EPPO Datasheet: *Cacoecimorpha pronubana*

Last updated: 2023-02-08

IDENTITY

Preferred name: *Cacoecimorpha pronubana*
Authority: (Hübner)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Lepidoptera: Tortricidae
Other scientific names: *Cacoecia pronubana* (Hübner), *Cacoecimorpha ambustana* (Frölich), *Cacoecimorpha hermineana* (Duponchel), *Cacoecimorpha insolatana* (Lucas), *Tortrix pronubana* Hübner
Common names: Mediterranean carnation leafroller, Mediterranean carnation tortrix, carnation leaf roller, carnation tortrix, carnation tortrix moth
view more common names online...
EPPO Categorization: A2 list
view more categorizations online...
EPPO Code: TORTPR

more photos...

Notes on taxonomy and nomenclature

The species *Tortrix pronubana* was described by Hübner [1796-1799]. Other 19th century authors described *Tortrix ambustana* (Frölich, 1830), *Tortrix hermineana* (Duponchel, 1834), *Tortrix insolatana* (Lucas, 1848), *Tortrix perochreana* [Herrich-Schäffer, 1856], and *Tortrix musculana obsoletana* (Strand, 1901), all of which subsequently were recognized as junior synonyms of *pronubana*.

Obraztsov (1954) recognized that *pronubana* was distinct from other species of *Tortrix* (sensu lato) and proposed the monotypic genus *Cacoecimorpha* for the species. In a molecular phylogenetic analysis of genera related to *Choristoneura* based on COI (a mitochondrial gene) and 28S (a ribosomal gene), Fagua *et al.* (2019) found weak support for a sister relationship between *Cacoecimorpha pronubana* and *Archips occidentalis*, surrounded by species of *Choristoneura*.

The BOLD database hosted by the Biodiversity Institute of Ontario, University of Guelph, includes DNA barcodes (COI over 500 basepairs) for 44 specimens that form a single BIN (BOLD: AAD3477), with an average distance of 0.26 % among samples, and a distance of 1.96 % to its nearest neighbour.

HOSTS

While the principal host of *C. pronubana* is carnation (*Dianthus caryophyllus*), the species is highly polyphagous, reported to feed on over 160 plant species in 42 families, including fruit trees, shrubs, ornamentals, and crop plants. Important ornamental hosts include *Acacia*, *Acer*, *Chrysanthemum*, *Coriaria*, *Coronilla*, *Euphorbia*, *Ilex*, *Jasminum*, *Laurus*, *Mahonia*, *Pelargonium*, *Populus*, *Rhododendron*, *Rosa*, and *Syringa*. Important fruit crop hosts include *Citrus*, *Malus*, *Olea*, *Prunus*, and *Rubus*. Vegetable hosts include *Brassica* spp., peas (*Pisum sativum*), potatoes (*Solanum tuberosum*), tomatoes (*Solanum lycopersicum*), bell peppers (*Capsicum* spp.), *Trifolium*, and *Vicia*.

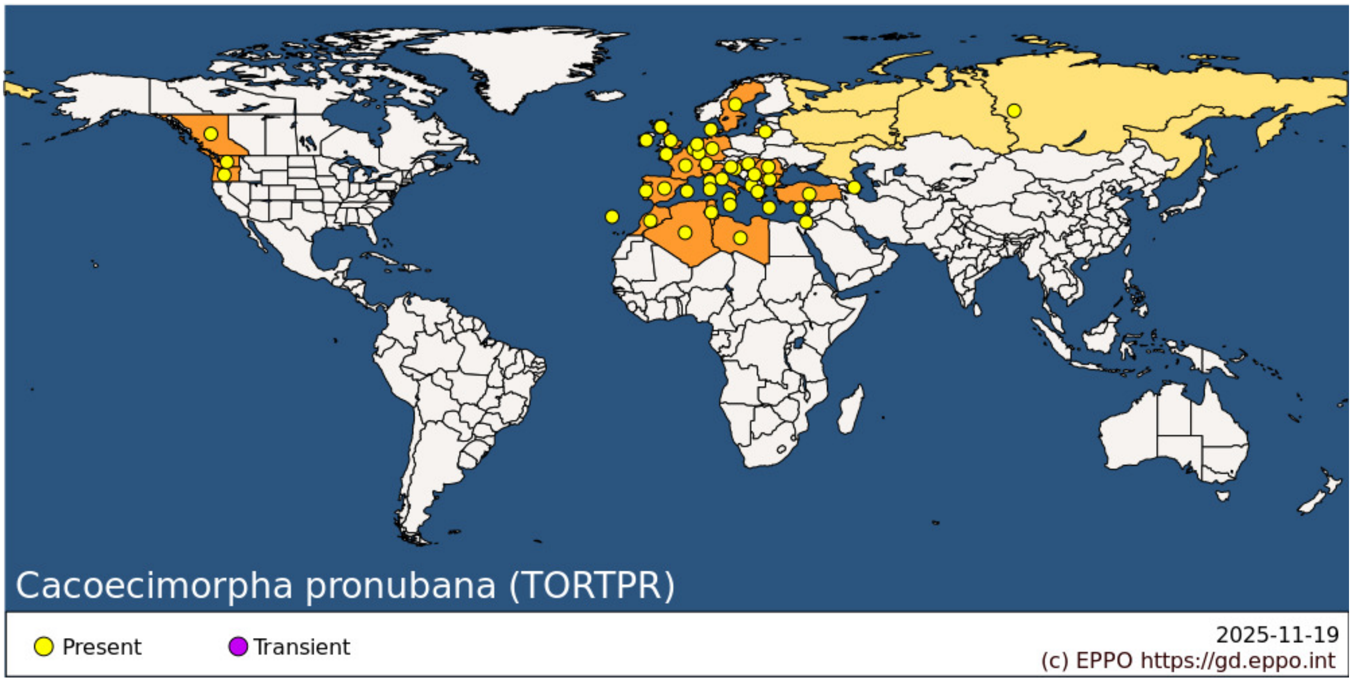
Cacoecimorpha pronubana has been reported as a pest of strawberry (*Fragaria*) crops in England, as a pest ofavocado (*Persea*) in Israel (Wyoski & Izhar, 1976), and as a pest of olive (*Olea*) in Northern Africa and Turkey (Kac?ar & Ulusoy, 2008). Sokoloff (1983) and Castresana *et al*. (1996) report the species on conifers.

Host list: *Acacia sp.*, *Acer sp.*, *Aegopodium podagraria*, *Allium ampeloprasum*, *Arbutus sp.*, *Aster sp.*, *Aucuba japonica*, *Berberis aquifolium*, *Berberis sp.*, *Brassica oleracea*, *Chamaecyparis pisifera*, *Choisya ternata*, *Chrysanthemum sp.*, *Citroncirus webberi*, *Citrus reticulata*, *Citrus sp.*, *Citrus x aurantiifolia var. macrophylla*, *Citrus x limon*, *Coriaria myrtifolia*, *Coronilla varia*, *Daphne odora*, *Daphne sp.*, *Daucus carota*, *Dianthus caryophyllus*

, *Drosera capensis*, *Euonymus japonicus*, *Euonymus sp.*, *Euphorbia amygdaloides*, *Fragaria sp.*, *Fuchsia sp.*, *Gerbera sp.*, *Hedera helix*, *Hieracium sp.*, *Hippophae rhamnoides*, *Hylotelephium spectabile*, *Ilex aquifolium*, *Ilex sp.*, *Jasminum nudiflorum*, *Jasminum sp.*, *Laurus nobilis*, *Laurus sp.*, *Leucadendron sp.*, *Leucospermum sp.*, *Ligustrum sp.*, *Malus domestica*, *Narcissus sp.*, *Nerium oleander*, *Nerium sp.*, *Olea europaea*, *Oxalis acetosella*, *Papaver rhoeas*, *Pelargonium sp.*, *Pelargonium zonale*, *Persea americana*, *Petroselinum sp.*, *Photinia sp.*, *Pinus halepensis*, *Pisum sativum*, *Pittosporum tenuifolium*, *Populus sp.*, *Prunus laurocerasus*, *Prunus persica*, *Prunus sp.*, *Punica granatum*, *Pyracantha angustifolia*, *Pyrus communis*, *Rhododendron x praecox*, *Robinia pseudoacacia*, *Rosa sp.*, *Rubus sp.*, *Ruscus sp.*, *Salix integra*, *Salix sp.*, *Salvia sp.*, *Schlumbergera sp.*, *Solanum lycopersicum*, *Solanum tuberosum*, *Sonchus oleraceus*, *Syringa vulgaris*, *Tamarix sp.*, *Trifolium sp.*, *Vaccinium corymbosum*, *Vaccinium sp.*, *Viburnum tinus*, *Vicia faba*, *Vinca sp.*, *Vitis sp.*, *x Cuprocyparis leylandii*

GEOGRAPHICAL DISTRIBUTION

Cacoecimorpha pronubana is native to the Mediterranean Region. Meijerman & Ulenberg (2000) reported the pest as present throughout much of Europe (Italy (mainland, Sicily), France, Greece, Malta, the Netherlands, Poland, Spain, Switzerland, United Kingdom), Asia Minor (Israel, Turkey), and Northern Africa (Algeria, Libya, Morocco). It was unintentionally introduced to North America (British Columbia, California, Oregon, Washington).



EPPO Region: Albania, Algeria, Azerbaijan, Belgium, Bulgaria, Croatia, Cyprus, Denmark, France (mainland, Corse), Germany, Greece (mainland, Kriti), Guernsey, Hungary, Ireland, Israel, Italy (mainland, Sardegna, Sicilia), Jersey, Lithuania, Luxembourg, Malta, Morocco, Netherlands, Portugal (mainland, Madeira), Romania, Russian Federation (the), Serbia, Slovenia, Spain (mainland, Islas Baleares), Sweden, Switzerland, Tunisia, Türkiye, United Kingdom (England, Scotland)
Africa: Algeria, Libya, Morocco, Tunisia
Asia: Israel
North America: Canada (British Columbia), United States of America (Oregon, Washington)

BIOLOGY

Cacoecimorpha pronubana may have as many as six generations per year, depending on latitude, elevation, and local climatic conditions. In the more northern areas of its distribution (e.g., England), *C. pronubana* overwinter on host plants as larvae. Mortality among these larvae may be as high as 90% because of their sensitivity to low temperatures and rain. In regions with two generations per year, larvae mature from the end of March to May, with the pupal stage lasting 10-45 days. Adults emerge in April and May, with females depositing eggs until June. These eggs hatch, producing larvae that feed from late April to August. Pupation of this generation takes 15-17 days, with adults appearing in mid-August and flying until late September or early October. Some individuals may eclose as late as November if conditions (food plant quality and temperature) are favourable. During years with an exceptionally long, warm summer, a third generation may develop in the autumn on evergreen plants.

In the central part of its range (e.g., France, Italy), four generations occur. Overwintering is accomplished by larvae of the third and fourth generation; those in greenhouses (i.e., with minimum temperature 8°C) typically produce adults about 15 days earlier than those on crops outside of these artificial conditions. In the southern part of its range (North Africa), five, and possibly six, generations annually have been reported on citrus.

In greenhouses with a minimum temperature of 15°C (e.g., for roses), more than five generations may develop each year, and all stages of the insect may be found between spring and autumn, but not during the winter. So, in the south of France, ovipositing females of the last generation of the year never overlap with the appearance of the first adults of the following year.

Adults usually hatch at night, with copulation, which lasts 1?2 h, taking place immediately. The large-bodied females are not particularly good flyers; males are considerably more active. Egg laying occurs in clusters, beginning 3?4 h after copulation, and continues over several days. Eggs are laid primarily on smooth surfaces, and the first clutch, usually of 150-250 eggs, is the largest. Females may lay up to 700 eggs during their lifetime (average 430).

Eggs hatch within 8?51 days, again, dependent upon latitude and temperature. Hatching larvae are positively phototactic, and quickly move to, or are carried by wind (usually on a silk thread in an activity known as ‘ballooning’), to new vegetative growth or flowers. Here, they spin silk around two to three terminal leaves or petals, and feed on the upper surface, making numerous holes; first instars may also mine the parenchyma. By the end of the third instar, the entire leaf may be engulfed in a dense silken mass.

From egg-hatch to pupation (seven larval instars) takes 19?70 days; pupation lasts 10?15 days for most generations, but as mentioned above, may last as long as 45 days in more northern latitudes. Adult females live about 11?12 days, males about 14?18; males, in particular, are strongly attracted to light. Temperature minimums for copulation, egg laying, and hatching are 10.5, 12?13 and 14°C, respectively. Pupae cannot survive 2 h at -4°C, and therefore are incapable of overwintering in the northern part of the range. At average temperatures of 15 and 30°C, the complete life cycle takes 123?147 and 28?44 days, respectively. Humidity is also an important factor; larvae can develop at 10?15% RH; 40?70% RH is optimum, but above 90% RH, larval and pupal mortality increases. For addition information on biology, see Fisher (1924), Bestango (1955), Balachowsky (1966).

DETECTION AND IDENTIFICATION

Symptoms

On carnation cuttings

Terminal and axial leaves and buds may be enclosed in silk and show feeding damage, becoming characteristically crooked; this is usually more serious in spring.

On carnation flowers

Larvae may bore into unopen buds and join the petals with silk and frass, restricting flower opening and giving flowers a characteristic swollen appearance. In some cases, internal feeding larvae may not be apparent.

On citrus

Foliage attack is similar to that described for carnations, with characteristic crooked growth (Delucchi & Merle, 1962). Young stems may be mined. On fruit, there are two types of damage. In April to July, larvae feed superficially on the skin at the base of the peduncle (EPPO, 2004). They then move up the fruit and continue to consume the skin while protected by leaves that they have spun together with silk. The pulp is never attacked, and the damaged mesocarp quickly suberizes. The result is the presence of light-brown to blackish patches on the fruit surface, reducing marketability. The second type of damage is that on ripe fruit, which occurs in October and November; the calyx end is usually unaffected, and damaged areas do not suberize, facilitating the introduction and development of rots.

For more information on damage, see Targe & Deportes (1961), Balachowsky (1966).

Morphology

Egg

Like those of most tortricids, the eggs of *C. pronubana* are oval to round, flattened and scale-like, about 1.0 mm x 0.6 mm, with a reticulate chorion (= shell). They are laid in overlapping, shingle-like rows, that form an irregularly rounded cluster that may include 10-200 eggs, the number usually diminishing with age of the female. The eggs are initially light-green, becoming yellow. Prior to hatching, the pale embryonic larva with a dark head capsule becomes conspicuous through the translucent chorion of the egg. A colour illustration of an egg mass is provided by Chambon (1986).

Larva

Larvae are initially yellow with a black head, the latter becoming brown in the second instar. Late instar larvae are green to dark green with conspicuous light green pinacula, white setae, and dark brown to black spiracles. The head is green to yellowish brown with a dark brown to black posterolateral dash and variable dark brown markings on the posterior margin. The prothoracic shield is brownish green to yellowish brown, usually with a characteristic dark brown to black triangular patch at the posterolateral corner and other smaller markings near the middorsal line. The anal shield is variably mottled with brown or black, and the anal fork is well developed with six tines (Gilligan and Epstein 2014). Chaetotaxy (the arrangement of the setae) is typical of most Archipini, with a trisetose L-group on the first thoracic segment; a dorsal ‘saddle’ on abdominal segment nine representing the shared pinaculum of the D2 setae; and D1 and SD2 on separate pinacula on abdominal segment 9. There are numerous colour images of the larvae on the internet, and line drawings of the chaetotaxy may be found in Fisher (1924), Swatschek (1958), and Carter (1984).

Pupa

Pupae are initially brown, becoming almost black. They are 9?12 mm in length (Meijerman & Ulenberg, 2000), with two rows of tiny spines across the dorsum of most abdominal segments, and an elongate, tapered cremaster with four pairs of tiny, hooked setae. They are nearly indistinguishable from those of many other Archipini.

Adult

Forewing length is 6.5?8.5 mm in males, 7.5?11.5 mm in females. The forewing is orange-brown to dark brown; males typically have a dark brown median fascia, whereas females are lighter brown with darker reticulations. A male forewing costal fold, present in many related Archipini, is absent. The hindwing of both sexes is distinctively bright orange and black, although some females lack the black scaling (Razowski 2002, Gilligan & Epstein, 2014). The hindwing colour distinguishes the species from most similar tortricids. Colour illustrations of the adult may be found in Bradley *et al.* (1973), Razowski (2002), and Gilligan & Epstein (2014).

Egg clusters, larva, and pupae of *C. pronubana* are not easily distinguished from those of *Epichoristodes acerbella* (EPPO/CABI, 1996), but adults of the two species are easily separated by forewing pattern and hindwing colour.

Detection and inspection methods

Cacoecimorpha pronubana may be encountered in greenhouses, nurseries, and urban and agricultural landscapes, as well as in native habitats.

Visual inspection may be time consuming, and may not always successfully detect low-density infestations. Egg masses may be found on the upper surface of leaves, and first instars may leave small mines within leaves. Later instars may be detected by the presence of rolled or folded leaves, which the larvae bind with silk, creating a characteristic shelter. When feeding on flowers and buds, larvae may be detected by the presence of silk webbing and frass on petals. On citrus, larvae may leave light-brown to blackish patches on the surface of the fruit.

A more reliable method of detection is the use of artificial attractants. Sex pheromones have been developed for *C. pronubana* males (Descoins et al., 1985, Witzgall, 1990), and these have proven very effective for detecting and monitoring adult populations of this species.

PATHWAYS FOR MOVEMENT

The adults can disperse locally, but not over long distances. In international trade, eggs and larvae of *C. pronubana* may be transported on plants for planting or on cut flowers of carnations, chrysanthemums, pelargoniums, roses, and other hosts. In the 2000s, the species was commonly intercepted at US ports of entry on *Ruscus* sp. (Asparagaceae) from Italy and *Capsicum* spp. (Solanaceae) from the Netherlands.

PEST SIGNIFICANCE

Economic impact

In spite of the polyphagous nature of this insect, serious damage is mainly confined to carnation crops in the Mediterranean area, where losses have been reported since the 1920s. Near Nice, France, 25?35% of carnations were affected in 1972?1973, and losses in consignments for export were valued at about 100 000 francs (equivalent to 15 000 euros in 1972). In Morocco, *C. pronubana* was first detected in 1933 on citrus, but it was not until 20 years later that it developed into a widespread pest on this crop, the larvae destroying foliage and damaging fruit. In Algeria, *C. pronubana* is found mainly on lemons, but is not considered a serious pest. In Italy (Sicily) surveys reported *C. pronubana* mainly on olive trees, weeds, and roses, but not on lemons (Inserra *et al.*, 1987; Siscaro *et al.*, 1988). Alford (1975) and Cross *et al.* (2001) indicate that tortricid moths on strawberry "… are a more benign pest that is often believed and spray treatment cannot often be economically justified." In contrast, in Central and Northern Europe (e.g., Poland, the Netherlands), *C. pronubana* may be an important pest in greenhouses.

Control

Control of *C. pronubana* can be achieved using pyrethroids such as deltamethrin and fenvalerate (Pandolfo & Zagami, 1983; Inserra *et al*., 1987). In Sicily, a single application of a pyrethroid provided control, and in the Middle East, chemical control has not been deemed necessary (Plant Pests of the Middle East, 2015). Burgess and Jarret (1978) studied the effect of *Bacillus thuringiensis* on tortricid pests in greenhouses, and concluded that a higher-than-normal dose was necessary for effective control of *C. pronubana*. Wysoki (1989) tested *B. thuringiensis* in Israel where the moth is a pest of avocados.

Control of *C. pronubana* by biological means has not been investigated thoroughly, but the endoparasitoid *Elachertus lateralis* Spinla (Eulophidae) is known to attack the larvae in Israel. CABI (2021) provides a list of natural enemies known to attack larvae and eggs of *C. pronubana*.

The efficacy of sex pheromones for mating disruption is still in question (Guda & Capizzi, 1988). Baraldi (1996) stated that experimental research on the use of direct radiation (male sterilization) to control insect pests on cut flowers is promising. However, both mating disruption or male sterilisation may be cost prohibitive compared to the damage caused by the *C. pronubana*.

Phytosanitary risk

Cacoecimorpha pronubana is a A2 quarantine pest by EPPO, and it is also of quarantine significance for JUNAC. Research in Germany (Herfs, 1963) suggested that the insect is unlikely to become established to the east and north of the January +2°C isotherm, which continues to gradually shift northward with global climate change. Based on this temperature threshold, the insect may already occupy the limits of its natural range in the Palaearctic, baring future climatic change. However, global climate change may obviously provide an opportunity for further range expansion. In addition, *C. pronubana* is a threat to greenhouse crops, especially carnations and other flowers and ornamental plants. For more information, see Balachowsky (1966).

PHYTOSANITARY MEASURES

In countries where *C. pronubana* occurs, nursery inspections should be carried out during the growing season prior to dispatch of nursery stock and cut flowers. Requiring that plants for planting or cut flowers of hosts originate from a pest free area can also be an appropriate phytosanitary measure. Other risk management options may be relevant, such as growing the plants under complete physical isolation (EPPO, 2016).

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ACKNOWLEDGEMENTS

This datasheet was extensively revised in 2023 by John W. Brown, National Museum of Natural History, Smithsonian Institution, Washington, DC. His valuable contribution is gratefully acknowledged.

How to cite this datasheet?

EPPO (2025) *Cacoecimorpha pronubana*. 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 1981 and revised in the two editions of 'Quarantine Pests for Europe' in 1992 and 1997, as well as in 2023. 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