Autographa gamma

Scientific Name
Autographa gamma L., 1758

Synonyms:
Plusia gamma var. *gammina* Staudinger

Previous older combinations:
Phytometra gamma L.,
Plusia gamma L.

Common Name
Silver Y moth, beet worm, gamma owlet

Figure 1. *Autographa gamma* adult (Julieta Brambila, USDA-APHIS-PPQ, Bugwood.org).

Type of Pest
Moth

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

Reason for Inclusion in Manual
CAPS Target: AHP Prioritized Pest List - 2006 through 2009

Pest Description
Eggs: Eggs are semi-spherical and 0.57 mm (< $^{1}/_{32}$ in) in diameter. They are strongly and irregularly ribbed with 28 or 29 ribs (Paulian et al., 1975; Carter, 1984). Eggs are initially yellowish-white, but as they age, they turn yellowish-orange and later brown. They are laid singly or in small groups on the underside of leaves (Hill, 1987).


Figure 2. Eggs of *Autographa gamma* (Jurgen Rodeland, http://www.rodeland.de/fotos/lepidoptera/autographa_gamma.htm).

Larvae: The larvae are “semiloopers” with only three pairs of prolegs: two pairs of abdominal prolegs and one pair of anal prolegs (abdominal segments 5, 6, and 10) (Fig. 3) (Carter, 1984; Hill, 1987; INRA/HYPP Zoology, 2011). The caterpillar ranges from bright green to dark olive green. There is a dark green dorsal line edged

with white (Fig. 3) (Jones and Jones, 1984). The spiracular line is yellowish, edged above with green. There are several white transverse lines between the spiracular line and the dorsal dark green line (Jones and Jones, 1984). Some larval forms have white spots. The head has a dark patch under the ocelli or is entirely black and glossy (Emmett, 1980). Maximum length ranges from 20 to 40 mm (approx. $^{13}/_{16}$ to 1 $^{9}/_{16}$ in). The larvae complete five instars (Dochkova, 1972).

Figure 3. Larva of *Autographa gamma* (Paolo Mazzei, Bugwood.org).

Pupae: *Autographa gamma* pupates on the lower leaf surface or within the first centimeter of soil (Dochkova, 1972). The pupa is 20 mm (approx. $^{13}/_{16}$ in) long, black, shiny, and encased in a loose, web-like cocoon (Jones and Jones, 1984) (Fig. 4). The cremaster is "strongly developed, ridged, with two outcurved, spatulate spines and six terminally coiled setae" (Carter, 1984).


Figure 4. Cocoon of *Autographa gamma* (Alain Fraval. http://www.inra.fr/hyppz/RAVAGEUR/6autgam.htm).

Adults: Forewing is marbled silvery gray to brown to velvety black. There is a distinct white/silver "Y" or Greek letter gamma (γ) in the center of the forewing (Fig. 1 & 5). Wingspan is 36 to 40 mm (approx. 1 $^{7}/_{16}$ to 1 $^{9}/_{16}$ in) (Jones and Jones, 1984). The hind wing is light brown with a dark brown marginal border (Nazmi et al., 1980).

Further descriptions of this species can be found in Emmett (1980), Nazmi et al. (1980), and Sannino and Espinosa (2000).

Biology and Ecology

Autographa gamma is a migratory species and adults undertake seasonal migrations to areas where they are able to breed. The silver Y moth can be found in many habitats including agricultural land, waste land, and gardens. In areas where *A. gamma* is unable to overwinter, severe infestations occur sporadically.

Female moths take nectar from flowers and can often be seen feeding during the day or early evening. Females lay from 500 to more than 1,000 whitish eggs (Hill, 1983) (Fig. 2), singly or in small batches, on the underside of leaves of low-growing plants.

In temperate regions, hatching may take 10 to 12 days (Hill, 1983). The incubation period lasts for three days at 25°C (77°F) (Ugur, 1995).

The young larvae feed on the foliage of their host plants and tend to occur singly rather than in groups. When larvae are young, they skeletonize the leaves, but older caterpillars eat the whole leaf (Hill, 1983). Larval development takes from 51 days at 13°C (55°F) to 15 to 16 days at 25°C (77°F). The pupal stage takes from 32 days at 13°C (55°F) to 6 to 8 days at 25°C (77°F) (Hill and Gatehouse, 1992; Ugur, 1995). Larvae drop off the plant when they are disturbed.

Figure 5. Adult showing the silver "Y" mark that resembles the Greek letter gamma (Jeremy Lee).

Local distribution, reproductive potential, and migration are determined to a considerable extent by the availability of suitable wild plants in a given area. Good weed control can reduce the threat of outbreaks. Mortality in the egg stage and the first larval instar is lowest at high humidity levels; mass outbreaks are known to have occurred mainly during periods of very wet weather (Maceljski and Balarin, 1974).

In areas where *A. gamma* is able to survive the winter, it overwinters as a third or fourth instar (Tarabrina, 1970; Kaneko, 1993; Saito, 1988) or a pupa (Dochkova, 1972). There is no true diapause (Tyshchenko and Gasanov, 1983).

Damage

Leaves may be skeletonized by young larval feeding, leaving plants with a brownish appearance. Older leaves are preferred by larvae. The petioles or leaf stalks may be cut by the larvae. Older larvae eat from the edge of the leaf towards the midrib, consuming the leaves completely or at times leaving pieces of the midrib.

Eggs (singly or in small clusters) may be visible on leaves of low growing plants. Larvae are active at night. During the day, they remain pressed against the underside of the leaf; when disturbed, they tend to drop off the plant. Frass may or may not be visible. Pupae are found in the folds of the lower leaves of the host plant. Webbing may be present. Adult moths feed in flowers (nectar) and can often be seen feeding during the day or early evening.

Grape: “Larvae can scrape the skin from grapes and feed on the contents of the fruits. A single larva could damage 20 or more mature grapes (Abdullagatov and Abdullagatov, 1986)” (reviewed in CABI, 2012).

Tomato: Avidov and Harpaz (1969) state that this species can infest the fruit of tomato.

Pest Importance

This species has outbreaks periodically over wide areas of Europe, Asia, and North Africa (CABI, 2007). This species is a polyphagous pest, causing damage to a wide variety of hosts which include vegetable, flower, and greenhouse crops (reviewed in Venette et al., 2003). It is an economically important pest of flax, sugarbeet, tobacco, and fruit and vegetables crops in Africa and the former Soviet Union (reviewed in Venette et al., 2003). It is also considered a destructive pest in England and Denmark (CABI, 2007).

Historically, outbreaks of this pest have occurred on peas in Poland, artichokes in Italy, and tobacco seedlings in Yugoslavia (CABI, 2007).

“With respect to injury levels, an economic threshold of 25% loss in leaf area has been suggested, though a 60% loss of leaf area can be sufficient to destroy an entire crop (Novák 1975)” (reviewed in Venette et al., 2003).

Known Hosts

This polyphagous pest is found on cereals, grasses, fiber crops, *Brassica* spp., and other vegetables, including legumes. Hill (1987) states that tomato and potato are main hosts while tobacco is an alternative host.

Autographa gamma can feed on at least 224 plant species, including 100 weeds, from 51 families (Maceljski and Balarin, 1972).

Major hosts

Beta vulgaris (beet), *Beta vulgaris* var. *vulgaris* (sugarbeet), *Borago officinalis* (common borage), *Brassica oleracea* var. *capitata* (cabbage), *Brassica oleracea* var. *gemmifera* (Brussels sprouts), *Brassica rapa* subsp. *chinensis* (Chinese cabbage), *Brassica rapa* subsp. *pekinensis* (Pe-tsai), *Cannabis sativa* (marijuana, hemp), *Capsicum* (peppers), *Chrysanthemum indicum* (chrysanthemum), *Cicer arietinum* (chickpea), *Cichorium intybus* (chicory), *Cynara cardunculus* (artichoke), *Daucus carota* (carrot), *Glycine max* (soybean), *Gossypium* spp. (cotton), *Helianthus annuus* (common sunflower), *Hyssopus officinalis* (hyssop), *Lactuca sativa* (lettuce), *Linum usitatissimum* (flax), *Medicago sativa* (alfalfa), *Nicotiana tabacum* (tobacco), *Pelargonium* (geranium) hybrids, *Petroselinum crispum* (parsley), *Solanum lycopersicum* (tomato), *Solanum tuberosum* (potato), *Spinacia oleracea* (spinach), *Trifolium pratense* (red clover), *Triticum aestivum* (wheat), *Vitis vinifera* (grape), *Zea mays* (corn), and *Zinnia elegans* (zinnia).

Pathogens or Associated Organisms Vectored

Autographa gamma is not a known vector and does not have any associated organisms. Chumakov and Kuznetsova (n.d.) state that larvae can transfer the tobacco mosaic virus; however, no studies were cited.

Known Distribution

Autographa gamma is widely distributed from Greenland (Lafontaine and Poole, 1991) throughout all of Europe and eastward through Asia to India and China; it also occurs in North Africa (USDA, 1958).

Asia: Azerbaijan, China, India, Iran, Iraq, Israel, Japan, Kazakhstan, Korea, Saudi Arabia, Syria, Turkey, and Uzbekistan; **Europe:** Albania, Andorra, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Channel Islands, Croatia, Cyprus, Czech Republic, Denmark (including Faroe Islands), Estonia, Finland, France (including Corsica), Germany, Greece (including Crete, Cyclades, and Dodecanese), Greenland, Hungary, Iceland, Ireland, Italy (including Sardinia and Sicily), Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Montenegro, the Netherlands, North Aegean Islands, Norway, Poland (including Azores and Madeira), Portugal, Romania, Russian Federation (including Kaliningrad Oblast), Serbia, Slovakia, Slovenia, Spain (including Balearic Islands and Canary Islands), Sweden, Switzerland, Ukraine, and the United Kingdom (including Gibraltar); **Africa:** Algeria, Egypt, Libya, and Morocco (Fibiger and Skule, 2011).

Pathway

Autographa gamma could potentially move through international trade. This species has been intercepted over 500 times at U.S. ports of entry. The top two countries of origin were the Netherlands (271) and Israel (192). Some other countries where infested material originated from include France (7), Italy (7), Germany (3), Zimbabwe (3) and Palestinian Territory (3). Most interceptions were on material for consumption (490), 14 were for non-entry, and 4 were for propagation. The majority of interceptions were on permitted cargo of cut flowers and leaves of various herbs. Interceptions were most common on *Origanum* sp. (47), *Trachelium* sp. (40), *Thymus* sp. (39), *Veronica* sp. (31), and *Bupleurum* sp. (24). Most interceptions occurred in permit cargo (468), followed by general cargo (13), baggage (13), stores (6), holds (4), miscellaneous (3), and quarters (1) (AQAS, 2012; queried August 6, 2012).

Potential Distribution within the United States

The likelihood and consequences of establishment by *A. gamma* have been evaluated in a pathway-initiated risk assessment. *Autographa gamma* was considered highly likely of becoming established in the United States if introduced. The consequences of its establishment for U.S. agricultural and natural ecosystems were also rated high (*i.e.*, severe) (Lightfield, 1997).

Survey

CAPS-Approved Method*:

The CAPS-approved method is a trap and lure combination. The trap is the plastic bucket trap. The lure is effective for 28 days (4 weeks).

IPHIS Survey Supply Ordering System Product Names:
1) *Autographa gamma* Lure
2) Plastic Bucket Trap

Method Notes: This trap is also known as the unitrap. The trap has a green canopy, yellow funnel, and white bucket and is used with a dry kill strip. For instructions on using the trap, see Brambila et al. (2014).

IMPORTANT: Do not include lures for other target species in the trap when trapping for this target.

Trap spacing: When trapping for more than one species of moth, separate traps for different moth species by at least 20 meters (65 feet).

*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/.

Survey site selection:
This species has a large host range. Surveys can occur in any area that has host material including field crops, greenhouses, and nurseries. Trapping is suggested in major truck farming areas.

Trap placement:
Traps should be placed within or on the edge of fields of the host crops. Traps should be suspended from stakes and placed at crop height and raised as the crop matures.

Time of year to survey:
Due to the migratory nature of this species, adult *A. gamma* can be observed every month from April to November, usually peaking in late summer.

Literature-Based Methods:
Due to the migratory nature of this species, adult *A. gamma* can be observed every month from April to November, usually peaking in late summer (CABI, 2007).

Trapping: The sex pheromone of *A. gamma* is composed of (*Z*)-7-dodecenyl acetate (*Z*7-12:Ac) and(*Z*)-7-dodecenol (*Z*7-12:OH); *Z*7-12:Ac is the major component (Tóth et al., 1983; Mazor and Dunkelblum, 2005). (*Z*)-7-dodecen-1-yl acetate and (*Z*)-7-dodecen-1-ol in 100:1 and 95:5 mixtures attract male *A. gamma* moths (Tóth et al., 1983). Traps can be baited with rubber septum dispensers with 1 mg dispensing rates. Lures should be replaced every 4 weeks. Optimum trap height is 1.5 m (about 5 ft) (Terytze et al., 1987). Newly-emerged adult males of *A. gamma* are not attracted to the pheromone; 3-day old males are most responsive to the lure.

Not recommended: Adult males and females have also been collected using Robinson black-light traps, but these traps attract moths non-discriminately. Such traps, placed three meters above the ground, have been used to successfully monitor the dynamics of *A. gamma* and other Noctuid moths. Sticky traps have been used, but are not recommended as pheromone traps are much more effective.

Key Diagnostics/Identification

CAPS-Approved Method*:

Morphological. *Autographa gamma* is very similar to several North American species in the subfamily Plusiinae (Noctuidae), some of which are attracted to the same lure (Brambila, 2011). The wing color of *A. gamma* is not distinctive. Therefore, for final identification, it is necessary to dissect and examine adult male genitalia (Brambila, 2011).

For field level screening, use:
Brambila, J. and S. Passoa. 2009. *Autographa gamma* Field Screening and Diagnostic Aid.

For identification, use:
Brambila, J. 2011. *Autographa gamma* Identification Aid.

For additional dissection images, see:
Passoa, S. 2006. *Autographa gamma* - Silver Y Moth Separation by Genitalic Dissection from Non-target Species.

For additional information, see Eichlin and Cunningham (1978) and Lafontaine and Poole (1991).

*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

Brambila and Passoa (2009) list nine species that are commonly found in *A. gamma* traps and that may be confused with *A. gamma*: *Anagrapha falcifera, Autographa ampla, Autographa californica, Autographa pseudogamma, Chrysodeixis includens*, *Ctenoplusa oxygramma*, *Rachiplusia ou, Spodoptera frugiperda,* and *Trichoplusia ni.* See Brambila and Passoa (2009), Brambila (2011), Passoa (2006) for additional information and images to differentiate between these similar species.

Similar-looking exotic species include *Cornutiplusia circumflexa* (Essex Y), which occurs in Africa, Asia, and Europe, and *Syngrapha interrogationis* (scarce silver Y) which occurs in the UK (Venette et al., 2003). See Nazmi et al. (1980) for comparison and similarities between closely related species.

Figure 7. Adult and larva of *Trichoplusia ni* (Left: Keith Naylor, Bugwood.org, Right: Alton N. Sparks, Jr., University of Georgia, Bugwood.org).

Figure 8. Adult and larva of *Syngrapha celsa* (John Cooper and Natural Resources Canada).

Commonly Encountered Non-targets

The pheromone of *A. gamma* also attracts the following Lepidoptera in the United States: *Anagrapha ampla, Anagrapha falcifera, Autographa ampla, Autographa biloba, Autographa californica, Autographa pseudogamma, Caenurgia* spp., *Chrysodeixis includens*, *Ctenoplusa oxygramma*, *Epismus argutanus, Geina periscelidatyla, Helvibotys helvialis, Lacinipolia lutura, Lacinipolia renigera, Ostrinia nubilalis, Pieris rapae, Polia* spp., *Pseudoplusia includes, Rachiplusia ou, Spodoptera frugiperda, Spodoptera ornithogalli, Syngrapha falcifera,* and *Trichoplusia ni*. Brambila and Passoa (2009) has photos and lists important characteristics for the majority of these species.

In the eastern United States, *A. gamma* is most likely to be confused with *Autographa californica* and *Rachiplusia ou* (Passoa, 2006). In the western United States, *A.*

Figure 9. Adult and larva of *Autographa californica* (Top: Peggy Greb, USDA Agricultural Research Service, Bugwood.org, Bottom: Franklin Dlott, UC Cooperative Extension, Monterey County).

gamma is easily confused with *Autographa californica* (Passoa, 2006). See Passoa (2006) and Brambila (2011) for additional information and images.

Figure 10. Adult of *Autographa pseudogamma* (Natural Resources Canada).

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Revisions

January 2014
1) Corrected links to screening aids.
2) Clarified information in **Key Diagnostics/Identification** section based on Brambila (2011).
3) Clarified information in **Easily Confused Pests** section based on Brambila and Passoa (2009).
4) Added additional species to **Commonly Encountered Non-targets** section.