European and Mediterranean Plant Protection Organization
Organisation Européenne et Méditerranéenne pour la Protection des Plantes

Data sheets on quarantine pests[1]
Fiches informatives sur les organismes de quarantaine

Bactrocera zonata

Identity

Name: *Bactrocera zonata* (Saunders)
Taxonomic position: *Insecta*: *Diptera*: *Tephritidae*
Synonyms: *Dacus zonatus* (Saunders), *Dasyneura zonata* Saunders, *Rivellia persicae* Bigot
Common names: peach fruit fly, guava fruit fly (English)
Notes on taxonomy and nomenclature: *Bactrocera maculigera* Doleschall was previously listed as a synonym of *B. zonata*. White & Evenhuis (1999) have shown that it is unrelated
EPPO code: DACUZO
Phytosanitary categorization: EPPO A1 action list no. 302; EU Annex designation I/A1 (as *Dacus zonatus*)

Hosts

The main hosts of *B. zonata* are guava, mango and peach. Secondary hosts include apricot, fig and citrus. *B. zonata* has been recorded on over 50 cultivated and wild plant species, mainly those with fleshy fruits.

Geographical distribution

EPPO region: absent. Trapped in Israel at the Egyptian border; eradication measures applied
Asia: Bangladesh, India (Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Uttar Pradesh, West Bengal), Indonesia (Sumatra) (probable confusion with *B. maculigera*), Iran (southern), Laos, Myanmar, Nepal (Kapoor, 1993), Oman, Pakistan, Saudi Arabia, Sri Lanka, Thailand, United Arab Emirates, Viet Nam, Yemen (unconfirmed recent finding)
Africa: Egypt (on the mainland, the whole Nile Delta region, Nile Valley, and Kharga and Dakla oases; on the Sinai peninsula, Ras El Sudr, El Tur and Nuweiba in South Sinai Governorate, captures all along the North Sinai Governorate from El Qantara (north-west) to Rafah (north-east)), Mauritius, Réunion
North America: trapped in USA (California) (Carey & Dowell, 1989), but eradicated (Spaugy, 1988). Also in 2001 (Santa Clara county), under eradication
EU: absent
Distribution map: See CABI/EPPO (2001)

Biology

Eggs are laid below the skin of the host fruit. These hatch within 1–3 days and the larvae feed for another 4–5 days. Pupation is in the soil under the host plant and adults emerge after 1–2 weeks (longer in cool conditions). Adults occur throughout the year (Christenson & Foote, 1960). For most *Bactrocera* spp., it is the adults that are best able to survive low temperatures, with a normal torpor threshold of 7°C, dropping as low as 2°C in winter. *B. zonata*, however, overwinters in the larval or pupal stage (Fletcher, 1987). Qureshi *et al.* (1993), investigating development of *B. zonata* at different temperatures, showed that no stages developed at temperatures of 15°C or under, the optimum being at 25–30°C. Originally considered as an exclusively tropical fruit fly, *B. zonata* has now established in Egypt. This raises questions about its possible survival during periods of cold weather. See also White & Elson-Harris (1992).

Detection and identification

Symptoms

Attacked fruits usually show signs of oviposition punctures. Fruits with a high sugar content, such as peaches, exude a sugary liquid, which usually solidifies adjacent to the oviposition site.

Morphology

Larva
Described by Kandybina (1977), Jabbar Khan & Jabbar Khan (1987). However, these descriptions were made before modern SEM-based studies which have been used to define keys

[1]This is a revised version of the data sheet which appeared in EPPO/CABI (1997).

for a number of other species, and the important characters to distinguish larvae of *B. zonata* are therefore not known.

Adult

Colour: Face with a spot in each antennal furrow; scutum with lateral yellow or orange vittae; scutellum entirely pale coloured, except sometimes for a narrow black line across the base; costal margin of wing without a coloured band along whole length of cell r1; cell sc usually yellow, and apex of vein R4 + 5 often with a brown spot; crossveins R-M and Dm-Cu not covered by any markings.

Head: With reduced chaetotaxy, lacking ocellar and post-ocellar setae; first flagellomere at least three times as long as broad.

Thorax: With reduced chaetotaxy, lacking dorsocentral and katepisternal setae. Post-pronotal lobes without any setae (sometimes with some small setulae or hairs); scutum with anterior supra-alar setae and prescutellar acrostichal setae; scutellum not bilobed, with only two marginal setae (the apical pair).

Wing: Vein sc abruptly bent forward at nearly 90°, weakened beyond this bend and ending at subcostal break; vein R1 with dorsal setulae; cell bcu (= cup) very narrow, about half depth of cell bm; bcu (= cup) extension very long, equal or longer than length of vein A1 + CuA2; 4–6 mm long. Raised narrow subbasal section of cell br lacking microtrichiae.

Abdomen: All tergites separate (view from side to see overlapping sclerites); tergite five with a pair of slightly depressed areas (ceromata); male with a row of setae (the pecten) on each side of tergite three.

Detection and inspection methods

B. zonata can be monitored by traps (Jackson or Steiner traps, though Jackson traps are preferable) baited with the male lure methyl eugenol (O-methyl eugenol), which attracts male flies at very low concentrations (Qureshi *et al*., 1992) and insecticide. In Jackson traps, a cotton wick impregnated with about 6 mL of a mixture methyl-eugenol:insecticide (3 : 1) is placed inside the trap. Malathion or dichlorvos is generally used as the killing agent. Traps are usually placed in fruit-bearing trees inside the canopy at about two-thirds of the tree height. For detection activities, 'sentinel' traps should be located at all potential points of entry (seaport, airport, border crossing etc.) while in commercial orchards traps should be set at a rate of 1 trap per km^2. The mixture methyl-eugenol : malathion usually remains effective in the field for one month and traps need to be serviced twice a month. A review of the biological aspects of male lures was presented by Cunningham (1989) and the use of lures is described more fully by Drew (1982). The FAO/IAEA peach fruit fly action plan gives very detailed indications on trapping for *B. zonata* (FAO/IAEA, 2000).

Pathways for movement

Transport of infested fruits, either through trade or by travellers, is the main means of movement. Adult flight will also spread the pest.

Pest significance

Economic impact

B. zonata is polyphagous, but is particularly a pest of peach, mango and guava. It is a significant pest in India and Pakistan. Publications from Pakistan show that it is possibly more important in that country than *B. dorsalis* (Qureshi *et al*., 1991). Current annual costs of damage in the Near East are estimated at 320 million EUR, and intensive control measures are needed to grow susceptible crops commercially. In Egypt, *B. zonata* has caused an estimated 190 million EUR damage a year. In infested countries, it was reported that *B. zonata* could outcompete other Tephritid fruit fly species such as *Ceratitis capitata*.

Control

Malathion is the usual choice of insecticide for fruit-fly control and this is usually combined with protein hydrolysate to form a bait spray (Roessler, 1989); practical details are given by Bateman (1982). Yeast hydrolysate or autolysate is used commonly as the protein source. Bait sprays work on the principle that mainly female Tephritid fruit flies are strongly attracted to a protein source from which ammonia emanates, and ingest a lethal dose of insecticide together with the protein. 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. Attraction to the protein allows the use of spot sprays, rather than broadcast applications of insecticides. 'Hot spots' of the fly should be located to apply protein bait sprays. These methods should be used in conjunction with fruit sanitation programmes. In case of an eradication, post-programme monitoring is essential to avoid reintroduction. Preventive sprays may be applied in areas which are the most at risk. FAO/IAEA (2000) provides many details of methods and techniques for monitoring and control of *B. zonata*.

In areas where containment or eradication is envisaged, *B. zonata* should be continually monitored using insecticide traps baited with methyl eugenol. The male annihilation technique is the most suitable method available to date for the eradication and control of *B. zonata*. This technique relies on the combined use of sexual attractants (methyl eugenol in the case of *B. zonata*) and insecticide to eliminate male flies, thus stopping mating. The insecticides used are generally organophosphorus compounds, such as malathion or naled, applied as spot treatments, using neutral gel as carrier of a mixture of methyl-eugenol and insecticide (also called Min-U-Gel applications). The use of lure-and-kill stations (i.e. wooden blocks, caneite blocks or cotton cord impregnated with the methyl eugenol-insecticide mixture) is often preferred. It should be noted that the use of lure-and-kill blocks may interfere with trapping. This technique may be combined with the protein bait control technique (see above).

Phytosanitary risk

EPPO originally mentioned *B. zonata* as an A1 quarantine pest within the broad category 'non-European Trypetidae' and *B. zonata* is of phytosanitary significance for APPPC, CAN, CPPC, JUNAC and OIRSA. In a later review by EPPO, it was noted that, when *B. zonata* established adventive populations, it did so exclusively in tropical areas (e.g. Mauritius, Réunion), and that the countries where *B. zonata* occurs are those where the generally more damaging species *B. dorsalis* is also found (EPPO/CABI, 1997). On this basis, it was decided no longer to mention *B. zonata* specifically. However, *B. zonata* is now established and widespread in Egypt (Hashem *et al*., 2001), and has therefore demonstrated its ability to establish outside tropical conditions and adapt to local conditions (Iwahashi & Routhier, 2001). Pest risk analysis suggests that *B. zonata* can establish in other countries of the Mediterranean region. The EPPO Workshop on *B. zonata* (Paris, 2002-03) recommended that *B. zonata* should again be specified individually on the EPPO A1 list of pests recommended for regulation, which was done in 2002-09.

Phytosanitary measures

European countries generally take a common set of measures against non-European *Trypetidae* (e.g. EU, 2000) but specific phytosanitary measures to be taken against *B. zonata* within the Mediterranean area have yet to be developed. Attention should focus on fruit consignments from countries where *B. zonata* occurs. Several countries have already taken measures to prohibit transport of fruits in trade and with passengers from countries where *B. zonata* occurs. Countries at risk should put in place monitoring (as described in the section on 'control') and should start purchasing required materials, so that they are available immediately upon introduction of the pest. Details are provided in the FAO/IAEA action plan (FAO/IAEA, 2000). EPPO is preparing a Standard in series PM9 (OEPP/EPPO, 2006), and further information is available on the EPPO website (www.eppo.org).

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