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Data Sheets on Quarantine Pests

Bactrocera cucurbitae

IDENTITY

Name: *Bactrocera cucurbitae* (Coquillett)
Synonyms: *Chaetodacus cucurbitae* (Coquillett)
Dacus cucurbitae Coquillett
Strumeta cucurbitae (Coquillett)
Zeugodacus cucurbitae (Coquillett)
Taxonomic position: Insecta: Diptera: Tephritidae
Common names: Melon fly, melon fruit fly (English)
Mouche du melon (French)
Bayer computer code: DACUCU
EPPO A1 list: No. 232
EU Annex designation: I/A1 - as *Dacus cucurbitae*

HOSTS

Recorded almost exclusively on Cucurbitaceae (Weems, 1964), both tropical species (e.g. *Momordica charantia*) and temperate species. In the EPPO region, courgettes (*Cucurbita pepo*), cucumbers (*Cucumis sativus*) and melons (*Cucumis melo*) would be the main potential hosts.

GEOGRAPHICAL DISTRIBUTION

EPPO region: Egypt.
Asia: Afghanistan, Bangladesh, Brunei, Cambodia, China (Guangdong, Guangxi, Hainan, Jiangsu, Yunnan), Christmas Island, Hong Kong, India (Andaman and Nicobar Islands, Andhra Pradesh, Bihar, Delhi, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal), Indonesia (Irian Jaya, Java, Kalimantan, Nusa Tenggara, Sulawesi, Sumatra), Iran (recently established; Fischer-Colbrie & Busch-Petersen, 1989), Japan (Ryukyu Archipelago: progressively eradicated using the sterile insect technique (Iwahashi, 1977; Anon., 1987) from, starting from the west (adjoining Taiwan), the Yaeyama group (1993), the Miyako group (1987), Kumejima (1978), the rest of the Okinawa group (1990), the Amami group (1989); (Anon., 1993), Lao, Malaysia (Peninsular, Sabah, Sarawak), Myanmar, Nepal, Oman, Pakistan, Philippines, Saudi Arabia, Singapore, Sri Lanka, Taiwan, Thailand, United Arab Emirates and Viet Nam.
Africa: Adventive populations in Egypt, Kenya, Mauritius, Réunion, Tanzania.
North America: USA, trapped in the wild in California (Carey & Dowell, 1989), but eradicated (Spaugy, 1988); adventive populations in Hawaii, since the 1980s and eradicated again.
Oceania: Australia (records are mistaken, owing to confusion with *B. cucumis*), Guam (adventive populations), Kiribati, Nauru, Northern Mariana Islands (eradicated using the

sterile insect technique, but re-established on Rota in 1981; Cunningham, 1989b), Papua New Guinea (including New Britain, New Ireland, Bougainville and Lihir Islands), Solomon Islands (established in the Shortland Islands group, where it has been subjected to an eradication campaign using a combination of bait spraying and male annihilation with cue-lure traps (Eta, 1986)).
EU: Absent.
Distribution map: See IIE (1995, No. 64).

BIOLOGY

Eggs are laid below the skin of the host fruit. These hatch within 1-3 days and the larvae feed for another 4-7 days at 21°C. Pupariation is in the soil under the host plant and adults emerge after 1-2 weeks (longer in cool conditions) and adults occur throughout the year (Christenson & Foote, 1960). *B. cucurbitae* would be unable to survive the winter in the EPPO region, except possibly in the extreme south. The adults are best able to survive low temperatures, *Bactrocera* spp. generally having a normal torpor threshold of 7°C, dropping as low as 2°C in winter. Sadoshima *et al.* (1990) have shown that strains of *B. cucurbitae* can be selected for cold tolerance, which implies that this might happen in nature. Regression models have been developed in Pakistan to predict population density (Inayatullah *et al*., 1991a) and levels of fruit infestation (Inayatullah *et al*., 1991b).

DETECTION AND IDENTIFICATION

Symptoms
Attacked fruits will usually show signs of oviposition punctures.

Morphology
Recently, DNA probes have been proposed as a practical means of discriminating between all life stages of the three main tephritids present in Hawaii (*C. capitata*, *Bactrocera cucurbitae* and *B. dorsalis*) (Haymer *et al*., 1994).

Larva
Described by Hardy (1949), Menon *et al.* (1968), Kandybina (1977), Berg (1979), Jabbar Khan & Jabbar Khan (1987), Rohani (1987), Heppner (1989), White & Elson-Harris (1992).

Adult
Colour: Scutum with both lateral and medial yellow vittae; wing with crossvein dm-cu covered by an infuscate area which is separate to other parts of the wing pattern; crossvein r-m usually covered by an infuscate area.
Head: With reduced chaetotaxy, lacking ocellar and postocellar setae; first flagellomere at least three times as long as broad.
Thorax: With reduced chaetotaxy, lacking dorsocentral and katepisternal setae. Postpronotal lobes without any setae (sometimes with some small setulae or hairs); scutum with prescutellar acrostichal setae; scutellum not bilobed, usually with only two marginal setae (the apical pair), but sometimes with four.
Wing: Vein Sc abruptly bent forward at nearly 90°, weakened beyond this bend and ending at subcostal break; vein R1 with dorsal setulae; cell cup very narrow, about half depth of cell bm; cup extension very long, equal or longer than length of vein A1+CuA2; 4-8 mm long; vertical orange-red marking in the apical third.
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. cucurbitae can be monitored by traps baited with male lures. Cue lure (4-(p-acetoxyphenyl)-2-butanone) attracts flies at very low concentrations and is believed to attract over a range of up to 1 km. The lure is usually placed on a cotton-wool wick suspended in the middle of a plastic trap that has small openings at both ends; Drew (1982) describes the Steiner trap. Lure can either be mixed with an insecticide (malathion or dichlorvos) or a piece of paper dipped in dichlorvos can be placed in the trap. Traps are usually placed at a height of about 2 m above ground and should be emptied regularly as it is possible to catch hundreds of flies in a single trap left for just a few days, although the lure may remain effective for at least 2 weeks. A review of the biological aspects of male lures was presented by Cunningham (1989a) and the use of lures is described more fully by Drew (1982). A trapping system used to monitor for possible introductions of *B. cucurbitae* into New Zealand has been described by Somerfield (1989).

MEANS OF MOVEMENT AND DISPERSAL

Adult flight and the transport of infested fruits are the main means of movement and dispersal to previously uninfested areas. Many *Bactrocera* spp. can fly 50-100 km (Fletcher, 1989).

PEST SIGNIFICANCE

Economic impact

B. cucurbitae is a very serious pest of the fruits and flowers of cucurbits, and will sometimes attack non-cucurbit hosts. Waterhouse (1993) identifies it as one of the five most important pests of agriculture in South East Asia.

Control

When detected, it is important to gather all fallen and infested host fruits, and destroy them. Liquido (1991) has confirmed that fallen pawpaw fruits are a major sourc of *B. cucurbitae* in plantations in Hawaii (USA). Fruit infestation can be much reduced by enclosing fruits in paper bags as soon as the flowers have fallen (Fang & Chang, 1987). *B. cucurbitae* should be continually monitored using bait traps (Bateman, 1982). Insecticidal protection is possible by using a cover spray or a bait spray. 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). 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. Biological control has been tried against *B. cucurbitae*, but introduced parasitoids have had little impact (Wharton, 1989). The techniques of male annihilation and sterile insect release have been used to eradicate some populations of *B. cucurbitae*. Male annihilation utilizes the attraction of males to chemical lures (cue lure). The sterile insect technique (SIT) requires the release of millions of sterile flies into the wild population so that there is a strong likelihood of wild females mating with sterile males (Gilmore, 1989). SIT was used to eradicate *B. cucurbitae* from Kume Island, Japan (Shiga, 1989).

Phytosanitary risk

EPPO lists *B. cucurbitae* as an A1 quarantine pest (OEPP/EPPO, 1983) within the broad category "non-European Trypetidae"; it is also of quarantine significance to APPPC, COSAVE, CPPC, JUNAC and OIRSA. *B. cucurbitae* is indigenous to Asia, but like other

Bactrocera spp. is known by experience to have the potential to establish adventive populations in various other tropical areas. Its presence in Hawaii, but not in mainland USA, has contributed to its high international profile as a quarantine pest. The direct risk of establishment of *B. cucurbitae* in most of the EPPO region is minimal, though populations might enter and multiply during the summer months. In southern areas, some populations might survive one or several winters, though in any case the direct losses from such introductions would probably not be high. *B. cucurbitae* is not considered to present a particular risk to cucurbit crops grown in glasshouses. The major risk for EPPO countries arises from the probable imposition of much stricter phytosanitary restrictions on exported fruits (particularly to America) if *Bactrocera* spp. enter and multiply, even temporarily.

PHYTOSANITARY MEASURES

Consignments of fruits of *Citrullus*, *Cucumis* and *Cucurbita* from countries where *B. cucurbitae* occurs should be inspected for symptoms of infestation and those suspected should be cut open in order to look for larvae. EPPO recommends that such fruits should come from an area where *B. cucurbitae* does not occur, or from a place of production found free from the pest by regular inspection for 3 months before harvest. Fruits may also be treated in transit by vapour heat (e.g. keeping at 44.5°C for 8.75 h, USDA, 1994; 46°C for 30 min, Iwata *et al*., 1990) or forced hot-air treatment (Armstrong *et al*., 1995). Ethylene dibromide was previously widely used as a fumigant but is now generally withdrawn because of its carcinogenicity; methyl bromide is less satisfactory, damaging many fruits and reducing their shelf life, but treatment schedules are available (e.g. 32 g/m^3 for 2 h at 21-26°C; USDA, 1994). Wrapping fruits in shrinkwrap film has been investigated as a possible method of disinfesting fruits (Jang, 1990).

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