

EPPO Datasheet: *Gilpinia hercyniae*

Last updated: 2023-05-12

IDENTITY

Preferred name: *Gilpinia hercyniae*

Authority: (Hartig)

Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Hymenoptera: Diprionidae

Other scientific names: *Diprion hercyniae* Hartig, *Diprion polytoma* Hartig, *Gilpinia polytoma* auctorum, *Lophyrus hercyniae* Hartig, *Lophyrus polytomus*

Common names: European spruce sawfly

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EU Categorization: PZ Quarantine pest ((EU) 2019/2072 Annex III)

EPPO Code: GILPPO



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Notes on taxonomy and nomenclature

Considerable confusion has occurred regarding the taxonomy of *Gilpinia hercyniae* (Adams and Entwistle 1981). Hartig first described *Lophyrus polytomus* in 1834, and then *Lophyrus hercyniae* in 1837 as two distinct spruce-feeding sawfly species in Europe. In 1910, both species were moved to the genus *Diprion*, but many authors continued to use *Lophyrus*. In 1912, a different author synonymized *L. hercyniae* under *L. polytomus*. Then in 1939, Benson erected a new genus, *Gilpinia*, under which he listed *L. polytomus* as *G. polytoma*, but did not recognize *L. hercyniae*. Soon thereafter, Reeks (1941) and Smith (1941), using cytological and morphological evidence, demonstrated that *G. hercyniae* and *G. polytoma* were distinct species, and that the species introduced into North America in the early 1900s was *G. hercyniae*. For several years, some authors used *G. hercyniae*, while others used the genus *Diprion*. Finally, in Smith's (1974) list of the Diprionidae of the world, he recognized both *G. hercyniae* and *G. polytoma* as distinct species. Therefore, in the early literature *G. hercyniae* will be found under many scientific names and often confused with *G. polytoma*. There are two other European spruce-feeding sawflies in the genus *Gilpinia*: *G. abieticola* (Dalla Torre) and *G. fennica* (Forsius) (Smith, 1974; Holuša & Roller, 2004).

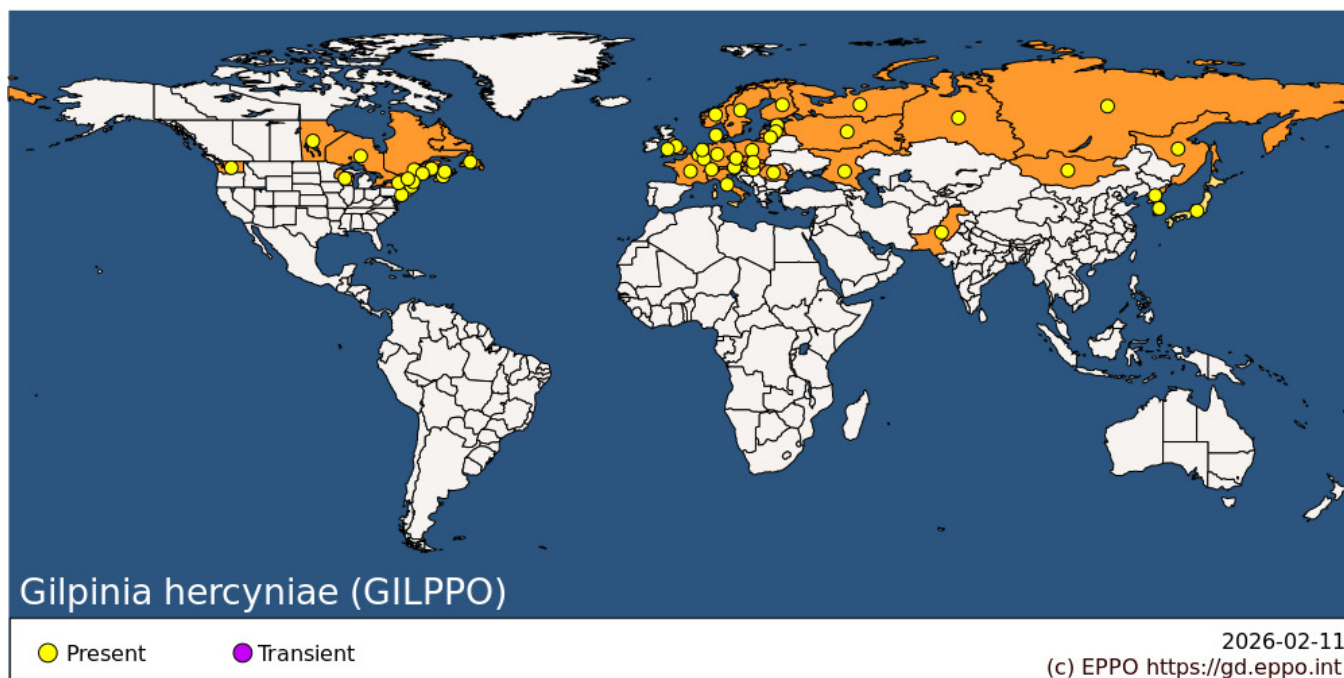
HOSTS

The insect occurs primarily on spruce (*Picea*) species such as *P. abies*, *P. glauca*, *P. mariana*, *P. pungens*, *P. rubens*, and *P. sitchensis*. On rare occasions, larvae have been observed feeding on species of fir (*Abies*) when spruce foliage is limiting during outbreaks (Browne, 1968; Schedl, 1975).

Host list: *Abies alba*, *Abies balsamea*, *Picea abies*, *Picea glauca*, *Picea jezoensis* subsp. *hondoensis*, *Picea mariana*, *Picea obovata*, *Picea omorika*, *Picea pungens*, *Picea rubens*, *Picea sitchensis*

GEOGRAPHICAL DISTRIBUTION

In addition to the published records, several additional North American field-collected specimens of *G. hercyniae* have been documented in university and government insect collections in both Canada and the United States, as well as verified from photographs submitted to BugGuide.net and iNaturalist.org by Dr. David R. Smith, a world sawfly expert. These locations include the Canadian province of Alberta, and the US states of Georgia, Iowa, Maryland, Michigan, Minnesota, North Carolina, Ohio, Pennsylvania, Tennessee, and West Virginia. There was also a published report of *G. hercyniae* from the Canadian province of British Columbia (Langor *et al.*, 2014), but that particular specimen cannot be found for verification.



EPPO Region: Austria, Belgium, Czechia, Denmark, Estonia, Finland, France (mainland), Germany, Hungary, Italy (mainland), Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Romania, Russian Federation (Central Russia, Eastern Siberia, Far East, Northern Russia, Southern Russia, Western Siberia), Slovakia, Sweden, Switzerland, United Kingdom (England, Wales)

Asia: Japan, Korea, Democratic People's Republic of Korea, Republic of Korea, Mongolia, Pakistan

North America: Canada (Manitoba, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, Québec), United States of America (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Vermont, Washington, Wisconsin)

BIOLOGY

An annotated bibliography of the literature dealing with *G. hercyniae* up to 1979 was published by Adams and Entwistle (1981). *G. hercyniae* overwinters as a prepupa (eonymph 6th) in a cocoon that it spins on the forest floor under leaf litter or moss. Pupation starts in early spring with adults emerging in early summer. Depending on the length of the summer season and temperatures, there are usually one or two generations per year; however, three generations have been recorded in the southern part of the insect's range (MacAloney, 1936; Balch, 1939; Prebble, 1941). The sex ratio is highly female biased at about 1 male to 1200 females (Balch, 1939). The species is mainly parthenogenetic, producing diploid females from unfertilized eggs (thelytoky) (Balch *et al.*, 1941; Smith, 1941). Adults are strong flyers (Balch, 1939). Females start ovipositing soon after emergence and usually lay 30–60 eggs (Prebble, 1941; Thalenhorst, 1968). Eggs are inserted singly in old needles via a slit which is cut in the needle using the ovipositor. Eggs hatch in approximately 10 days (Balch, 1939). Larvae feed singly and mostly on 1–3-year-old foliage (Jensen 1988). New foliage may be avoided by first-generation larvae because of high levels of some secondary compounds (Jensen, 1988). Second and third generation larvae may feed on old as well as current-year needles, especially in white spruce (*Picea glauca*) (Balch, 1939). Larvae pass through six instars in about one month (MacAloney, 1936). The sixth instar does not feed, but instead drops to the forest floor (MacAloney, 1936; Balch, 1939). Depending on local conditions, pupation may be completed in 2–4 weeks with new adults beginning the next generation while other prepupae undergo diapause. Some individuals remain in extended diapause for as many as 6 years, although 2–3 years is more common (MacAloney, 1936; Balch, 1939).

DETECTION AND IDENTIFICATION

Signs and Symptoms

Larval feeding occurs first on older needles, usually starting at the tip. Larval fecal pellets (frass) often accumulate

on foliage and on the forest floor beneath infested trees. The individual fecal pellets of older larvae are about 2 x 1 mm in size, green at first but turning reddish brown with age (Morris, 1942). Larval life stages of *G. hercyniae* are found most often during the summer months, especially fourth and fifth instars that have a brownish head capsule, green body, and five white longitudinal stripes (Wilson, 1977).

Morphology

Eggs

The eggs are pale green, elongate oval, and about 1.9 mm long and 0.5 mm wide (Billany, 1978). Eggs are inserted near the center of a needle, one egg per needle. Females oviposit throughout the crown, selecting mostly 1-year-old needles for oviposition (Balch, 1939; Billany *et al.*, 1978). There is a distinct bulge in the needle where the egg is inserted.

Larva

There are six larval instars: the first five instars actively feed whereas the sixth is nonfeeding and spins a cocoon. Larval length increases from about 3 mm in first instars to about 15-20 mm in fifth and sixth instars (Lorenz & Kraus, 1957; Wong & Szlabey, 1986). First to third instar larvae are green and lack longitudinal stripes. Fourth and fifth instars have five white longitudinal stripes along their abdomen. The sixth instar lacks stripes. Abdominal prolegs are found on segments 2-8 and 10. The three pairs of thoracic legs are brown to black. Spiracles are light brown. The head capsule is mainly black in first instars, brownish in second to fifth instars, and green in sixth instars. Head capsules have a dark triangular patch (Wong & Szlabey, 1986). Keys to larvae of *Gilpinia* species are available for Europe (Benes & Kristek, 1979) and North America (Wong & Szlabey, 1986).

Pupa

The cocoon is spun in the leaf litter layer by the 6th instar larva. The cocoon is finely textured, reddish brown, cylindrical with rounded ends, 8-9 mm long and 4 mm wide (Billany, 1978).

Adult

Reeks (1941) separated *G. hercyniae* from *G. polytoma* based on morphological differences of the genitalia. Additional characters of the head and antenna were used by Goulet (1981) to separate these two species. Adult *G. hercyniae* females are stout-bodied, 6.0-9.5 mm long, with serrate antennae. Head and body are black with many yellow markings and bands as described in Reeks (1941), Benson (1951), and Billany (1978). Adult males are 4.0-8.5 mm long, with pectinate antennae, and are mostly black on the upper thorax and abdomen with yellow lateral markings as described in Reeks (1941) and Benson (1951).

Detection and inspection methods

Larvae and adults of *G. hercyniae* are the life stages which are most likely to be found in the field. However, at low populations, detection is difficult because larvae feed singly on older needles and adult females often oviposit in the upper crown. Larvae can be collected by beating the branches over a sheet or tray (Martineau, 1943; Thalenhorst, 1960; Neilson & Morris, 1964). Techniques such as collecting frass as it falls to the ground from infested trees or collecting sawfly cocoons on the forest floor have been used to monitor *G. hercyniae* population fluctuations (Martineau, 1943; Prebble, 1943; Morris, 1949). During outbreaks, the degree of defoliation can be estimated at the tree and stand level (Martineau, 1943).

PATHWAYS FOR MOVEMENT

G. hercyniae adults are strong fliers and can be carried several kilometers by air currents (Balch, 1939). Given that females are parthenogenetic, a single female can initiate a new population. All immature life stages of *G. hercyniae* can be transported to new areas by artificial means. For example, eggs and larvae can be transported on live plants or branch cuttings. For potted nursery stock infested with *G. hercyniae*, mature larvae could drop into the soil in the container and pupate. Although less likely, mature larvae could drop onto vehicles and other equipment and spin cocoons, and then be transported to new areas.

PEST SIGNIFICANCE

Economic impact

Currently, *G. hercyniae* is of little significance throughout its native range of Eurasia as well as in its introduced range of North America. Historically, outbreaks have occurred in Canada (Balch, 1939; Neilson & Morris, 1964), the United States (MacAloney, 1936; Baldwin, 1939; Dowden, 1939; Reeks & Barter, 1951), and Wales (UK) (Billany & Brown, 1977; Bevan, 1987) following the introduction of *G. hercyniae* without its natural enemies. During these outbreaks, usually after consecutive years of defoliation, spruce trees of various species have shown reduced growth rates, crown dieback, and at times widespread tree mortality (Balch, 1939; Martineau, 1943; Reeks & Barter, 1951; Billany, 1978; Williams *et al.*, 2003).

Control

Control measures have not been necessary for *G. hercyniae* in its native range due to the presence of natural enemies. In its introduced range, large-scale biological control programs were successful in controlling *G. hercyniae*. The first outbreaks of *G. hercyniae* in North America occurred in Eastern Canada and the adjacent United States in the early 1930s. Given low parasitism rates in the infested areas by native natural enemies (Balch, 1939), about 25 different parasitoids were selected, primarily from Europe, reared, and released during the 1930s and early 1940s in both countries, totaling over a billion individuals released (Dowden, 1962; MacQuarrie *et al.*, 2016). Several of these parasitoids became established, with some effective at high sawfly densities and others at low sawfly densities (Reeks, 1953; MacQuarrie *et al.*, 2016). During the 1930s, a viral disease of *G. hercyniae* larvae was first noted in 1936 in laboratory colonies in Canada and then in field populations in 1938 (Balch and Bird, 1944). The virus was apparently introduced to Canada on parasitoid shipments from Europe. Over the next few years, this nuclear polyhedrosis virus was largely responsible for the collapse of *G. hercyniae* populations in North America (Bird & Elgee, 1957; Neilson & Morris, 1964; Magasi & Syme, 1981; van Frankenhuyzen *et al.*, 2016). Similarly, in Wales, the same virus entered the country and controlled populations of *G. hercyniae*, especially where the sawfly was found at high levels. The virus is dispersed by birds after eating infected larvae (Entwistle *et al.*, 1977), and by adult sawflies (Buse, 1977). Currently, the virus and parasitoids have kept *G. hercyniae* populations at low levels in North America and Wales (Magasi & Syme, 1981; Entwistle *et al.*, 1983).

Phytosanitary risk

G. hercyniae is an EU listed Protected Zone Quarantine Pest (Annex III) for Greece, Ireland and the United Kingdom (Northern Ireland). It is widely distributed throughout the range of *Picea* in the EPPO region (where it is not a serious pest) but can cause severe defoliation and tree mortality when it moves to areas where it has no natural enemies. Currently, its population levels are well controlled by natural enemies, both within and outside of its natural range.

PHYTOSANITARY MEASURES

Plants for planting of *Picea* entering a protected zone (as detailed above) should be accompanied with an official statement that the plants have been produced in nurseries and that the place of production is free from *G. hercyniae*.

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Datasheet history

This datasheet was first published in 1997 in the second edition of 'Quarantine Pests for Europe' and revised 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.

CABI/EPPO (1997) *Quarantine Pests for Europe* (2nd edition). CABI, Wallingford (GB).



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