Screening Aid

Pine Beauty

Panolis flammea (Denis & Schiffermüller)

Todd M. Gilligan[1] and Steven C. Passoa[2]

1) Identification Technology Program (ITP) / Colorado State University, USDA-APHIS-PPQ-Science & Technology (S&T), 2301 Research Boulevard, Suite 108, Fort Collins, Colorado 80526 U.S.A. (Email: todd.m.gilligan@aphis.usda.gov)
2) USDA-APHIS-PPQ, The Ohio State University and USDA Forest Service Northern Research Station, 1315 Kinnear Road, Columbus, Ohio 43212 U.S.A. (Email: steven.c.passoa@aphis.usda.gov)

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The pine beauty, *Panolis flammea* (Denis & Schiffermüller), is a serious pest of Pinaceae in Europe. Larvae have been recorded on Douglas-fir, fir, juniper, larch, pine (lodgepole pine, Scots pine), and spruce. Early instar larvae feed inside the needles of new growth and later instars feed on older foliage. Outbreaks of *P. flammea* in pine plantations in the United Kingdom and Continental Europe have caused damage to thousands of acres and resulted in significant tree mortality. In the UK, adults are present from March through May. Twenty to eighty year old pine monocultures are especially at risk, and lodgepole pine, common in the western U.S., has been attacked when planted in Scotland (see Bradshaw et al. 1983; Sukovata et al. 2003).

Fig. 1: *Panolis flammea* resting (Photo by Malcolm Storey, Discover Life).

Panolis flammea is a member of the Noctuidae (tribe Hadenini), the family of moths (Lepidoptera) with the largest number of total species and also the most pest species. In North America there are approximately 2,500 species of noctuids, which are often referred to as “owlet moths,” “cutworms,” or “miller moths.” Most noctuids are medium-sized with relatively drab brown or gray coloration, although they can range in size from very small to very large and some species are brightly colored.

The genus *Panolis* contains six species; only *P. flammea* is present in Europe, while the other five species occur in the western Palearctic and Asia. A reddish-brown forewing with distinctive markings is diagnostic for the genus (Figs. 1-2, 4, 8-10) and the forewing pattern is sufficient to separate *P. flammea* from other North American noctuids. Non-targets expected to be encountered in CAPS pheromone traps include North American Hadenini as well as *Orthosia* (Orthosiini), which were commonly attracted to the same pheromone during surveys in the UK (see Bradshaw et al. 1983). Differences in the wing markings for *P. flammea* are compared to possible North American non-targets in Fig. 7.

Fig. 2: *Panolis flammea* resting (Photo by Olaf Leillinger).

This aid is designed to assist in the sorting and screening *P. flammea* suspect adults collected from CAPS bucket traps in the continental United States. It covers basic sorting of traps and first level screening, all based on morphological characters. Basic knowledge of Lepidoptera morphology is necessary to screen for *P. flammea* suspects.

Sorting

Pine Beauty

Panolis flammea (Denis & Schiffermüller)

Panolis flammea pheromone traps should be sorted initially for the presence of moths of the appropriate size, color, and shape. Traps that contain moths meeting all of the following requirements should be moved to Level 1 Screening (Page 3):

1) Moths are approximately 18-25 mm (0.7-1 inches) long (Fig. 3).

2) Moths have an overall shape that is similar to the outline depicted in Fig. 3. Most noctuids caught in bucket traps will rest with their wings closed in this manner (Figs. 1-2).

3) Moth forewings are a mix of reddish brown, orange, brown, and tan - see the comparison of forewing colors in Fig. 4 and Figs. 1-2.

4) Moth antennae are filiform (threadlike - Figs. 3-4) and not feathery or plumose.

If traps are very full and specimens are worn, it may be difficult to determine wing shape and pattern. For this reason, any medium sized reddish-brown moth should be forwarded to Level 1 Screening.

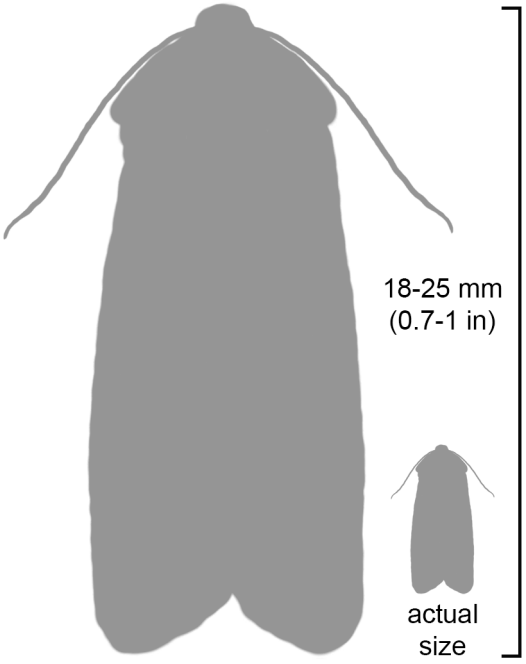

Fig. 3: Outline and size of a resting *P. flammea* male. Most noctuid moths have a similar resting posture. This general shape can be used to separate notcuids from other medium sized moths such as geometrids.

Fig. 4: Variation in wing pattern and coloration of *P. flammea* adults (top two rows = males; bottom row = females).

Suspect adults should be pinned and properly labeled. Level 1 Screening is based on wing and eye characters. In most cases, wing markings are sufficient to separate *P. flammea* from North American non-targets. If specimens are highly worn or damaged, a genitalic dissection by a specialist may be necessary.

Hairy Eyes

Moths in the tribes Hadenini (e.g., *P. flammea*) and Orthosiini (e.g., *Orthosia* spp.) have hairs on the compound eyes. These hairs are easily observed under low magnification.

Forewing Coloration and Pattern

Most individuals of *P. flammea* have reddish- to orangish-brown forewings with consistent markings - an example of forewing variation is shown in Fig. 4. Forewing coloration varies from light (Fig. 4, top row) to dark (Fig. 4, second row), and dark or melanic individuals are often referred to as forms *griseovariegata* or *grisea*.

Forewing pattern consists of two primary elements: a basal “orbicular spot” and a discal “reniform spot,” both of which are white or light tan in *P. flammea* (Figs. 5-6). These same markings are found in many other species of noctuids; however, in most Noctuidae the reniform spot is usually kidney-shaped or C-shaped, where it is elongate and extends towards the apex of the forewing in *P. flammea* (Fig. 7).

Hindwing Coloration

The hindwings of *P. flammea* are a uniform color, varying from brown to dark brown to grayish brown (Fig. 4). The hindwings in many North American non-targets are much lighter in color (Figs. 18-19) or are not uniform (Figs. 8-9, 15-17).

The following is a summary of suspect *P. flammea* adult characters:

1) **Medium sized noctuid moth**
2) **Hairy eyes**
3) **Reddish- to orangish-brown forewings**
4) **Extended reniform spot**
5) **Uniform brown hindwings**

Suspect *P. flammea* specimens should be sent forward for identification. Specimens must be pinned, properly labeled, and carefully packed to avoid damage during shipping.

A sampling of North American non-targets is displayed on Page 4. Non-targets expected to be encountered in *P. flammea* pheromone traps include other Hadenini as well as *Orthosia* (Orthosiini). Note that the species on Page 4 have not been verified to be attracted to *P. flammea* traps and that non-targets encountered during CAPS surveys will vary by region.

Fig. 5: Typical forewing markings (outlined in blue) for *P. flammea* (spread specimen).

Fig. 6: Typical forewing markings (outlined in blue) for *P. flammea* (resting specimen - lateral view) (Photo by Malcolm Storey, Discover Life).

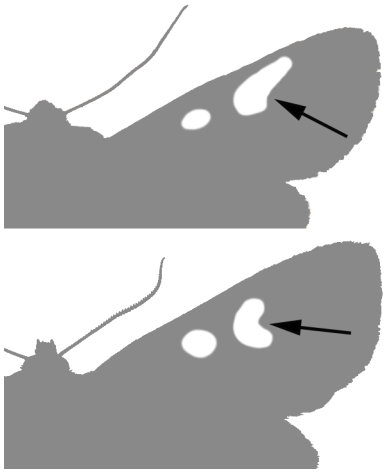

Fig. 7: Noctuid forewing spots. The arrow denotes the reniform spot, which is elongated towards the wing apex in *P. flammea* (top) and kidney-shaped in most non-targets (bottom).

Fig. 8: *Orthosia rubescens*.

Fig. 9: *Orthosia rubescens*.

Fig. 10: *Orthosia pulchella*.

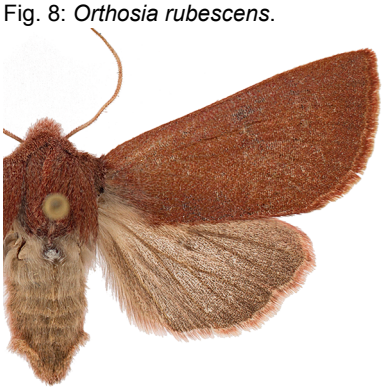

Fig. 11: *Orthosia pulchella*.

Fig. 12: *Orthosia transparens*.

Fig. 13: *Orthosia praeses*.

Fig. 14: *Orthosia alurina*.

Fig. 15: *Orthosia revicta*.

Fig. 16: *Orthosia revicta*.

Fig. 17: *Sideridis congemana*.

Fig. 18: *Lacinipolia lepidula*.

Fig. 19: *Hexorthodes hueco*.

Key to Sort and Screen *Panolis flammea* Suspects in the United States

1. Moths approximately 18-25 mm long; overall shape is typical for a noctuid (Fig. 3); antennae are filiform; and forewings are a mix of reddish brown, orange, brown, and tan as in Fig. 4 2
1'. Moths larger or smaller than 18-25 mm long; overall shape not typically noctuid; antennae feathery or plumose; or forewing color not reddish brown, orange, brown, and tan ..... Not *P. flammea*

2. Eyes hairy 3
2'. Eyes not hairy (naked) ..... Not *P. flammea*

3. Forewings reddish to orangish brown with prominent orbicular and reniform spots; reniform spot elongated and extending towards the wing apex (Fig. 7) 4
3'. Forewings not reddish to orangish brown or lacking prominent orbicular and reniform spots; or reniform spot kidney- or C-shaped and not extending towards the wing apex ..... Not *P. flammea*

4. Hindwings uniform in color, brown to dark brown to grayish brown ..... ***P. flammea* suspect**
4'. Hindwings not uniform in color or not a shade of brown ..... Not *P. flammea*

Citation

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References for more information on *P. flammea* and non-targets

Bradshaw, J. W. S., R. Baker, C. Longhurst, J. C. Edwards and J. C. Lisk. 1983. Optimization of a monitoring system for the pine beauty moth, *Panolis flammea* (Denis & Schiffermüller), using sex attractants. Crop Protection 2: 63-73.

Moth Photographers Group. Mississippi State U. (http://mothphotographersgroup.msstate.edu/Plates.shtml)

Powell, J. A. and P. A. Opler. 2009. Moths of western North America. University of California Press, Berkeley. 369 pp.

Sukovata, L., A. Kolk, J. Jaroszynska, U. Krajewska, A. Purzynska and V. Isidorov. 2003. Host-tree preferences of the pine moth (Lepidoptera: Lasiocampidae) and pine beauty moth (Lepidoptera: Noctuidae) larvae in relation to needle quality. In: McManus, M. L. and A. M. Liebhold, eds. Proceedings: Ecology, Survey and Management of Forest Insects; 2002 September 1-5; Krakow, Poland. Gen. Tech. Rep. NE-311. Newtown Square, PA: U.S. Dept. of Agriculture, Forest Service, Northeastern Research Station. 98-106.

Wang, H., X. Fan, M. Owada, M. Wang and S. Nylin. 2014. Phylogeny, systematics and biogeography of the genus *Panolis* (Lepidoptera: Noctuidae) based on morphological and molecular evidence. PLoS ONE 9(3): e90598. doi:10.1371/journal.pone.0090598.

Acknowledgments

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