in about 61 days at 25°C (Duyck *et al.*, 2007). Females start laying eggs in fruit between 2 and 3 weeks after adult emergence. The maximum number of eggs laid per day by one female is 13 (Duyck *et al.*, 2007). The total number of eggs laid in a lifetime of a female was calculated to be 303 (Duyck *et al.*, 2007). The total duration of the larval stages varies from 4 to 30 days at 35°C and 15°C respectively (Duyck *et al.*, 2004). According to Qureshi *et al.* (1993) the immature stages cannot develop at temperatures below 15°C. Once mature the third instar larvae burrow into the soil where they pupate. In areas where winter conditions occur, the winter is passed in the pupal stage according to Rahman *et al.* (1993). The pupal development takes 8 and 53 days, at 35°C and 15°C respectively (Duyck *et al.*, 2004). Females of *B. zonata* can live for up to 18 weeks.

**DETECTION AND IDENTIFICATION**

**Symptoms**

Attacked fruit have tiny oviposition punctures, but these and other symptoms of damage are often difficult to detect in the early stages of infestation. Considerable damage may occur inside the fruit before symptoms are visible externally, often as networks of tunnels accompanied by rotting.

**Morphology**

*Larva*

Fruit fly larvae in general have a typical shape, i.e., cylindrical maggot-shape, elongate, anterior end narrowed and somewhat recurved ventrally, with anterior mouth hooks, and flattened caudal end. Their length varies from 5 to 15 mm. The 3rd-instar larva has been described by Carroll *et al.* (2004). White & Elson-Harris (1992) provide a key to 3<sup>rd</sup>-instar larvae which is useful for an identification to genus level. A key to this and other tephritids for the 3<sup>rd</sup>-instar larvae is available in Balmès & Mouttet (2017).

**Adult** (after diagnostic description given by Drew & Romig (2013) with additional character states by White, 2006)

#### Male

Face fulvous with a pair of medium-sized oval black spots; postpronotal lobes and notopleura yellow; scutum red-brown with pale fuscous patterning posteriorly; medium-width parallel-sided lateral postsutural yellow vittae ending at or just behind intra-alar seta; medial postsutural yellow vitta absent; mesopleural stripe reaching to or almost to anterior notopleural seta dorsally; scutellum yellow (except for basal dark margin); legs with all segments entirely fulvous except apices of femora red-brown and hind tibiae pale fuscous to fuscous; wing with cells bc and c colourless, and entirely devoid of microtrichia; a narrow fuscous costal band confluent with R2+3 and ending at apex of this vein, small oval fuscous spots across apex of R4+5; anal streak absent, at most reduced to a pale tint within cell cup; supernumerary lobe of medium development; abdominal terga III-V red-brown with a 'T' pattern consisting of a narrow transverse black band across anterior margin of tergum III (often broken in the central region) and narrow medial longitudinal black band over all three terga (often reduced to a stripe over parts of terga IV and V), narrow anterolateral fuscous corners of terga IV and V, a pair of oval red-brown shining spots on tergum V.

#### Female

As for male in the general body colour patterns. Supernumerary lobe weak; pecten absent from abdominal tergum III. Ovipositor basal segment red-brown, dorsoventrally compressed and tapering posteriorly in dorsal view; aculeus apex needle shaped.

A diagnostic protocol for this species has been published by EPPO (2013).

#### **DNA barcoding**

DNA barcoding may be used for the molecular identification of *B. zonata*, however, it should be noted the Barcoding Index Number Systems (BINs) in which this species is represented, also include a few unidentified / possibly misidentified reference sequences. Sequences are available in the [Barcode of Life Data Systems \(BOLD\)](#) and in [EPPO-Q-Bank](#).

#### **Detection and inspection methods**

Males are attracted to methyl eugenol. Both sexes can be monitored by traps baited with protein-based attractants. An EPPO Standard PM 9/011 (1) *Bactrocera zonata*: procedure for official control includes details on trapping (EPPO, 2010). Detection is also possible by examination of fruit for oviposition punctures and then rearing the larvae through to the adult stage.

#### **PATHWAYS FOR MOVEMENT**

Transport of infested fruits is the main means of movement and dispersal to previously uninfested areas. The natural dispersal ability of *B. zonata* is unclear. Qureshi *et al.* (1975) report records of up to 40 km of spread by individual flies in experiments with sterile males. This seems to be the maximum and possibly a rare occurrence as Hicks *et al.* (2019) recently published a review stating that long distance dispersal (50-100 km) for several *Bactrocera* species is largely based on erroneous citations. Dispersal up to 2 km is considered more typical.

#### **PEST SIGNIFICANCE**

## Economic impact

*B. zonata* is polyphagous, but is particularly a pest of peach, mango and guava. The impact of *B. zonata* appears to be variable according to the region and presence or absence of other polyphagous species. In Egypt, losses can be substantial, especially on mangoes, citrus and peaches reaching levels of 20% (Cayol *et al.*, 2002; Saafan *et al.*, 2005). In Pakistan and northern parts of India *B. zonata* is considered more important than *Bactrocera dorsalis* (Qureshi *et al.*, 1991; Kapoor, 1993) causing major losses in peach, apricot, guava and figs; while in Sri Lanka it does not seem to be an important pest (Tsuruta *et al.*, 1997). Siddiqui *et al.* (2003) reports damage up to 50% to guava in Pakistan.

In countries where the pest is present, it was reported that *B. zonata* could outcompete other tephritid fruit fly species such as *Ceratitis capitata* (Duyck *et al.*, 2007).

## Control

Management for this species includes the general control measures for *Bactrocera* spp. (see Vargas *et al.* 2015 for an overview of management options). These include sanitation (to gather all fallen and infested host fruits and destroy them). Insecticidal protection is possible by using a cover spray or a bait spray. Bait sprays work on the principle that both male and female tephritids are strongly attracted to a protein source from which ammonia emanates. Bait sprays have the advantage over cover sprays in that they can be applied as a spot treatment so that the flies are attracted to the insecticide and there is minimal impact on natural enemies and other beneficials. Singh & Sharma (2016) report on the positive impact of such an integrated pest management (IPM) program (including ploughing, sanitation, bait sprays and male annihilation technique) against *B. zonata* (together with *B. dorsalis*) on Kinnow Mandarin (*Citrus deliciosa*) in Punjab (India).

## Phytosanitary risk

*Bactrocera zonata* is a known pest of several commercial fruit crops in the area where it is present. It can be moved in trade with infested fruit. With the isolated occurrences in Israel, *B. zonata* is already present in the EPPO region. EFSA analyzed the distribution models published for *B. zonata* and concluded that several southern parts of the EPPO region, around the Mediterranean are climatically suitable for potential establishment (Baker *et al.*, 2019). Transient populations could also have impacts on export of host fruit from the EPPO region. EFSA compiled a pest report to support the ranking of *Bactrocera zonata* as a priority pest for the EU (Baker *et al.*, 2019).

## PHYTOSANITARY MEASURES

Consignments of fruits from countries or regions where *B. zonata* occurs should be inspected for symptoms of infestation and those suspected should be cut open in order to look for larvae. Possible measures include that such fruits should come from an area where *B. zonata* does not occur, or from a place of production found free from the pest by regular inspection in the 3 months before harvest. Plants transported with roots from countries or regions where *B. zonata* occurs should be free from soil, or the soil should be treated against puparia. The plants should not carry fruits.

Procedures for official control aiming to monitor, contain and eradicate *Bactrocera zonata* are described in the EPPO Standard PM 9/011 (1) *Bactrocera zonata*: procedure for official control (EPPO, 2010).

## REFERENCES

Allwood AJ, Chinajariyawong A, Drew RAI, Hamacek EL, Hancock DL, Hengsawad C, Jipanin CJ, Jirasurat M, Kong Krong C, Kritsaneepaiboon S, Leong CTS & Vijaysegaran S (1999) Host plant records for fruit flies (Diptera: Tephritidae) in South East Asia. *The Raffles Bulletin of Zoology suppl* 7, 1-92.

Baker R, Gilioli G, Bering C, Candiani D, Gogin A, Kaluski T, Kinkar M, Mosbach-Schulz O, Neri FM, Preti S,

- Rosace MC, Siligato R, Stancanelli G & Tramontini S (2019). *Bactrocera zonata* Pest report to support ranking of EU candidate priority pests. *European Food Safety Authority*, 39pp.
- Balmès V & Mouttet R (2017) Development and validation of a simplified morphological identification key for larvae of tephritid species most commonly intercepted at import in Europe. *EPPO Bulletin* **47**, 91-99.
- Carroll LE, Norrbom AL, Dallwitz MJ & Thompson FC (2004) Pest fruit flies of the world – larvae. Version 9<sup>th</sup> April 2019. [https://www.delta-intkey.com/ffl/www/bac\\_zona.htm](https://www.delta-intkey.com/ffl/www/bac_zona.htm) [accessed 22/11/2020]
- Cayol JP, Roessler Y, Weiss M, Bahdousheh M, Omari M, Hamalawi M & Almughayyar A (2002) Fruit fly control and monitoring in the Near East: shared concern in a regional transboundary problem, in: Barnes, B.N. (Ed.), *6th International fruit fly symposium*. Isteg scientific publications, Stellenbosch, South Africa, pp. 155-171
- Culliney TW, Liquido NJ, McQuate GM, Hanlin MA, Tateno APK, Lee KKL, Birnbaum AL, Ching AJ, Nakamichi KA, Inskeep JR & Marnell SA (2017). A review of recorded host plants of peach fruit fly, *Bactrocera (Bactrocera) zonata* (Saunders) (Diptera: Tephritidae), Version 1.3. Available online at: *USDA Compendium of Fruit Fly Host Information* (CoFFHI), Edition 3.0, <https://coffhi.cphst.org/> [accessed 22<sup>nd</sup> November 2020]
- Drew RAI & Romig MC (2013) *Tropical Fruit Flies of South-East Asia*. CABI, Wallingford (UK), vii+653pp.
- Duyck PF, Sterlin JF & Quilici S (2004) Survival and development of different life stages of *Bactrocera zonata* (Diptera: Tephritidae) reared at five constant temperatures compared to other fruit fly species. *Bulletin of Entomological Research* **94**, 89-93.
- Duyck PF, David P & Quilici S (2007) Can more K-selected species be better invaders? A case study of fruit flies in La Reunion. *Diversity and Distributions* **13**, 535-543
- EPPO (2010) PM 9/11 (1): *Bactrocera zonata*: procedure for official control. *EPPO Bulletin* **40**, 390-395. <https://doi.org/10.1111/j.1365-2338.2010.02421.x>
- EPPO (2013) PM 7/114 (1) *Bactrocera zonata*. *EPPO Bulletin* **43**, 412-416. <https://doi.org/10.1111/epp.12058>
- Hicks CB, Bloem K, Pallipparambil GR & Hartzog HM (2019) Reported long-distance flight of the invasive Oriental fruit fly and its trade implications. In *Area-Wide Management of Fruit Flies* (eds Pérez-Staples D, Diaz-Fleischer F, Montoya P. & Vera MT), pp. 9-26. CRC Press, Boca Raton (USA)
- Kapoor VC (1993) *Indian Fruit Flies (Insecta: Diptera: Tephritidae)*. International Science Publisher, New York (USA), 228pp.
- Qureshi ZA, Ashraf M, Bughio AR & Siddiqui QH (1975) Population fluctuation and dispersal studies of the fruit fly, *Dacus zonatus* Saunders. International Atomic Energy Agency; Food and Agriculture Organization: Sterility principle for insect control 1974. *Proceedings of the Symposium on the sterility principle for insect control, Innsbruck*, pp. 201-2016.
- Qureshi ZA, Hussain T & Siddiqui QH (1991) Relative preference of mango varieties by *Dacus zonatus* and *D. dorsalis*. *Pakistan Journal of Zoology* **23**, 85–87.
- Qureshi Z, Hussain T, Carey JR & Dowell RV (1993) Effects of temperature on development of *Bactrocera zonata* (Saunders) (Diptera: Tephritidae). *Pan-Pacific Entomologist* **69**, 71-76.
- Rahman O, Rahman S & Agarwal ML (1993) Biology and immature stage of *Dacus (Bactrocera) zonatus* (Saunders) (Diptera: Tephritidae). *Journal of Animal Morphology and Physiology* **40**, 45-52.
- Saafan MH, Fod SM & Abdel-Hafez TA (2005) Ecological studies of flies on different hosts at Fayoum Governorate. 3 - Ecological studies of Mediterranean fruit fly, *Ceratitis capitata* (Wied.) and Peach fruit fly, *Bactrocera zonata* (Saund.) in apricot orchards. *Egyptian Journal of Agricultural Research* **83**, 1635-1648.
- Siddiqui QH, Ahmad N, Shah Rashdi SMM & Niazi S (2003) Effect of time of the day and trap height on the catches

of peach/guava fruit flies, *Bactrocera zonata* (Saunders) through Male Annihilation Technique. *Asian Journal of Plant Sciences* **2**, 228-232.

Singh S & Sharma D (2016) Integrated pest management for *Bactrocera dorsalis* (Hendel) and *Bactrocera zonata* (Saunders) on Kinnow mandarin in the Indian Punjab. *Proceedings of the 9<sup>th</sup> ISFFEI*, 172-183.

Tsuruta K, White IM, Bandara HMJ, Rajapakse H, Sundaraperuma SAH, Kahawatta SBMUC & Rajapakse GBJP (1997) A preliminary notes on the host-plants of fruit flies of the tribe Dacini (Diptera, Tephritidae) in Sri Lanka. *Esakia* **37**, 149-160.

Vargas RI, Pinero JC & Leblanc L (2015) An overview of pest species of *Bactrocera* fruit flies (Diptera: Tephritidae) and the integration of biopesticides with other biological approaches for their management with a focus on the Pacific region. *Insects* **6**, 297-318.

White IM (2006) Taxonomy of the Dacina (Diptera: Tephritidae) of Africa and the Middle East. *African Entomology Memoir* **2**, 156pp.

White IM & Elson-Harris MM (1992) *Fruit flies of economic significance: their identification and bionomics*. CAB International, Wallingford (UK), xii+601pp

### **CABI resources used when preparing this datasheet**

CABI Datasheet on Pest <https://www.cabi.org/isc/datasheet/17694>

### **ACKNOWLEDGEMENTS**

This datasheet was extensively revised in 2021 by Dr M. De Meyer. His valuable contribution is gratefully acknowledged.

### **How to cite this datasheet?**

EPPO (2024) *Bactrocera zonata*. EPPO datasheets on pests recommended for regulation. Available online. <https://gd.eppo.int>

### **Datasheet history**

This datasheet was first published in the EPPO Bulletin in 1983 and revised in the two editions of 'Quarantine Pests for Europe' in 1992 and 1997, as well as in 2005 and 2021. It is now maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', 'Hosts', and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

CABI/EPPO (1992/1997) *Quarantine Pests for Europe (1<sup>st</sup> and 2<sup>nd</sup> edition)*. CABI, Wallingford (GB).

EPPO (1983) Data sheets on quarantine organisms No. 41, Trypetidae (non-European). *EPPO Bulletin* **13**(1). <https://doi.org/10.1111/j.1365-2338.1983.tb01715.x>

EPPO (2005) Data sheets on quarantine pests. *Bactrocera zonata*. *EPPO Bulletin* **35**(3), 371-373. <https://doi.org/10.1111/j.1365-2338.2005.00848.x>



Co-funded by the  
European Union