

Panolis flammea

Scientific Name

Panolis flammea Denis & Schiffermüller

Synonyms:

Bombyx spreta Fabricius

Noctua flammea Denis & Schiffermüller

Noctua piniperda

Panolis griseovariegata

Panolis griseovariegatus

Panolis piniperda

Phalaena griscovariegata Goeze

Phalaena pini Villers

Phalaena piniperda Loschege

Phalaena Noctua telifera Paykull

Trachea piniperda

Common Names

Pine beauty moth

Type of Pest

Moth

Taxonomic Position

Class: Insecta, **Order:** Lepidoptera, **Family:** Noctuidae

Reason for Inclusion

CAPS Target: AHP Prioritized Pest List for FY 2012

Pest Description

Egg: “The flattened, circular eggs are centripetally notched, and each has a small declivity in its middle. At first the eggs are whitish but later turn violet-brown. The size of an egg is 0.6 mm x 0.8 mm [0.02 x 0.03 in]” (Novak, 1976).

Larva: “The yellow-green larvae of the 1st instar are 2 to 3 mm [0.08 to 0.11 in] long and have a large conspicuous yellow head (mean width 0.4 mm [0.02 in]). The fully grown caterpillars are 37 to 40 mm [1.06 to 1.57 in] long, dark green with a brown head, and are about 3 mm [0.11 in] wide.



Figure 1. Adult female of *P. flammea* (Image courtesy of Stanislaw Kinelski, Bugwood.org)



Figure 2. Fifth instar larva of *P. flammea* on *P. sylvestris* (Image courtesy of Hannes Lemme, Bugwood.org)

A broad white band occurs in the middle of the dorsum. On both sides there are narrow white bands and on the underside there are wide orange bands” (Novak, 1976). “It is not until the fifth or final stage (instar) that the caterpillar develops the characteristic bright orange stripe on either side” (Heritage, 1997).

Pupa: “The free shiny brown pupa is 16 to 18 mm [0.63 to 0.71 in] long and ends with two thin spines. On the dorsal side of the abdomen is a characteristic declivity” (Novak, 1976).

Adult: “This night moth has a wing span of 30 to 35 mm [1.18 to 1.38 in]. The basic colour of the thorax and wings changes from red-brown to gray-brown. The bristle-shaped antennae of the males are composed of segments which resemble saw-like points while the antennae of the females are simple. The front edge of the thorax is decorated with a pale coloured band and on both sides there are some light coloured patches. The abdomen is yellow-gray. The end of the male is angularly broad, whereas the end of the female is conical and has a blunt point. The fore-wings are decorated with almost round or kidney-shaped patches. The dark moth has markings consisting of dark, transverse and zigzagging bands. The hind wings are gray. The resting moths sit with their roof-like wings folded. In the pine bark they coalesce in colour with the surroundings (mimicry)” (Novak, 1976).

Biology and Ecology:

Adults swarm after sunset for about one hour (Kolk and Starzyk, 1996). Adults feed on honeydew (a liquid excretion produced by aphids) (Kolk and Starzyk, 1996) and also *Salix* (willow) blossoms (Kimber, 2011). Mating occurs in the tree crown (Kolk and Starzyk, 1996). After mating, females lay 2-25 eggs in a line on host needles and can produce 100-210 throughout their lifetime (Kolk and Starzyk, 1996). Eggs are laid on needles from previous years (Hicks et al., 2001) with dense foliage preferred (Anonymous, 1960). They are usually laid on needles towards the tops of the trees (Heritage, 1997). Although females usually lay eggs on trees at least 25 years of age, “larvae may migrate to younger trees” after hatching (Carter, 1984).

In the United Kingdom, this moth flies from March to April and is found in coniferous forests and plantations (Kimber, 2011). When at rest, adults are hard to see as they are well camouflaged (Kimber, 2011).

Incubation of eggs requires about 14 days (Novak, 1976), although larval hatch can occur anywhere from 9 to 30 days later (Kolk and Starzyk, 1996). In Scotland, larvae emerge from the end of May to early June (Hicks et al., 2001). Afterwards, the larvae climb up into the crown and feed on buds, needles and the bark of young shoots (Kolk and Starzyk, 1996). Larvae “begin to feed on new growth where they consume the internal tissues at the base of developing needle pairs with their heads within the needle and their abdomens exposed” (Hicks et

al., 2001). Older larvae will feed on old host needles (Kolk and Starzyk, 1996). Larvae go through five instars (Novak, 1976). If disturbed, larvae can drop to the ground suspended by a silken thread (Anonymous, 1960).

P. flammaea overwinters as a pupa (Kolk and Starzyk, 1996). Pupation occurs in the litter or soil (Kolk and Starzyk, 1996) or in bark crevices in a silken cocoon (Carter, 1984). In Scotland, pupation begins by about mid-July (Hicks et al., 2001).

Symptoms/Signs

This species is considered a severe defoliator of certain *Pinus* spp. throughout many parts of Europe. Larvae can be observed feeding on new growth at the base of developing needle pairs (Hicks et al., 2001).

Larval feeding on young buds can be very damaging to the host trees (Kolk and Starzyk, 1996). Larvae can consume approximately 200 needles throughout this stage (Kolk and Starzyk, 1996). Older larvae can consume entire needles (Novak, 1976). Complete defoliation of host plants can occur in serious outbreaks of this pest. In addition, tree growth may be retarded and trees may die (Carter, 1984).

The most commonly attacked pine stands are aged from 30 to 60 years (Novak, 1976).

Pest Importance

This species is considered a severe pest of certain pine species (*P. sylvestris*) in parts of Europe (Watt, 1988). In Scotland, outbreaks of *P. flammaea* occur on *P. contorta* (lodgepole pine) (Watt, 1988). *P. flammaea* is considered the most important forest defoliator in the British Isles and *Pinus contorta* monocultures are no longer planted in the area because of the damage caused by *P. flammaea* (Watt and Hicks, 2000)."

When outbreaks occur, they usually last from two to three years (Kolk and Starzyk, 1996). Heavy infestations can cause host mortality (Hicks et al., 2001) and two successive attacks can kill a pine forest (Anonymous, 1960).

Known Hosts

Hosts include *Picea abies* (Norway spruce)*, *Pinus* spp. (pines), *P. contorta* (lodgepole pine), *P. pinaster* (maritime pine), *P. sylvestris* (Scots pine), and *Salix caprea* (pussy willow) (food plant for adults) (Kolk and Starzyk, 1996; Watt, 1989; Watt, 1988; Kurir, 1986; Carter, 1984).

Anonymous (1960) states that *P. flammaea* will also attack *Abies alba* (silver fir), *Juniperus* spp. (juniper), *Larix decidua* (European larch), *Pseudotsuga* spp. (Douglas-fir), and some broad-leaved trees. Carter (1984) included and *Betula* spp. (birch) as well as *Chamaecyparis* spp. and *Quercus* spp. (oak) as other host

plants. These plants do not seem to be main hosts of this species and damage of these hosts could not be found in the literature.

*Sporadic host (Kolk and Starzyk, 1996).

Pathogens Vectedored

This pest is not currently known to vector any pathogens or other associated organisms.

Known Distribution

This species is found throughout Europe and Asia (Novak, 1976). The northern range of *P. flammaea* is limited by climate (Novak, 1976).

This species is present in: Andorra, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Channel Island, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Gibraltar, Greece, Hungary, Italy (including Sardinia and Sicily), Japan, Kosovo, Latvia, Lithuania, Luxembourg, Macedonia, Moldova, Montenegro, the Netherlands, Norway, Poland, Romania, Russia (including Kaliningrad Oblast), Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Ukraine, and the United Kingdom (Fauna Europaea, 2011; Szabóky, 2004; Zolubas, 2003; Johansson et al., 2002; Kolk and Starzyk, 1996; Watt, 1988; Walter and Wawrzyniak, 1986; Slivov, 1984; Austara, 1982; Novak, 1976; Schimitschek, 1932; Saalas, 1929).

Potential Distribution within the United States

This species is most likely to cause damage throughout many parts of the United States if it were to become established. *P. flammaea* has caused serious damage to *Pinus contorta* (lodgepole pine) in Scotland (Hicks et al., 2001) which is originally native to parts of North America. *P. contorta* is present in at least 11

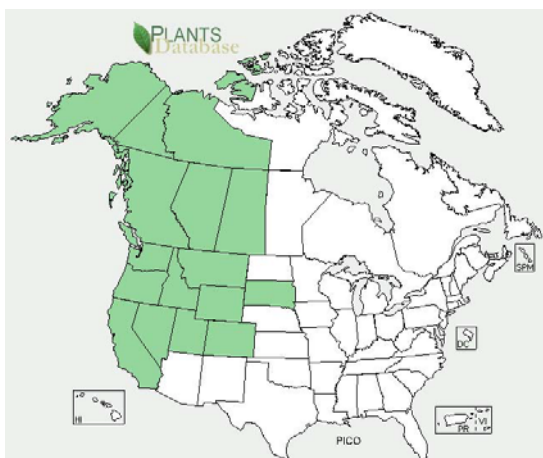


Figure 3. Distribution of *Pinus contorta* throughout North America (USDA-NRCS, 2011; accessed 23 March, 2011)

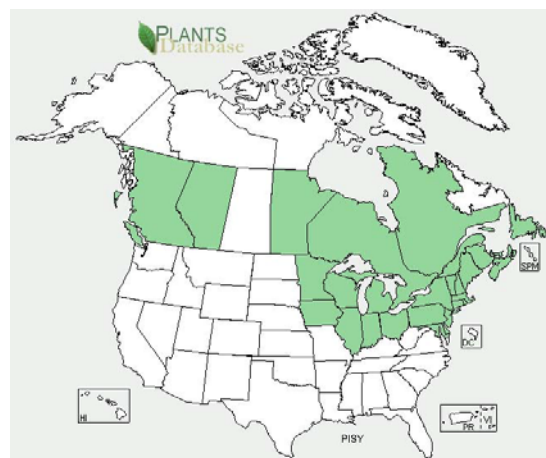


Figure 4. Distribution of *Pinus sylvestris* throughout North America (USDA-NRCS, 2011; accessed 24 March, 2011)

states in the western portion of the country while *P. sylvestris*, another main host, is present in at least 18 states in the northeastern and upper Midwest portion of the United States (USDA-NRCS, 2011).

Pathway

There are no records of this genus being intercepted at any United States ports of entry (AQAS, 2011).

This species may be introduced into the United States through nursery stock. Eggs are laid on pine needles and may be able to survive international trade as they usually take around 14 days to mature before hatch. Pupae may also move through international trade if soil is present on host plants, although this is unlikely as movement of soil is restricted in trade to the United States.

Survey

CAPS-Approved Method*:

Trap and lure. The lure has two components: Z9-14:Ac and Z11-14:Ac loaded into a rubber septum. The trap is the plastic bucket trap (also known as a “Unitrap” or universal moth trap). Refer to the [Plastic Bucket Trap Protocol](#) (Brambila et al., 2010) for detailed instructions on how to use the trap.

Literature-Based Methods:

Trapping:

In Scotland from 1993 on, monitoring surveys for *P. flammaea* were carried out using pheromone traps (Hicks et al., 2001). “Funnel traps...were baited with a lure containing 25µg Z-9-tetradecenyl acetate + 2.5µg Z-11-tetradecenyl acetate. The traps were placed in the forests during the third or fourth week of March and left until early May” (Hicks et al., 2001). Funnel traps were used to ensure that traps did not become oversaturated with moths (Hicks et al., 2001).

Survey site and selection:

The most commonly attacked pine stands are aged from 30 to 60 years (Novak, 1976). The host *Pinus contorta* is found throughout the western part of the United States, while *Pinus sylvestris* is found throughout the northeastern and upper Midwestern parts of the United States (USDA-NRCS, 2011).

Time of year to survey:

In Scotland, *P. flammaea* adults fly from mid-March to May (Heritage, 1997; Hicks et al., 2001). In England, adults fly as early as the end of February (Hicks et al., 2001). The time of year at which the adult stage is found is dependent on temperature (Heritage, 1997).

Trap Placement:

Bradshaw et al. (1983) states that traps should not be obstructed by vegetation and that the height of traps from 1 to 2 m (3.28 to 6.56 feet) caught the most target insects. Traps placed at 0.5 m (1.64 feet) had less total catches, but this

may be because the undergrowth at the site was 0.3 to 0.5 m (0.98 to 1.64 feet) high.

Visual:

In Scotland, *P. flammea* populations were monitored using annual pupal surveys from 1977 to 1993 (Watt and Hicks, 2000). Within sites selected for survey “11 positions were randomly selected within an area of about 0.3 ha [0.74 acre] and a portable frame, 30 cm x 30 cm x 15 cm deep [11.8 in x 11.8 in x 5.91 in deep], was used to sample the forest litter and peat” (Hicks et al., 2001). Today pheromone traps are used to monitor populations in Scotland, although they are augmented by selective pupal surveys (Hicks et al., 2001).

Identification

CAPS-Approved Method*:

Morphological. A brief description of all life stages can be found in Carter (1984). Both South (1961) and USDA (1958) include a description of the adult and larvae. South (1961) also includes a colored plate of the adult male and female. Descriptions of this pest can also be found in Hampson (1905) and Novak (1976).

Adults have hairy eyes (as do all Hadeninae) which can be seen even in sticky trap material. Forward any specimens with hairy eyes to your regional domestic identifier for identification.

Images of male and female can be found at the following links:

Male genitalia: <http://www.dissectiongroup.co.uk/page1448.html>

Female genitalia: <http://www.dissectiongroup.co.uk/page1447.html>

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at <http://caps.ceris.purdue.edu/>.

Easily Confused Pests

The pupae of *P. flammea* are similar to both *Semiothisa liturata* and *Bupalus piniarius* and can be frequently found in the soil together in the United Kingdom (Bevan and Brown, 1978).

Commonly Encountered Non-targets

When trapping in the United Kingdom, *Orthosia gothica* (Hebrew character [moth]) was the only similar species caught in large numbers. This species is similar in size but is grey in color instead of orangish-brown like *P. flammea* (Bradshaw et al., 1983).

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