EENY 486

UF UNIVERSITY of FLORIDA
IFAS Extension

Fall webworm, *Hyphantria cunea* (Drury) (Insecta: Lepidoptera: Arctiidae: Arctiinae)[1]

Andrei Sourakov and Thomson Paris[2]

Introduction

The fall webworm, *Hyphantria cunea* (Drury), is a pest of a number of ornamental trees and shrubs as well as of several agricultural crops. The larvae feed in huge nests and are able to completely defoliate trees and shrubs. Native to North America, this species has become an invasive pest throughout Europe and Asia, and therefore is well studied.

Synonymy

Hyphantria

liturata (Goeze, 1781)

punctatissima (Smith, 1797)

budea (Hübner, 1823)

textor (Harris, 1828)

mutans (Walker, 1856)

punctata (Fitch, 1857)

pallida (Packard, 1864)

candida (Walker, 1865)

suffusa (Strecker, 1900)

Distribution

The fall webworm originally occurred throughout North America to its northernmost limit in southern Canada. The nothern range limit for *Hyphantria cunea* occurs at the latitude of 50–55° (Morris 1963).

The fall webworm was introduced into Yugoslavia in the 1940s, and since then has invaded most of Europe. It now also inhabits parts of China and North Korea, again due to accidental introduction, and it is found in Japan.

Description and Life Cycle

The adult fall webworm moth is bright white, with a hairy body. In the southern part of its range, the moth is white with dark wing spots while in the northern part of its range it is nearly always pure white (MPG 2010) and was once thought to be a

1. This document is EENY-486 (IN878), one of a series of the Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date December 2010. This document is also available as a Featured Creature at http://entomology.ifas.ufl.edu/creatures. Please visit the EDIS website at http://edis.ifas.ufl.edu.

2. Andrei Sourakov, Florida Museum of Natural History; Thomson Paris, Entomology and Nematology Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611.

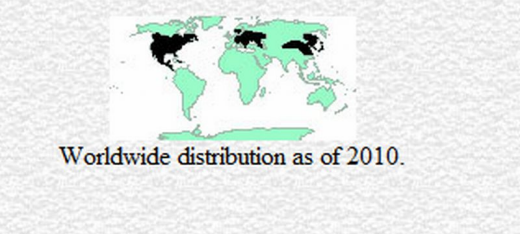

Figure 1. Worldwide distribution as of 2010.

separate species from the southern populations. The gregarious larvae form large tents around the host plant. Currently, the taxonomic status of *Hyphantria cunea* as a single species remains intact. The variations in phenotypes of both adults and larvae (presence of dark markings on the wings in some populations and presence of populations with red-headed vs. dark-headed larvae) have caused speculation that more than one species might be involved. For example, in Japan, DNA barcoding studies have shown that two species might be occurring there sympatrically (Takeda 2005).

Figure 2. Adult male fall webworm, *Hyphantria cunea* (Drury). This adult is all white, which is typical for members of this species from the northern part of its range. Photograph taken at Gainesville, Florida from a reared larva. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Like most moths, the fall webworm moths are nocturnal and are attracted to light. Adult moths have a wingspan of between 1.4–1.7 inches (35–42 mm). The bases of the front legs are orange or bright yellow.

The number of generations per year depends greatly on latitude. Southern populations may complete four generations in one year, while in the north the fall webworm completes only one life cycle. The univoltine chiefly black-headed and dark-bodied

Figure 3. Adult fall webworm, *Hyphantria cunea* (Drury), with spots on white, which is typical for members of this species from the southern part of its range. Photograph by: Lyle J. Buss, University of Florida

larvae tend to occur above 40° latitude, while the multivoltine cycles with green-bodied, red or black-headed larvae tend to be found in the southern part of the distribution area.

Adults emerge as early as March in the south, but do not fly until late spring or early summer in northern areas. Mostly, the adults appear from May to August and deposit their eggs.

Eggs

The egg mass of *Hyphantria cunea* is almost iridescent green in color. The egg batch contains 400-1000 eggs. The eggs are usually deposited on the undersides of leaves in the spring, in a single (black-headed larva race) or double (red-headed larvae race) layer of several hundred eggs. The egg mass is lightly covered with scales from the female's abdomen.

Larvae

In one to two weeks, the larvae hatch and immediately begin spinning their silk tent. The neonate caterpillars place the web over single leaves and feed by skeletonizing.

Figure 4. Eggs and neonate larvae of the fall webworm, *Hyphantria cunea* (Drury). Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Figure 5. Second instar larvae of the fall webworm, *Hyphantria cunea* (Drury), making the nest. Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Mature larvae are hairy and either have a lime green body with black spots or can have darker color, especially in the later instars. The head capsules in some populations can be either red or black. In other populations, they are entirely black. The black-headed larvae are thought to be more prevalent in the northern climes, while the red-headed larvae are thought to be dominant in the southern climes. Some behavioral differences have been noted between different larval morphs. For instance, larvae of the red-headed morph stay inside the tent throughout the larval stage, while the black-headed morph leaves the tent in its fifth instar.

Figure 6. Close-up of second instar larva of the fall webworm, *Hyphantria cunea* (Drury). Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Figure 7. Second instar larvae of the fall webworm, *Hyphantria cunea* (Drury), feeding. Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Figure 8. Second instar larvae of the fall webworm, *Hyphantria cunea* (Drury), before molting. Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

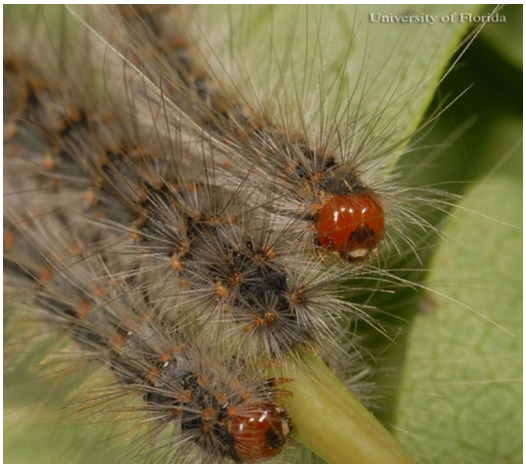

Figure 9. Late instar, red-headed morph larvae of the fall webworm, *Hyphantria cunea* (Drury). Photograph by: Lyle J. Buss, University of Florida

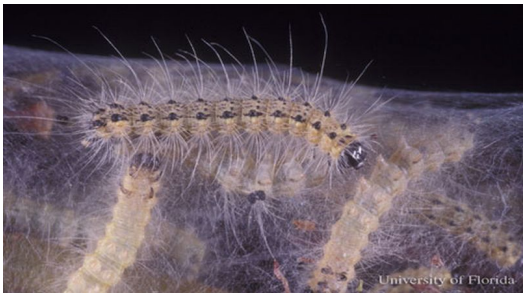

Figure 10. Late instar, black-headed morph larvae of the fall webworm, *Hyphantria cunea* (Drury). Photograph by: Lyle J. Buss, University of Florida

Figure 11. Third instar larvae of the fall webworm, *Hyphantria cunea* (Drury). Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Pupae

Full-grown larvae leave the web to pupate in leaf litter or bark crevices. Fall webworms overwinter in the pupal stage. Pupation occurs in thin cocoons. The pupae are brown.

Figure 12. Third instar larvae of the fall webworm, *Hyphantria cunea* (Drury), feeding. Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Figure 13. Fourth (middle) and fifth (bottom) instar larvae of the fall webworm, *Hyphantria cunea* (Drury). The top image is the skin left behind by a molted fourth instar caterpillar. Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

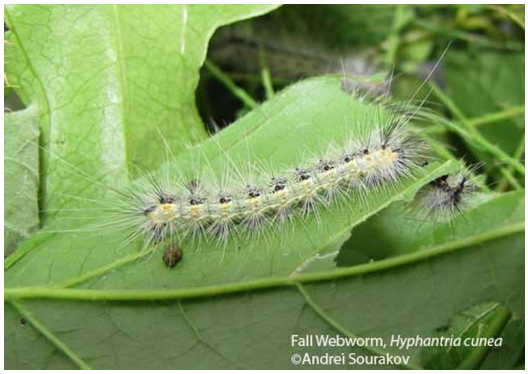

Figure 14. Close-up of fifth instar larvae of the fall webworm, *Hyphantria cunea* (Drury). Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Figure 15. Fifth instar larvae of the fall webworm, *Hyphantria cunea* (Drury). Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Figure 16. Freshly molted fifth instar larvae of the fall webworm, *Hyphantria cunea* (Drury). Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

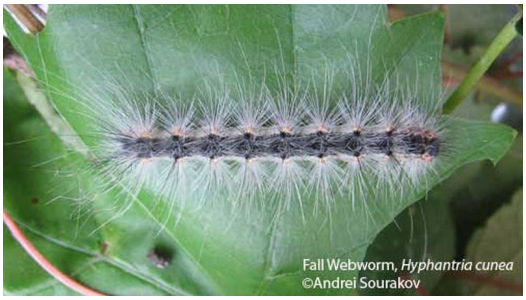

Figure 17. Dorsal view of a fifth instar larva of the fall webworm, *Hyphantria cunea* (Drury). Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Hosts

Part of Hyphanea cunea's success as a species can be attributed to the fact that its larvae are consummate generalists, capable of developing on a wide range of host plants. Preferred host plants include hickory, pecan, walnut, elm, alder, willow, mulberry, oak, sweetgum, and poplar.

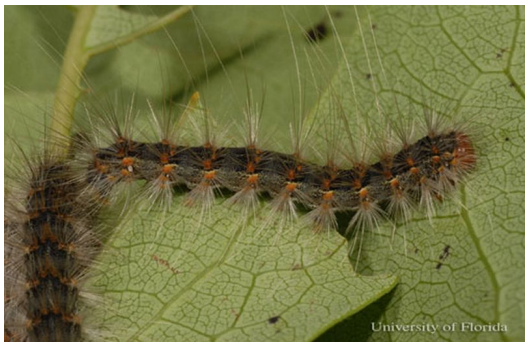

Figure 18. Lateral view of a fifth instar larva of the fall webworm, *Hyphantria cunea* (Drury). Photograph by: Lyle J. Buss, University of Florida

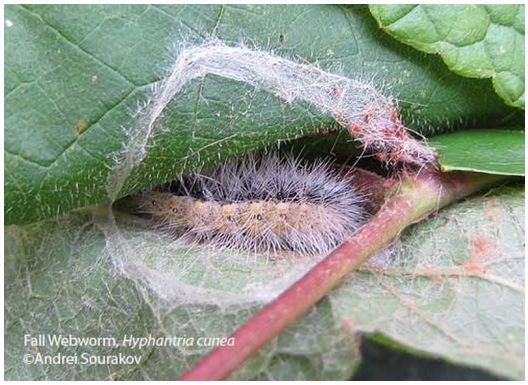

Figure 19. Fifth instar larva of the fall webworm, *Hyphantria cunea* (Drury), inside a cocoon. Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Figure 20. Cocoon of the fall webworm, *Hyphantria cunea* (Drury). Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Figure 21. Pupae of the fall webworm, *Hyphantria cunea* (Drury), removed from a cocoon. Photograph taken at Gainesville, Florida. Photograph by: Andrei Sourakov, Florida Museum of Natural History, University of Florida

Host plants recorded in Florida (Heppner 2007, and personal observation)

Aceraceae: *Acer* spp. - *A. negundo, A. rubrum, A. saccharinum, A. saccharophorum*

Anacardiaceae: *Cotinus coggygria*

Anacardiaceae: *Schinus terebinthifolius*

Annonaceae: *Asimina triloba*

Aquifoliaceae: *Ilex* spp. - *I. decidua, I. opaca*

Berberidaceae: *Berberis canadensis*

Betulaceae: *Alnus* spp.; *Betula* spp. - *B. alba, B. nigra, B. papyrifera; Carpinus caroliniana; Corylus americana; Ostrya virginiana*

Bignoniaceae: *Campsis radicans, Catalpa bignonioides, Catalpa speciosa*

Buxaceae: *Buxus* spp. - *B. sempervirens*

Cannaceae: *Canna* spp.

Caprifoliaceae: *Lonicera* spp., *Sambucus canadensis*, *Symphoricarpos albus*, *Virburnum* spp.

Celastraceae: *Euonymus atropurpureus*

Chenopodiaceae: *Chenopodium album, Spinacia oleracea*

Comaceae: *Cornus* spp. - *C. alternifolia, C. drummondii, C. florida*

Compositae: *Helianthus* spp., *Parthenium argentatum*

Cupressaceae: *Chamaecyperis thyoides, Cupressus* spp., *Juniperus virginiana, Taxodium distichum*

Ebenaceae: *Diospyros kaki, Diospyros virginiana*

Ericaceae: *Kalmia* spp.

Ericaceae: *Oxydendrum arboretum, Rhododendron* spp.

Euphorbiaceae: *Ricinus communis*

Fagaceae: *Castanea* spp. - *C. dentata, C. pumila*; *Fagus grandifolia*; *Quercus* spp. - *Q. alba, Q. coccinea, Q. phellos, Q.prinus, Q. rubra*

Geraniaceae: *Pelargonium* spp., *Geranium* spp.

Gramineae: *Zea mays*

Hamamelidaceae: *Hamamelis virginiana, Liquidambar styraciflua*

Hippocastanaceae: *Aesculus* spp. - *A. glabra, A. hippocastanum, A. octandra*

Juglandaceae: *Juglans* spp. - *J. californica, J. nigra, J. regia; Carya* spp. - *C. glabra, C. illinoinensis, C. laciniosa*

Lauraceae: *Sassafras albidium*

Leguminaceae:

Leguminosae: *Cercis canadensis; Gleditsia triacanthos; Gymnocladus dioica; Robinia pseudo-acacia; Trifolium* spp.; *Wisteria* spp. - *W. frutescens, W. sinensis*

Malvaceae: *Althaea rosea, Gossypium herbaceum, Hibiscus syriacus*

Magnoliaceae: *Liriodendron tulipifera, Magnolia* spp.

Moraceae: *Ficus carica, Maclura pomifera, Morus* spp. - *M. rubra*

Naucleaceae: *Cephalanthus occidenalis*

Nyssaceae: *Nyssa sylvatica*

Oleaceae: *Chionanthus virginicus; Fraxinus* spp. - *F. americana, F. excelsior; Jasminum* spp., *Ligustrum vulgare, Syringa* spp.

Platanaceae: *Platanus occidentalis*

Pinaceae: *Larix deciduas, Pinus* spp.

Portulacaceae: *Portulaca oleracea*

Ranunculaceae: *Clematis* spp.

Rhamnaceae: *Rhamnus alnifolia*

Rosaceae: *Amelanchier canadensis; Crataegus* spp.; *Cydonia oblonga; Malus* spp. - *M. angustifolia, M. coronaria, M. diversifolia, M. pumila; Prunus* spp. - *P. americana, P. avium, P. cerasus, P.domestica, P. ilicifolia, P. persica, P. serotina, P. communis; Pyrus communis; Rosa* spp.; *Rubus* spp. - *R. allegheniensis, R. idaeus* var. *strigosus; Spiraea* spp.

Rutaceae: *Citrus* spp. - *C. aurantiifolia, C. lemon, C. paradisi, C. sinensis; Zanthoxylum americanum*

Salicaceae: *Populus* spp. - *P. alba, P. balsamifera, P. deltoides, P. fremonti, P. nigra var. Italica, P. tremuloides; Salix* spp.

Saxifragaceae: *Ribes* spp. - *R. lacustre, R. sativum*

Scrophu1ariaceae: *Paulownia tomentosa*

Simaroubaceae: *Ailanthus altissima*

Staphyleaceae: *Staphylea trifolia*

Taxaceae: *Taxus* spp.

Tiliaceae: *Tilia* spp. - *T. americana, T. europaea*

Ulmaceae: *Celtis* spp. - *C. laevigata, C. occidentalis; Ulmus* spp. - *U. americana, U. rubra*

Vitaceae: *Parthenocissus quinquefolia, Vitis vulpina*

Economic Importance

In the wild, within its native range, fall webworm does not usually damage the trees, since the defoliation occurs just before leaf drop. However, *Hyphanea cunea* is known to cause damage to ornamental trees, and is also known as a pest of sericulture because of its preference for mulberry leaves (Franz 1961, Yang & Zhang 2007).

Figure 22. Damage to persimmon tree caused by larval feeding of the fall webworm, *Hyphantria cunea* (Drury). Photograph by: Lyle J. Buss, University of Florida

Figure 23. Leaf damage caused by larval feeding of the fall webworm, *Hyphantria cunea* (Drury). Photograph by: James Castner, University of Florida

A fall webworm tent normally encloses the foliage at the end of a branch. The caterpillars can build large silk tents that sometimes spread over several branches. At maturity, the larvae may reach

one inch in length. Throughout their development, the caterpillars are able to make distinct jerking movements in unison if the nest is disturbed.

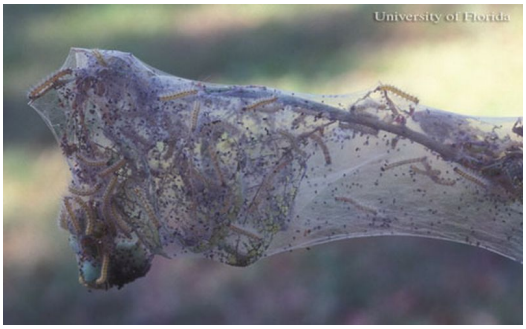

Figure 24. Silken tent created by larvae of the fall webworm, *Hyphantria cunea* (Drury). Photograph by: Lyle J. Buss, University of Florida

Figure 25. Numerous tents created by larvae from separate egg clusters of the fall webworm, *Hyphantria cunea* (Drury). Photograph by: James Castner, University of Florida

Management

Biological control

Parasitoids attacking *Hyphantria cunea* include:

Diptera:

Tachinidae: *Exorista japonica* Townsend, *Lespesia frenchii* (Williston), *Mericia ampelus* (Walker), *Pales pavida* Meigen, *Zanillia libatrix* Panz

Hymenoptera:

Braconidae: *Aleiodes malacosomatos* Mason, *Aleiodes sanctihyacinthi* (Provancher), *Apanteles diacrisiae* Gahan, *Apanteles hyphantriae* Riley, *Microplitis hyphantriae*, *Meteorus bakeri* Cook and Davis, *Meteorus hyphantriae* Riley

Chalcididae: *Brachymeria obscurata* (Walker)

Eulophidae: *Baryscapus esurus* (Riley), *Chouioia cunea* Yang, *Elachertus hyphantriae* Crawford

Ichneumonidae: *Campoplex validus* Cress, *Casinaria genuina* (Norton), *Casinaria limenitidis* Howard, *Coccygomimus disparis* (Viereck), *Coelichneumon navus* (Say), *Enicospilus glabratus* Say, *Hyposoter fugitivus* (Say), *Hyposoter rivalis* (Cresson), *Hyposoter pilosulus* Provancher, *Itoplectis inquisitor* Say, *Pimpla turionellae* Linnaeus, *Sinophorus validus* (Cresson), *Therion morio* (Fabricius), *Therion sassacus* Vier, *Vulgichneumon brevicinctor* (Say)

Pteromalidae: *Dibrachys cavus* (Walker)

Torymidae: *Monodontomerus minor* (Ratzeburg)

Trichogrammatidae: *Trichogramma dendrolimi* Matsumura

Figure 26. An adult parasitoid (unidentified species) of the fall webworm, *Hyphantria cunea* (Drury). Photograph by: Thomson Paris, University of Florida

Chemical control

Florida Insect Management Guide for commercial foliage and woody ornamentals

Figure 27. An adult parasitoid (unidentified species) of the fall webworm, *Hyphantria cunea* (Drury). Photograph by: Thomson Paris, University of Florida

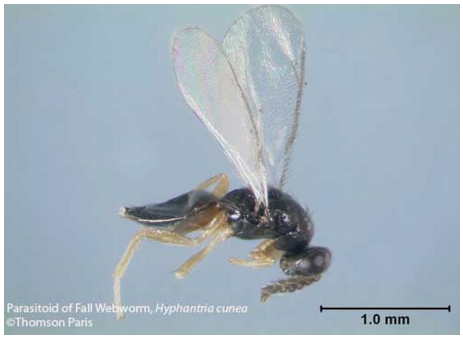

Figure 28. An adult parasitoid (unidentified species) of the fall webworm, *Hyphantria cunea* (Drury). Photograph by: Thomson Paris, University of Florida

Florida Insect Management Guide for pecans

Selected References

Franz JM. 1961. Biological control of pest insects in Europe. Annual Review of Entomology 6: 183-200.

Heppner JB. 2007. The Lepidoptera of Florida: Introduction and catalog, Part 1. Florida Department of Agriculture and Consumer Services, Division of Plant Industry. 670 pp.

Ito Y, Shibazaki A, Iwahashi O. 1969. Biology of *Hyphantria cunea* Drury (Lepidoptera:Arctiidae) in Japan. IX. Population Dynamics. Researches on Population Ecology (Kyoto) XI: 211-228.

Morris RF. 1963. Synonymy and color variation in the fall webworm, *Hyphantria cunea* Drury (Lepidoptera: Arctiidae). Canadian Entomologist 95: 1217-23.

(MPG) Moth Photographers Group. (2010). 930319 – 8140 – *Hyphantria cunea* – (Drury, 1773). *North American Moth Photographers Group*. http://mothphotographersgroup.msstate.edu/species.php?hodges=8140 (13 December 2010).

Takeda M. 2005. Differentiation in life cycle of sympatric populations of two forms of *Hyphantria* moth in central Missouri. Journal of Entomological Science 8: 211-218.

Wagner DL. 2005. Caterpillars of Eastern North America. Princeton University Press. Princeton, 512 pp.

Yang ZQ, Zhang YA. 2007. Researches on techniques for biocontrol of the fall webworm, *Hyphantria cunea*, a severe invasive insect pest to China. Chinese Bulletin of Entomology 44: 465-471.