EPPO Datasheet: *Carposina sasakii*

Last updated: 2022-12-15

IDENTITY

Preferred name: *Carposina sasakii*
Authority: Matsumura
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Lepidoptera: Carposinidae
Other scientific names: *Carpocapsa persicana* Matsumura, *Carposina persicana* (Matsumura)
Common names: peach fruit borer, peach fruit moth
view more common names online...
EPPO Categorization: A2 list
view more categorizations online...
EU Categorization: Quarantine pest ((EU) 2019/2072 Annex II A)
EPPO Code: CARSSA

more photos...

Notes on taxonomy and nomenclature

Carposina sasakii Matsumura was erroneously synonymized with *Carposina niponensis* Walsingham by Issiki in 1957. From then on, the name *Carposina niponensis* was used until Diakonoff differentiated the two species based on genitalia characters in 1989, and *Carposina sasakii* Matsumura had regained its original name. Hua (1992) and Li *et al.* (2001) stated that the species distributed in China is *Carposina sasakii* Matsumura, not *Carposina niponensis* Walsingham.

Carposina ottawana, that was once considered as subspecies of *Carposina niponensis,* is now considered a distinct species occurring in North America (Young & Robertson, 2020).

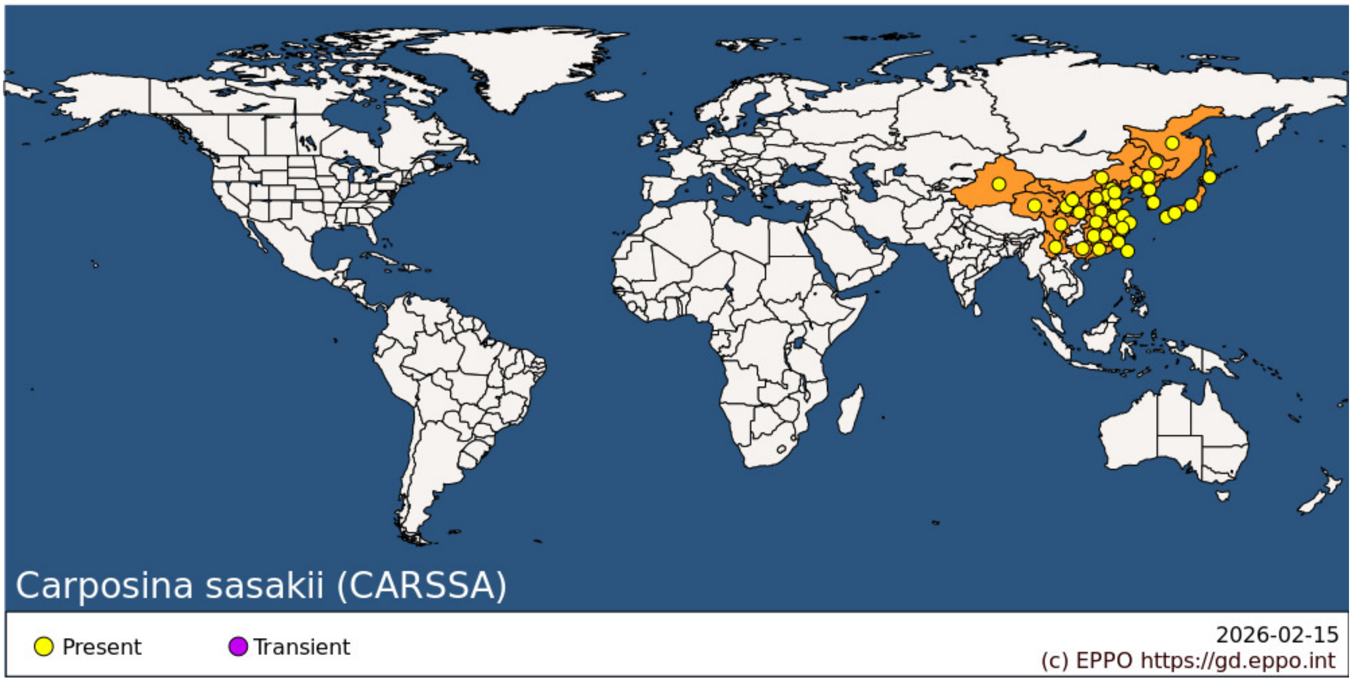
HOSTS

C. sasakii occurs on a range of cultivated and wild fruits, mainly Rosaceae. Jujube, apple and pear trees suffer the most serious damage (Hua & Hua, 1995; Wu & Huang, 2014).

Host list: *Chaenomeles japonica*, *Chaenomeles lagenaria*, *Crataegus cuneata*, *Crataegus pinnatifida*, *Crataegus*, *Cydonia oblonga*, *Malus domestica*, *Malus prunifolia*, *Malus spectabilis*, *Malus toringo*, *Malus x micromalus*, *Malus*, *Prunus armeniaca var. ansu*, *Prunus armeniaca*, *Prunus domestica*, *Prunus dulcis*, *Prunus mume*, *Prunus persica*, *Prunus salicina*, *Prunus*, *Pseudocydonia sinensis*, *Punica granatum*, *Pyrus communis*, *Pyrus pyrifolia*, *Pyrus*, *Sorbus commixta*, *Ziziphus jujuba*, *Ziziphus mauritiana*, *Ziziphus*

GEOGRAPHICAL DISTRIBUTION

C. sasakii occurs in in temperate Far East Asia. Although it is present the Far Eastern provinces of Russia, it does not occur in the European part or in Siberia and is a quarantine pest for Russia.



EPPO Region: Russian Federation (Far East)
Asia: China (Anhui, Beijing, Fujian, Gansu, Guangdong, Guangxi, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Neimenggu, Ningxia, Qinghai, Shaanxi, Shandong, Shanghai, Shanxi, Sichuan, Tianjin, Xinjiang, Yunnan, Zhejiang), Japan (Hokkaido, Honshu, Kyushu, Shikoku), Korea, Democratic People's Republic of, Korea, Republic of, Taiwan

BIOLOGY

C. sasakii overwinters as hibernating larvae in cocoons in the soil, though some larvae may overwinter in fruit in storage (Shutova, 1970). The development, reproduction, behaviour, emergence and diapause of *C. sasakii* are significantly affected by the environmental temperature, photoperiod (Lee *et al.*, 1963; Hwang *et al.*, 1976; Hou *et al.*, 1994; Li *et al.*, 2010; Toyoshima *et al.*, 2010; Zhao *et al.*, 2017) and by the different host species or varieties (Lei *et al.*, 2012; Li *et al.*, 2012). The life cycle can be univoltine or bivoltine. In northern China the completion of diapause occurs between late January and March (Zhang *et al.*, 2018). The larvae pupate in the spring in fresh cocoons on the surface of the soil and the moths emerge about 12 days later. The flight period starts in late May or early June in North Korea (Muramatsu, 1927) and ends in mid-June, with the second generation of adults flying from mid-August to early September. In China (Hwang, 1958), Japan (Yago & Ishikawa, 1936) and South Korea (Kim *et al.*, 2010), the overwintering larvae may pupate at any time between mid-May and late July, depending on soil temperature and soil humidity. *C. sasakii* larvae have higher emergence rates from the soil at moderate soil moisture levels (Ma *et al.*, 2017). The moths fly from mid-June until late September and there is considerable overlapping of generations. The second generation is only partial and first-generation larvae leaving the fruit in July may go into hibernation (Chang *et al.*, 1977).

Eggs are mainly laid on fruit, usually near the calyx end but some may be found near the stem end, or on the fruit stem. After hatching, the larvae crawl to the fruit surface and bore into the fruit (Chang *et al.*, 1977). Several eggs are laid on each fruit. Up to 20 larvae have been recorded in a single fruit (Yago & Ishikawa, 1936; Li *et al.*, 2019). One female can carry up to 350 mature eggs (Ohira, 1989) and lays an average of about 100 eggs (Gibanov & Sanin, 1971). The young larvae bore into the fruit, usually near the calyx, and feed on the inside of the fruit. Later, they may move from one fruit to another. Susceptibility to penetration by the young larvae varies with growth stage, species and cultivar of fruit. These factors (in addition to temperature) affect the rate of development of the larvae (Gibanov & Sanin, 1971; Chang *et al.*, 1977, Lei *et al.*, 2012).

DETECTION AND IDENTIFICATION

Symptoms

The larvae tunnel in all parts of the fruit, feeding on the fleshy parts and on the seeds. Several larvae may feed in each fruit. Infested apples exude a sticky gum, pears turn yellow, and apricots ripen unevenly (Gibanov & Sanin, 1971). Symptoms of infested fruit are the frass from larvae deposited on the fruit surface; fruit discolouration; abnormal shape, and a drop of fruit liquid that exudes from the entry site a day or two after larval penetration (Ishiguri & Toyoshima, 2006).

Morphology

Eggs

Elliptical, light yellowish-brown in colour with a granulated chorion. Bright red when freshly laid, and turn deep red as they age. Distinctive ring of spines round the apex, possibly encircling the micropyle (Wu & Hwang, 1955; Shutova, 1970; Kim & Lee, 2002).

Larva

Orange-red when newly hatched, changing to milky-white and then back to orange-red at maturity. Mature larva up to 13 mm long, with no anal comb. The setation is illustrated by Wu & Hwang (1955) and Lee *et al.* (2013).

Pupa

Reddish-brown, in cocoon.

Adult

Wingspan 13-19 mm. Long narrow forewings, mottled grey in colour, with a darker area along the anterior margin; hind wings with a fringe of long scales, and only five veins arising from the median cell. The genitalia have been illustrated by Wu & Hwang (1955), Ponomarenko (1999), Young & Robertson (2020). *C. sasakii*, *C. niponensis*, and *C. ottawana* cannot be separated reliably by external morphology and/or wing markings. Inspection of the genitalia is required for positive identification of adult specimens (Young & Robertson, 2020).

Detection and inspection methods

Eggs are mainly laid on the fruit, usually around the calyx. Using a hand lens (x10) will aid in detecting eggs (Chang *et al.*, 1977; Kim & Lee, 2002). Adults can be monitored with pheromone traps (Honma *et al.*, 1978; Liu *et al.*, 1981; Xue *et al.*, 2010; Lee *et al.*, 2014; Zhang *et al.*, 2017). Fruits that are suspected to be infested can be cut into halves for further inspection and detection of larvae. Cocoons or pupae can be found in soil.

Samples should be brought back to the laboratory for identification. The collected damaged fruits are packed in polyethylene plastic bags, and kept at a low temperature, sealed, moist and preserved. The samples should be identified as soon as possible, and the preservation time should not exceed 7 days.

Non-destructive technologies are being developed for detecting *C. sasakii* infestation in fruits such as magnetic resonance imaging (MRI) (Haishi *et al.*, 2011) but it is not known if this is used in practice.

Identification

Morphological identification of adults

The morphological characteristics, including the genitalia structure of the suspect adults collected in traps or reared from larvae following the on-site inspection, should be compared with those of the *C. sasakii* described above using a stereo microscope.

Morphological identification of larvae

The infested fruit should be dissected to collect the larvae, and the morphological characteristics of the suspect larvae should be compared with those of the *C. sasakii* described above using a stereo microscope. Larvae may be reared to adult stage by putting the infested fruit into a light incubator, under appropriate temperature, humidity and light conditions (e.g. 23°C, 80% HR, see Lei *et al.*, 2012). The morphological characteristics, including the genitalia structure of the adults should be checked for authentication.

Mass spectrometry (MALDI-TOF MS) may also be used (Jeon *et al.*, 2017).

Molecular identification methods

DNA markers applicable for identification of *C. sasakii* are available (Song *et al.*, 2007). A diagnostic multiplex polymerase chain reaction method can be used to identify *C. sasakii* (Hada *et al.*, 2011;. Kwon *et al.*, 2018).

PATHWAYS FOR MOVEMENT

The moth normally flies only short distances. In China, 80% of marked adults dispersed randomly within a radius of 100 m and the furthest distance an adult dispersed was 225 m (Sun *et al.*, 1987) although flight mill studies showed that the moth can fly further (Ishiguri and Shirai, 2004, Gong *et al.*, 2020). Hence, international dispersal by flight is extremely unlikely. Larvae can survive for long periods in stored fruits, so imported fruits are the most likely means of entry. *C. sasakii* has never been found in an imported fruit consignment in the EU but is regularly found in the USA in fruit from Japan and South Korea (EFSA, 2018). It could also be introduced with the host plants for planting (as pupae in associated soil, or as larvae or eggs if the plants have fruits on them).

PEST SIGNIFICANCE

Economic impact

C. sasakii is considered one of the most important pests of pome fruits in the Far East. On apples in Japan, South Korea and China, it causes heavy losses if not managed and therefore control measures are usually applied in commercial orchards (Fand *et al.*, 2022; Hua *et al.*, 1996; Kawashima, 2008; Kim & Lee 2010). In the Primorye province of Russia damage to pears could reach 100% in some cases, but apples were less heavily infested (40-100%) (Sytenko, 1960; Pavlova, 1970; Gibanov & Sanin, 1971). It is also an important pest of jujube in China (Tung *et al.*, 1964; Zhang *et al.*, 2017), damage to jujube can reach 68% in some cases.

Control

Control of the pest can be successfully achieved by applying insecticides at the oviposition peaks of the first and second generations. Beta-cypermethrin (Quan *et al.*, 2017), cypermethrin, emamectin benzoate, phoxim, cyhalothrin, abamectin, monosultap, tebufenozide (Xiong, 2013), chlorbenzuron, flubendiamide (Gong *et al.*, 2016) and chlorantraniliprole (Gong *et al.*, 2016; Sun *et al.*, 2018) have been widely used to control *C. sasakii* in orchards, in combination with the mechanical removal of fallen fruit (Huan *et al.*, 1987).

Alternatives to insecticides exist, such as mating disruption (Kawashima, 2008; Lee *et al.*, 2014; Zhang *et al.*, 2017) or application of calcium carbonate or a bioactive plasticizer to limit oviposition (Kazama *et al.*, 2020, 2022). In China, fruits are bagged during the growing season to protect them from a range of fruit borers including *C. sasakii* (EFSA, 2018).

Chelonus (Microchelonus) zhangi, *Pristomerus chinensis* (Xu & Hua, 2009) and *Trichogramma dendrolimi* have been reported as parasites of *C. sasakii* (Fang *et al.*, 2022). The fungi *Beauveria bassiana* (Xiong *et al.*, 2013), *Isaria farinosa* (Li *et al.*, 2012), and *Metarhizium anisopliae* (Wang *et al.*, 2013) as well as entomopathogenic nematodes, such as *Steinernema feltiae* (Li *et al.*, 1993) and *Heterorhabditis* sp. (Li *et al.*, 1990) have been reported to be effective at controlling *C. sasakii* populations.

Phytosanitary risk

Pome and stone fruits are important crops in the EPPO region. Considering the current range of the pest, it is likely that *C. sasakii* could establish, spread and cause damage if it was introduced in the region. Integrated Pest Management (IPM) is applied for host fruits in the EPPO region and measures applied against other fruit pests (e.g. *Cydia pomonella*) may limit the impact of *C. sasakii* but IPM programmes would need to be modified to adapt them to *C. sasakii* (e.g. the timing of application of insecticides).

C. sasakii presents a risk to fruit production in most parts of the EPPO region. While it might only complete one generation per year in northern countries, it seems likely that a partial or complete second generation would be possible over much of Europe. The introduction of *C. sasakii* into the EPPO region could have a severe economic impact on the fruit-growing areas of the region and require modification of IPM practices.

PHYTOSANITARY MEASURES

Fruits of host plants from countries where the pest occurs should be free from the pest. This can be achieved if the fruits come from a pest-free area or by treating fruit consignments after harvest. Fruit irradiation is approved at international level (IPPC, 2022), other possible treatments are fumigation, cold treatment and modified atmosphere (Kim *et al.*, 2022; Son *et al.*, 2012). Alternatively, pest freedom may be achieved by a systems approach combining monitoring orchards during production and applying control measures or bagging fruits during the growing season, and inspection before export. It should be also ensured that fruit crates are free of pupating larvae and/or pupae.

Host plants for planting of countries where the pest occurs should come from a pest free area; or not carry fruits and be free from soil. It may be noted that the import of *Prunus* plants for planting is prohibited in many EPPO countries (EFSA, 2018).

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ACKNOWLEDGEMENTS

This datasheet was extensively revised in 2022 by Zhiwei Zhang [College of Forestry, Shanxi Agricultural University, China]. His valuable contribution is gratefully acknowledged.

How to cite this datasheet?

EPPO (2026) *Carposina sasakii*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int

Datasheet history

This datasheet was first published in 1988 and revised in the two editions of 'Quarantine Pests for Europe' in 1992 and 1997, as well as in 2022. 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.

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Co-funded by the European Union