Navy Environmental & Preventive Medicine Unit FIVE
San Diego, CA

The Asian Gypsy Moth

Background

Gypsy moth is the common name for Lymantria *dispar* (Lepidoptera: Lymantriidae). There are two geographically isolated strains, the Asian and the European. This reflects their native Palearctic range of Greater Asia and Europe. The European strain was introduced into North America in 1869 and became an established pest species. Since the introduction of the European Gypsy Moth, millions of trees have suffered extensive defoliation and millions of dollars have been spent on control. It is this experience with the European Gypsy moth that has lead to the concern over the Asian Gypsy Moth (AGM). The Asian strain was first detected in North America in 1991 in Vancouver, British Columbia. It was detected again in 1993 in Wilmington North Carolina. It has been intercepted several more times since these first introductions. Small isolated populations of the Asian strain have become established in North America and massive control efforts are in place to control its spread.


Adult male and female AGM

If the AGM is introduced into a new ecosystem the potential for it becoming a major pest species is enormous.

So why is the U.S. Navy concerned about the AGM?

The U.S., under the guidance of the International Plant Protection Convention Treaty, has a responsibility to prevent the spread of plant pests between countries. Due to the nature of our mission, the U.S. Navy regularly transports large amounts of material between countries. Even though this treaty is mostly concerned with the movement of cargo, it also includes military AGM introductions into the United States.


AGM larva

For Example, 1993: In Wilmington, North Carolina, a contracted U.S. military transport carrying NATO munitions from Germany released hundreds of AGM's from its cargo during the unloading process. The adult moths had emerged from their pupal stages sometime during the trip from Germany.

1994: Egg masses and larvae were found on military cargo off-loaded in Charleston, South Carolina and Baltimore, Maryland. Fumigation of household goods, military trucks and trailers, and private automobiles had to be conducted to prevent introduction of the AGM.

Biology

AGM has four life stages:

Egg - eggs are laid in masses which can be found on almost any surface. The natural oviposition sites are tree trunks, but any item found outdoors is a potential oviposition site. Egg masses are covered by brown hairs and have a velvety appearance. Egg masses can range from 0.5 inch to 1.5 inches long and 0.5 inch to 0.75 inch wide.

Each egg mass can contain 50 to 1000 eggs. Under normal conditions, eggs take 4 to 6 weeks to develop, and then enter a prolonged diapause, or resting stage, to pass the winter months.

Egg masses can be very cryptic. The female will oviposit the egg masses in out of the way places to prevent them from being seen by predators or parasitoids, or exposed to harsh climatic conditions.

Egg masses serve as the primary stage for long distance dispersal of the AGM. They can be oviposited on any object, including household items, which can be transported long distances.

Larva - The larva or caterpillar is the stage of the life cycle which causes damage to trees. Larvae can feed on a wide variety of hosts, including both deciduous and evergreen trees. The AGM is known to have at least 250 known host trees.

Male caterpillars pass through 5 instars (or stages), females pass through six. During the day caterpillars hide, but at night crawl to the top of trees to feed on the foliage. Caterpillars are about 0.5 inch long when they first hatch from the egg. Later, they grow to 2.5 inches in length. Depending on temperature, feeding usually begins in June or July and lasts about 40-60 days.

First instar caterpillars exhibit a behavior called ballooning. Individuals will crawl to an exposed surface, release a single strand of silk which, combined with its small size and high numbers of hairs, will be caught on the wind to carry the larvae short distances. This behavior serves to disperse individuals to new areas, where there may be less competition for the best food sources.

How far the larvae travel is extremely dependent on wind velocity and direction.

Pupa - After maturing, caterpillars seek shelter to pupate.

The pupal stage can last from 10 to 14 days. Male moths emerge first, followed shortly after by the females.

Adult - This is the stage in which reproduction occurs. This stage lasts 1 to 3 weeks. The adults do not feed. Both male and female AGM fly in contrast to the European stage in which only the males fly. Female AGM's can fly up to 20 miles. This is the major cause for AGM's quarantinable status. Females can disperse long distances in search of mates or suitable oviposition sites. Because of the female's ability to fly, once the AGM is introduced into a new ecosystem, females could disperse throughout an entire ecosystem within a few short years.

Females are attracted to lights. Lights that give off large amounts of ultraviolet light are especially attractive to female moths, although any light on the pier or on a ship can also act as an attractant. This is the main reason AGM Is attracted to Navy ships. The lights from the pier and from the ship will entice the females to fly to the ship. She then searches for a suitable oviposition site to lay her egg

mass. Thus, if the only source of light were from the pier, the entire ship would still have some illumination. It is, therefore, possible for a female to find a suitable site even on the superstructure of a ship. Peak flight time of L. dispar in the Russian Far East has been reported between 2300 and 0100 hours.

Australia Specific Information


Adult male AGM

If in the past 2 years your ship has been in any Russian Far East ports between 40°N and 60°N during any period between July and September, you must perform an Asian Gypsy Moth Inspection. AGM egg masses remain dormant during cold temperatures. If a ship has AGM egg masses on the superstructure, and the ship remains in a cold climate, the eggs will not hatch. Warm temperatures will induce the eggs to hatch. Thus, ships entering warmer waters are considered at risk through ports, such as Australia, for a period of two years. Follow the above guidelines when conducting any AGM inspection.

Inspection Protocol

If your ship has been in a Far Eastern Russian, Northern Chinese, Japanese, or Korean port, be on the lookout for the AGM.

The three most likely ports where your ship will be infested with AGM are the Far Eastern Russian ports of Vladivostok, Nakhodka, and Vostochny.

You should consider your ship at **HIGH RISK** of infestation if you are in these ports during the period of July through September.

Inspection:
Materials needed:

- Flashlight
- Binoculars
- Mirror with extension
- Vials for samples
- Kneepads
- Hard Hat
- Gloves

Procedures:

ASIAN GYPSY MOTH ABOVE DECK INSPECTIONS

- DECK & DECK STRUCTURES. To ensure that all surfaces are inspected, have at least 2 people (or team) start at opposite ends of the ship. In this way, all surfaces are inspected twice, so that no infestations are missed. Each inspection should be the most thorough inspection you have ever made on your ship! Use a mirror with an extendable handle to look under and behind "hard-to-reach areas."

  - Eggs/Egg masses. If an egg mass is found, cut off a small part, place it in a sealed vial and submit it to the cognizant NEPMU or NECE for identification confirmation. Generally, egg masses can be found:
    - On and behind bulkheads and hatches
    - In overheads with wiring
    - In cracks and crevices
    - Where surface paint is peeling, cracked, or rough
    - Where open pipes, vent tubes or lagging are accessible.
    - Under areas covered with tarps.
    - Lifeboats and motor whale boats.
    - Life rafts and around all accessible life raft enclosures.

  - Larvae.
    - "Ballooning." Look for larvae ballooning on silk strands which may drift ONTO your SHIP from shore or away from your ship TOWARDS PIERSIDE, " Observing, finding and immediately destroying any start of an infestation will prevent or reduce the chances of a ship transporting it to another port. However, larvae will not usually live more than a week aboard a vessel enroute to another port, unless "food" is available onboard.
    - Hatching. Generally, once larvae hatch from the eggs and leave the egg mass, the move upwards, especially noteworthy as they move up the superstructure.

  - Pupae/Adults. Because of food requirements and restrictions for the larval stage, the most likely growth stages of the Asian gypsy moth to be found aboard ship will be the egg stage or the pupal/adult stage.

- SUPERSTRUCTURE (most vessels)/ISLAND (Aircraft Carriers). With binoculars from the deck, carefully scan the external surfaces of the superstructure, starting at the top and slowly scanning downwards to the deck plates. It is easiest to envision the superstructure as having 4 sides or quadrants. Thus, moving from top to bottom and in sequence from right to left around the superstructure from quadrants 1 – 4 will guarantee the best success in spotting any small life stages of the Asian Gypsy moth or other pests.

- LIGHTED AREAS. It is extremely important to keep in mind that adult egg laying female moths will be attracted at dusk and in the early evening hours to the ship's lights and surfaces adjacent to these lights. It is also important to note where the external surfaces of the ship are illuminated from lights originating from pierside. Although it is important to inspect all surfaces of the ship for the presence of the Asian gypsy moth, extra effort should be made to inspect those surfaces where adult females are most likely to oviposit their egg masses. Therefore, if an inspection is scheduled for the early morning hours, it is worth the effort, on the evening before, to observe and systematically record in a notebook all obvious areas of the ship that are illuminated by the ship or from lights pierside.
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ASIAN GYPSY MOTH BELOW DECK INSPECTIONS

After all deck surfaces have been thoroughly inspected, move to the spaces below deck. Equally divide the sections to be inspected between the 2 inspectors (or teams), then switch sections so that the other team also inspects the same spaces, to ensure all surfaces are completely free of pests and/or disease vectors. Unless live plants are brought aboard, the most likely stages to be found below deck will be the egg stage or pupal/adult stages. These situations will usually only occur if egg masses are attached by the females onto containers strapped to pallets which are staged pierside for later onloading aboard ship, or have been kept at other accessible outdoor (or rarely indoor) storage sites for some period of time.

ASIAN GYPSY MOTH CONTROL PROCEDURES

Egg Masses

- Sample. First, ensure a small part of the egg mass has been saved into a vial for later identification.
- Spraying. Using a hand compressed sprayer, apply a vegetable based oil onto the egg mass to suffocate the eggs (and any larvae crawling on or near the egg mass). Spray until the egg mass is completely saturated.
- Disposal. After it has been sprayed, scrape off the egg mass and crush and discard in a sealed plastic bag.

ASIAN GYPSY MOTH RECORDS & REPORTS PROCEDURES

Inspection Records

- Record of the inspection(s) and presence or absence of the Asian gypsy moth (and specific growth stages) should be noted on the country specific "Pratique."
- Actions taken should also be noted. Follow country specific requirements.

For further information contact NEPMU FIVE at COM: (619) 556-7070, DSN: 526-7070; Email -Vector Control Department: vector@med.navy.mil

Acknowledgements
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