EPPO Datasheet: *Orgyia leucostigma*

Last updated: 2025-08-07

IDENTITY

Preferred name: *Orgyia leucostigma*
Authority: (Smith)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Lepidoptera: Erebidae
Other scientific names: *Hemerocampa leucostigma* (Smith), *Phalaena leucostigma* Smith
Common names: white-marked tussock moth
view more common names online...
EPPO Categorization: A1 list, Alert list (formerly)
view more categorizations online...
EPPO Code: HEMELE

Notes on taxonomy and nomenclature

Several geographical populations of *O. leucostigma* exist, which are sometimes treated as five subspecies: *O. leucostigma* subsp. *leucostigma* (Smith, 1797), *O. leucostigma* subsp. *intermedia* Fitch, 1856, *O. leucostigma* subsp. *plagiata* (Walker, 1855), *O. leucostigma* subsp. *oslari* Barnes, 1900 and *O. leucostigma* subsp. *sablensis* Neil, 1979 (Ferguson, 1978; Wallner & McManus, 1989; Pohl et al., 2018).

HOSTS

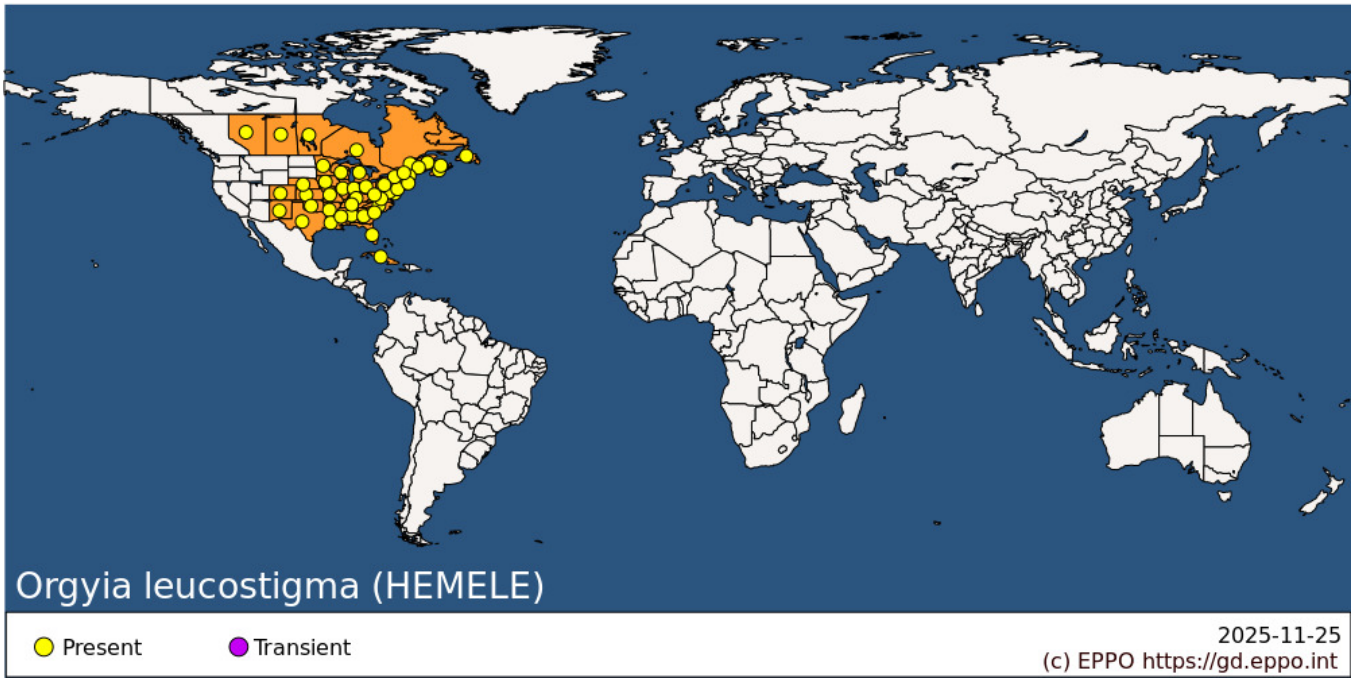
O. leucostigma is highly polyphagous and has been recorded on over 160 host plants belonging to 122 genera and 59 families (EPPO, 2021). Host plants include deciduous and coniferous woody plants, as well as herbaceous plants (including some weeds), however most damage is recorded on trees and bushes. In forests, *O. leucostigma* is primarily a pest of deciduous trees but coniferous species are also attacked when population density is high (Natural Resources Canada, 2020). The host species with most significant damage differ depending on areas, *O. leucostigma* subspecies and years. The EPPO PRA distinguished between main hosts and other hosts, and details can be found in EPPO (2021).

Host list: *Abies balsamea*, *Abies concolor*, *Abies*, *Acer negundo*, *Acer platanoides*, *Acer rubrum*, *Acer saccharinum*, *Acer saccharum*, *Acer spicatum*, *Acer*, *Aesculus flava*, *Aesculus glabra*, *Aesculus hippocastanum*, *Ailanthus altissima* , *Albizia julibrissin*, *Alnus incana subsp. rugosa*, *Alnus incana*, *Alnus viridis*, *Alnus*, *Amelanchier canadensis*, *Asimina triloba*, *Berberis canadensis*, *Berberis vulgaris*, *Betula alleghaniensis*, *Betula lenta*, *Betula nigra*, *Betula papyrifera*, *Betula pubescens*, *Betula*, *Buxus sempervirens*, *Callistemon*, *Camellia japonica*, *Camellia sasanqua*, *Camellia*, *Campsis radicans*, *Carpinus caroliniana*, *Carpinus*, *Carya*, *Castanea dentata*, *Castanea pumila*, *Catalpa bignonioides*, *Catalpa speciosa*, *Catalpa*, *Celtis laevigata*, *Celtis occidentalis*, *Cephalanthus occidentalis*, *Cercis canadensis*, *Chaenactis stevioides*, *Chamaecyparis thyoides*, *Chenopodium album*, *Chionanthus virginicus*, *Chrysalidocarpus lutescens*, *Clematis*, *Coffea arabica*, *Convallaria majalis*, *Cornus alternifolia*, *Cornus canadensis*, *Cornus florida*, *Cornus*, *Corylus americana*, *Corylus*, *Cotinus coggygria*, *Crataegus*, *Cupressus*, *Cydonia oblonga*, *Diospyros kaki*, *Diospyros virginiana*, *Eriobotrya japonica*, *Euonymus atropurpureus*, *Fagus grandifolia*, *Fagus*, *Ficus carica*, *Fragaria*, *Fraxinus americana*, *Fraxinus excelsior*, *Fraxinus*, *Geranium maculatum*, *Gleditsia triacanthos*, *Gordonia lasianthus*, *Gossypium herbaceum*, *Gymnocladus dioica*, *Hamamelis virginiana*, *Hedera helix* , *Helianthus*, *Hibiscus syriacus*, *Hibiscus trionum*, *Humulus lupulus*, *Ilex opaca*, *Illicium parviflorum*, *Ipomoea purpurea*, *Iris versicolor*, *Iris*, *Jasminum*, *Juglans cinerea*, *Juglans nigra*, *Juglans regia*, *Juniperus virginiana*, *Kalmia*, *Larix decidua*, *Larix laricina*, *Larix*, *Leptochloa nealleyi*, *Ligustrum vulgare*, *Liquidambar styraciflua*, *Liriodendron tulipifera*, *Litchi chinensis*, *Lonicera*, *Maclura pomifera*, *Magnolia*, *Malus domestica*, *Malus sylvestris*, *Malus*, *Malva*, *Mimosa*, *Morus rubra*, *Morus*, *Myrica cerifera*, *Myrica gale*, *Myrica pensylvanica*, *Nyssa sylvatica*, *Ostrya virginiana*

, Oxydendrum arboreum, Parthenocissus quinquefolia, Paulownia tomentosa, Pelargonium x hortorum, Persea borbonia, Photinia, Picea glauca, Picea mariana, Picea rubens, Picea, Pinus strobus, Pinus, Plantago, Platanus occidentalis, Platanus, Poa pratensis, Populus alba, Populus balsamifera, Populus deltoides, Populus fremontii, Populus nigra var. italica, Populus nigra, Populus tremuloides, Populus, Prunus americana, Prunus armeniaca, Prunus cerasus, Prunus domestica, Prunus ilicifolia, Prunus pensylvanica, Prunus persica, Prunus virginiana, Prunus, Punica granatum, Pyracantha coccinea, Pyracantha, Pyrus communis, Quercus alba, Quercus coccinea, Quercus laurifolia, Quercus michauxii, Quercus nigra, Quercus phellos, Quercus rubra, Quercus virginiana, Quercus, Rhamnus alnifolia, Rhaphiolepis indica, Rhizophora mangle, Rhododendron, Ribes, Ricinus communis, Robinia pseudoacacia, Rosa, Rubus, Salix babylonica, Salix caroliniana, Salix nigra, Salix, Sambucus canadensis, Sassafras albidum, Simmondsia chinensis, Sorbus, Spiraea, Staphylea trifolia, Symphoricarpos albus, Syringa vulgaris, Tamarix chinensis, Tamarix gallica, Taraxacum officinale, Taxus, Tilia americana, Tilia x europaea, Tilia, Trema micrantha, Trifolium, Triticum, Tsuga canadensis, Tsuga, Ulmus americana, Ulmus parvifolia, Ulmus rubra, Ulmus, Urena lobata, Vaccinium angustifolium, Vaccinium corymbosum, Vaccinium, Viburnum, Wisteria frutescens, Wisteria sinensis, Zanthoxylum clava-herculis, Zea mays

GEOGRAPHICAL DISTRIBUTION

O. leucostigma is distributed throughout the eastern part of North America, reaching to the west New Mexico and Colorado in the USA and Manitoba in Canada. There have also been two records in the western part of Cuba (Barro & Núñez, 2011, Núñez & Barro, 2012, EPPO, 2021).



North America: Canada (Alberta, Manitoba, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, Québec, Saskatchewan), United States of America (Alabama, Arkansas, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Vermont, Virginia, West Virginia, Wisconsin)
Central America and Caribbean: Cuba

BIOLOGY

Females of *O. leucostigma* lay up to 500 eggs in a froth-covered egg mass on the surface of or near their empty pupal

cocoons (Webster, 1916; Belton, 1988; Wilson, 1991; Isaacs & van Timmeren, 2009; Schowalter, 2018). *O. leucostigma* generally overwinters in the egg stage, although in some locations larvae, pupae or adults may be present during the winter (Webster, 1916; Ferguson, 1978). The period of larval emergence depends on location (e.g. latitude, climatic conditions) (Isaacs & van Timmeren, 2009) and is typically closely timed to match the availability of new host plant foliage (EPPO, 2021). First instar larvae disperse throughout the host plant, often by spinning down on long silk threads and floating on air currents ('ballooning') (Thurston, 2002). Such 'ballooning' is also the main means of natural dispersal of the species (Embree et al., 1984; Thurston & MacGregor, 2003). 'Ballooning' distances of *O. leucostigma* are not known, but most larvae of the related species *O. pseudotsugata* generally do not disperse more than 200 m (EPPO, 2021) by this means. Larvae of *O. leucostigma* feed on the surface of leaves and the larval stage lasts 5–6 weeks (Schowalter, 2018). The last instar larvae spin nymphal cocoons mostly on host plants (such as on branches or stems) but in abundant populations these are formed on other materials such as fences, houses, logs (Embree et al., 1984; Wilson, 1991; Thurston, 2002; Baker, 2017). The pupal stage lasts 2–3 weeks (Wilson, 1991). Upon emerging, the flightless females attract males to their cocoons using a sex pheromone (Grant et al., 2003. Hall & Buss, 2014). Males fly at night (Grant et al., 2003) and are attracted to artificial lights (Hancock, 1893). After oviposition, females die and fall to the ground (Thurston & MacGregor, 2003; Schowalter, 2018). Adults do not feed and thus are short-lived (Tammaru et al., 2002).

Orgyia leucostigma has 1–3 generations per year, depending on climatic conditions (Drooz, 1985; Thurston, 2002; Grant et al., 2003; Isaacs & van Timmeren, 2009). Using 12.8°C as a base threshold temperature, 2000 growing degree-days (GDD) are needed for the development of two generations of larvae (Isaacs & van Timmeren, 2009). In laboratory experiments on northern highbush blueberry (*Vaccinium corymbosum*), the lower threshold for development was 12.3°C and the optimal temperatures for development was between 18°C and 28°C (Isaacs & van Timmeren, 2009).

DETECTION AND IDENTIFICATION

Symptoms

The first sign of infestation by *O. leucostigma* is normally numerous holes in young leaves. Larvae are highly visible on the leaves. Later in the infestation, skeletonized shoots and bare stems indicate the presence of larger larvae.

Morphology

Eggs and egg masses

Eggs are 1-2 mm, round and cream-white in colour. They are laid in a foamy white egg mass (see Biology) (Webster, 1916; Wilson, 1991; Hall & Buss, 2014; Schowalter, 2018).

Larva

Newly hatched larvae are small and brown, around 2.5–4 mm long. Mature larvae are 25–37 mm long and have a reddish-orange head and hairy body. They are characterised by two white or yellow lines along the body's length, a black mid-dorsal stripe, four brush-like tufts of light tan hairs on the back (on the first four abdominal segments) and red dorsal glandular structures on abdominal segments six and seven. A pair of longer tufts (tussocks) of black hairs rises forward from the prothorax, and dorsal hair tufts of black setae extending backward on the eighth abdominal segment (Riley, 1888; Isaacs & van Timmeren, 2008; 2009; Wagner et al., 1997; Hall & Buss, 2014; Schowalter, 2018; Natural Resources Canada, 2020).

Pupa

Pupae appear hairy and have patches of dorsal spatulate setae on abdominal segments 1–3. They are enclosed in the nymphal cocoons, which are cream- or tan in colour, made of silk and body hairs, and approximately the size of the adult (Barnard & Dixon, 1983; Hall & Buss, 2014; Schowalter, 2018). Female and male pupae vary in size, length of the wings in relation to the abdomen, and antennae width (Riley, 1888; Hall & Buss, 2014)

Adult

Males are ash grey with prominent bipectinate antennae and a wingspan of 25–30 mm. Forewings have darker wavy bands and a conspicuous white spot near the anal angle. The wings of newly emerged males have a purplish tint. When at rest, males hold their first pair of legs in an outstretched position. Females are creamy white to grey, hairy and about 12 mm long. The literature often describes females as being wingless, but they are short-winged (brachypterous) and cannot fly (Hall & Buss, 2014; Schowalter, 2018; Isaacs & van Timmeren, 2009).

Detection and inspection methods

The life stages of *O. leucostigma* and its symptoms are usually visible to the naked eye (EPPO, 2021). Symptoms and life stages can be more difficult to detect on certain plants and plant shapes (such as dense, shady parts of plants, evergreen plants).

Adult males can be trapped using pheromone traps baited with *O. leucostigma* pheromone [(Z,Z)-6,9-heneicosadien-11-one] (Grant et al., 2003; Isaacs & van Timmeren, 2009) or *O. pseudotsugata* pheromone (Daterman et al., 1977). Large plastic delta traps were found to be the most effective at trapping males in field experiments on blueberry (*Vaccinium corymbosum*) (Isaacs & van Timmeren, 2009).

O. leucostigma can be distinguished from most *Orgyia* species by external morphological characteristics of males (EPPO, 2021; Daterman et al., 1977). Due to colour polymorphism, and if male specimens are damaged (as is common for trapped specimens), *O. leucostigma* may in some cases only reliably be distinguished from other *Orgyia* species by the male genitalia (Ferguson, 1978; pers. comm. in EPPO, 2021). Ferguson (1978) provides a key to last instar larvae of eight *Orgyia* species, including *O. leucostigma*.

A molecular diagnostic method based on PCR-RFLP of nuclear ribosomal DNA covering seven Lymantriidae species (including *O. leucostigma*) was developed in New Zealand to identify egg masses intercepted on imported used vehicles (Armstrong et al., 2003). Later, more advanced approaches for identification of Lymantriidae and two subspecies of *Orgyia trigotephras* using DNA barcoding of the *cox1* gene were tested and proved successful by Armstrong & Ball (2005), Ball & Armstrong (2006) and Ezzine *et al.* (2014).

PATHWAYS FOR MOVEMENT

All life stages can be present on the above-ground parts of the host plants, including foliage, branches and stems/trunks. The main pathway for *O. leucostigma* is plants for planting of hosts (except seeds, bulbs, corms, tubers, rhizomes, tissue cultures, pollen). Round wood with bark of main hosts is also a potential pathway (EPPO, 2021). The EPPO PRA assessed the likelihood of entry on cut branches (incl. Christmas trees), sawn wood with bark, bark of main hosts, and round wood with bark of other hosts as low (EPPO, 2021). For all pathways, the pest is more likely to be associated with its woody hosts than its herbaceous hosts. Transfer to a suitable host is a limiting step for entry on most pathways. However, arrival of a single egg-mass or a fertilized female may be sufficient to facilitate transfer, if it ends up in a site with a high density of suitable host plants. Larvae would need to reach a host through ‘ballooning’ or crawling.

Egg masses, pupae and adults may become associated as a contaminant to various commodities of non-hosts (such as wood packaging material, containers, conveyances, or any material likely to be stored outside). However, transfer to a suitable host plant would require specific conditions and, in the EPPO PRA, it was not possible to identify commodities that may present a higher likelihood of association as a contaminant (EPPO, 2021).

PEST SIGNIFICANCE

Economic impact

Damage by *O. leucostigma* is due to defoliation by larvae. Trees and shrubs may be entirely defoliated when larval

density is high (Webster, 1916; Drooz, 1985; Hall & Buss, 2014). Repeated years of severe defoliation can lead to significant wood loss and tree mortality (Magasi, 1995; Thurston, 2002; Dedes, 2014). In forests, *O. leucostigma* is primarily a pest of broadleaved trees but it also attacks conifers when the population density is high (Magasi, 1995; Taylor et al., 2020). On conifer hosts, larvae also feed on the bark of twigs, leading to curling of twigs and deformation of branches (Dedes, 2014). Environmental impact can occur during severe outbreaks, as large-scale defoliation leads to changes to forest ecosystems in short time periods (Taylor et al., 2020).

Outbreaks of *O. leucostigma* have been reported to occur periodically, at least in the north-eastern USA and Canada (van Frankenhuyzen et al., 2002; Taylor et al., 2020). Outbreaks commonly last from 1 to 4 years. In the native range, populations are usually regulated by natural enemies, such as parasitoids, predators and pathogens, and especially the latter were found to be associated with the termination of outbreaks (Embree et al., 1984; Magasi, 1995; Thurston, 2002; van Frankenhuyzen et al., 2002). In Atlantic Canada, outbreaks occur about every 9 years with major outbreaks every 20 years (Thurston, 2002). In Nova Scotia, in 1996-2000, an outbreak of *O. leucostigma* affected over 500 000 ha of forests (Thurston, 2002). Outbreaks in other parts of North America appear to be less severe (Drooz, 1985; Furniss & Carolin, 2002; Keating et al., 2013; Boggs, 2019).

In Canada, *O. leucostigma* is also a major pest in Christmas tree plantations of balsam fir (*Abies balsamea*), where defoliation can lead to a total crop loss in one year and presence of egg masses results in unmarketable trees (Embree et al., 1984; Thurston, 2002). Sporadic outbreaks in blueberry (*Vaccinium* sp.) fields in Nova Scotia (Canada) and Michigan (USA) also result in significant crop losses (Neilson & Crozier, 1989; Isaacs & van Timmeren, 2009). *O. leucostigma* has also been reported as a pest of fruit trees, such as apple (*Malus*), pear (*Pyrus*), plum (*Prunus*), strawberry (*Fragaria*) and raspberry (*Rubus*) (Belton, 1988), and ornamental plants in gardens and landscapes (Embree et al., 1984, Baker, 2017). Finally, social impact can occur due to allergic reactions to larvae (Baker, 2017; Thurston, 2002).

Control

Control measures in the native range are usually not required since outbreaks are commonly local and are brought under control by natural factors, mainly natural enemies (see *Economic impact*). Nevertheless, extensive spraying programmes have been used to control outbreaks in blueberry plantations and in forests using chemical or microbial plant protection products targeting larvae (Embree et al., 1984; Isaacs & van Timmeren, 2008; Thurston, 2002, Schowalter, 2018). Regarding microbial plant protection products, *Bacillus thuringiensis* subsp. *kurstaki* and *Orgyia pseudotsugata* nucleopolyhedrovirus (OrpsNPV) have been used (Cunningham & Kaupp, 1995; Thurston, 2002; Baker, 2017). At a small scale and when feasible for the host concerned, removing egg-masses, larvae and cocoons can reduce the density of the pest (Isaacs & van Timmeren, 2008; CABI, 2020).

Phytosanitary risk

Climatic conditions are suitable for the establishment of *O. leucostigma* in a large part of the EPPO region, at least from temperate oceanic Europe to the Russian Federation (EPPO, 2021). Host plants of *O. leucostigma* occur throughout the EPPO region in different environments including deciduous and coniferous forests, as well as plantations (especially Christmas trees), orchards and gardens (fruit trees and ornamentals), urban areas (ornamentals), in the wild and as weeds. The eastern and northern parts of the EPPO region are considered more at risk, because climate is similar to where *O. leucostigma* has caused economic damage in its current distribution. In forests, both economic and environmental impacts may occur. As in North America, impact may fluctuate depending on locations and years. Some known natural enemies are present in the EPPO region, but the same natural enemy complex that exists and regulates populations in North America does not occur in the EPPO region. In some environments, treatment options may be limited. Nevertheless, some plant protection products that have been used in North America are registered in at least part of the EPPO region for some uses, including microbial plant protection products such as *Bacillus thuringiensis* subsp. *kurstaki*.

PHYTOSANITARY MEASURES

Measures are recommended for main woody hosts (EPPO, 2021). The EPPO PRA recommended similar options for plants for planting (except seeds, bulbs, corms, tubers, rhizomes, tissue cultures, pollen) and cut branches (incl.

Christmas trees) of main hosts: pest free area, pest free production site under complete physical isolation according to EPPO Standard PM 5/8 (EPPO, 2016), and pest free place of production/pest-free production site (including visual inspection of the plants throughout the growing period, pheromone trapping, a 1 km buffer zone and visual inspection of consignments). Where relevant, packaging should prevent infestation during storage and transport.

For round wood and sawn wood with bark of main hosts, options include pest free area, heat treatment according to EPPO Standard PM 10/6(1) (EPPO, 2009a), irradiation treatment according to EPPO Standard PM 10/8(1) (EPPO, 2009b), bark freedom, or debarking associated with ISPM 28 PT 22 Sulfuryl fluoride fumigation treatment for insects in debarked wood (FAO, 2017a) or with PT 23 Sulfuryl fluoride fumigation treatment for nematodes and insects in debarked wood (FAO, 2017b). Finally, a pest free area or chipping to pieces of less than 2.5 cm in any dimension are possible options for isolated bark of main hosts.

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