Lymantria dispar 简体中文 正體中文 **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Arthropoda	Insecta	Lepidoptera	Lymantriidae

Common name neparnyy shelkopryad (Russian), gypsy moth (English), Asian gypsy moth (English), spongieuse (French), l�Vstraesnonne (Danish), Schwammspinner (German), lagarta peluda (Spanish), erdei gyapjaslepke (Hungarian), limantria (Italian), gubar (Romanian), mniska vel�kohlava (Slovak), maimai-ga (Japanese)

Synonym *Porthetria dispar*

Similar species

Summary Lymantria dispar commonly known as the Asian gypsy moth, is one of the most destructive pests of shade, fruit and ornamental trees throughout the Northern hemisphere. It is also a major pest of hardwood forests. Asian gypsy moth caterpillars cause extensive defoliation, leading to reduced growth or even mortality of the host tree. Their presence can destroy the aesthetic beauty of an area by defoliating and killing the trees and covering the area with their waste products and silk. Scenic areas that were once beautiful have become spotted with dead standing trees where the Asian gypsy moth has invaded. Also, urticacious hairs on larvae and egg masses cause allergies in some people.

[view this species on IUCN Red List]

Species Description
There are several subspecies and races of gypsy moth. There is the Asian gypsy moth *Lymantria dispar dispar* race *asian*; and the European gypsy moth *Lymantria dispar dispar* race *Europe*; and *Lymantria dispar japonica* the Japanese gypsy moth (Walker, 2005).
Male Gypsy moths are brown with a darker brown pattern on their wings. Females are slightly larger and nearly white, with a few dark markings on their wings. Newly hatched caterpillars are black and hairy, later developing a mottled yellow to gray pattern with tufts of bristle like hairs and two rows of blue then red spots on their back (Walker, 2005).
Adult females from Asian strains (west of the Ural mtns.) of gypsy moth are capable of flight but European strains are incapable of flight. Larvae of Asian strains also tend to grow larger. North American populations originated from Europe. Because of these differences, eradication is usually directed to be more aggressive during incursions of the Asian strain (Walker, 2005). The ability of Asian gypsy moth females to fly long distances (up to 20 miles) makes it probable that the Asian gypsy moth could quickly infest and spread throughout the United States. In contrast, the European gypsy moth has taken more than 130 years (since 1869) to spread throughout the Northeast. In the East, European gypsy moths defoliate an average of about 4 million acres each year, causing millions of dollars’ worth of damage. If the Asian gypsy moth were to become established in the United States, the damage could be even more extensive and costly (APHIS 2003).
Please follow these links to PaDIL (Pests and Diseases Image Library) Species Content Pages for high quality diagnostic descriptions and images of the three races of gypsy moths: *Lymantria dispar dispar* race *asian* (Linnaeus), *Lymantria dispar dispar* race *Europe* and *Lymantria dispar japonica* (Motschulsky).

Lifecycle Stages

Egg: Females lay egg masses ranging from 15-40mm in length which contain up to 1000 eggs. Egg masses are laid unselectively on objects such as tree trunks, branches, rocks, buildings, vehicles, outdoor furniture, and with the Asian race, on stored containers and ships near shore. In the European race egg masses are laid close to female pupation site, while in the Asian race they occur much further from female pupation site, often kilometers away (Humble and Stewart 1994).

Larva: Larvae are around 2-3mm long and hairy when they hatch and reach about 60mm when mature. They are highly distinctive with two rows of large spots along the back usually arranged in five pairs of blue and six pairs of red from head to rear. European larvae are uniform in colour, while Asian larvae are highly variable. In the European subspecies only first instar larvae disperse, while both first and second instar larvae disperse in the Asian subspecies. Larval dispersal occurs by spring “ballooning”: the small, hairy larvae assisted by long silk threads produced by special glands on their heads are blown by wind to new locations. Ballooning usually adds about 5km per year to new infestations, but has been recorded at over 50km. In European strains male caterpillars go through five growth stages and females grow through six stages. In the fifth and sixth stages, they feed most heavily and on the widest range of vegetation. Males and females of Asian strains may have six or seven larval instars. A final difference between gypsy moth subspecies is that European larvae feed at night, moving away from the canopy during the day, while Asian larvae feed and rest in the canopy (Humble and Stewart 1994).

Pupa: Gypsy moth pupae are dark reddish brown in color, often with some yellowish hairs attached. Female pupae are usually larger (15-35mm) than male (15-20mm). They are found in protected places such as bark fissures or crevices and underneath loose moss. Also the European race will pupate in litter, while the Asian race will pupate on foliage and hanging from branches. Pupation usually occurs in July and lasts The pupal stage lasts an average of 10 days for females and 13 days for males. (Humble and Stewart 1994)

Adult: Male moths are tan to brown with irregular black wing markings and a wingspan of 37-50mm. Males are strong fliers. Females are whitish with faint darker and wavy bands across the forewings. Females are larger with a wingspan of 37-62mm. Females of the European race are flightless, while those of the Asian race are strong fliers (Humble and Stewart 1994). While the two races are morphologically almost identical, genetic differences are well documented (Pfeifer *et al*. 1995; Garner and Slavicek 1996 in Peterson et al. 2007). Asian populations have a broader host range of plants, hatch at lower temperatures and reach adulthood more rapidly than European populations (Peterson *et al*. 2007).

Habitat Description

Asian gypsy moths are found in most temperate natural and artificial forests. Outbreak generally only occur in stands where primary hosts (e.g., *Quercus*, *Populus*, etc) comprise > 20% of the basal area.

Reproduction

Gypsy moths are univoltine, meaning that one generation occurs annually. They overwinter in the egg stage and usually hatch from mid to late April. Feeding usually occurs for six to eight weeks, depending on weather and location. By late June or early July feeding is completed and larvae move to protected locations to pupate. The pupal stage lasts around 10 days for females and 13 days for males with adults emerging in July. Female moths emit a pheromone to attract males, and mating occurs. Adults do not feed and live for up to several weeks. After mating laying of egg masses occurs from late July to September (Humble and Stewart 1994).

Nutrition

Asian gypsy moths feed on over 500 varieties of trees and shrubs. They prefer oak, alder broadleaf trees, Douglas fir, and western hemlock needle trees.

General Impacts

The gypsy moth *Lymantria dispar* is a defoliator of mainly deciduous trees. In most areas and in most years, gypsy moths remain at low densities and cause no discernible damage. Occasionally, however populations reach high densities and these outbreak populations may completely defoliate host trees.

Most impacts of gypsy moth are associated with the physiological stress in trees caused by defoliation, especially if it occurs several years in a row or in conjunction with drought. These effects include reduction in tree growth, crown dieback and tree mortality. Tree mortality is usually associated with other insects (wood borers) and pathogenic fungi that attack stressed trees. In extreme situations, nearly 100% tree mortality may occur over large areas. The most important impacts occur in urban/suburban settings. Defoliation and tree mortality may be very serious if impacted trees are valuable shade or street trees in urban settings.

Outbreaks typically last 1 to 5 years. Outbreak populations then decline because of starvation and increased disease. Small mammal predators are considered the most important source of mortality in low density populations and may keep sparse gypsy populations in check for several years before the next outbreak occurs.

Gypsy moth defoliation can reduce tree seed production and root sprouting, resulting in poor regeneration. The natural diversity and species composition of native insects, birds, and other animals may be altered during outbreaks through reductions in shelter, food supplies, and other benefits provided by host trees.

In its caterpillar stage, the gypsy moth can feed on more than 500 different species of trees and shrubs. In North America the long list of preferred hosts includes oak, cherry white birch, maple, alder, willow, elm and trembling aspen. The Asian race also does well on coniferous trees such as larch, and has a broader host range than that of the European race (Humble and Stewart 1994). It is estimated that more than 30 million hectares of forest in the United States have been defoliated since 1970 (de Beurs and Townsend 2008). The potential area that is climatically suitable for the gypsy moth is estimated to be 595 million hectares (Gray 2004 in de Beurs and Townsend 2008). In Canada spread of the gypsy moth to the north and west has so far been prevented by climatic barriers. However current climate change forecasts are expected to increase the area of climatic suitability for the gypsy moth (Regniere *et al*. 2009). Similarly in the western United States climate prediction models suggest a warming trend that will increase the area suitable for gypsy moth.

Annual losses can reach millions of dollars due to lost revenues from timber harvesting, cost of hazard tree removal and loss of amenity values. Defoliation and tree mortality caused by gypsy moth may also influence property values (Humble and Stewart 1994).

Also, during outbreaks caterpillars become so numerous that they become a nuisance to homeowners recreating in their yards. Some people also have allergies to the urticacious hairs on gypsy moth larvae, further compromising their recreational experience.

Not all impacts of gypsy moth are negative. In North America during outbreaks, gypsy moth represents a super-abundant food source for native cuckoos. In outbreak areas cuckoo abundance increased significantly, causing a redistribution of cuckoos within their current range. Presumably this would cause a redistribution of their predation impact. The flow on effects to forest food webs is unknown, but could have important effects on insect prey and plants by reducing herbivorous insects (Barber *et al*. 2008). Other positive impacts of gypsy moth defoliation could include a more open canopy due to overstorey tree mortality and increased shrub growth, and may benefit some understory-nesting bird species (Bell and Whitmore 1997, 2000 in Barber *et al*. 2008).

Management Info

Preventative measures: Landscapes may be protected from the gypsy moth in many different ways. Forests can be altered to prevent outbreaks. High-risk forests can be harvested before outbreaks occur to prevent some economic loss. Thinning stands of medium to high quality can increase the vigor of surviving trees, reducing the risk of major outbreak. Thinning to reduce the proportion of primary gypsy moth hosts can also reduce the frequency and intensity of defoliation. After defoliation has occurred, salvage logging can be carried out within 6 to 12 months of tree death to prevent complete economic loss and to advance regeneration.
\r\nIn New Zealand legislation and quarantine procedures may require vessels from areas with established gypsy moth populations before entering port to undergo 'high risk' inspection for gypsy egg masses eight kilometres off shore. If found, the vessel is directed back to the 20 nautical mile limit for cleaning, before 'high risk' inspection will be continues once again at eight kilometres off shore (M. Dijkhuis pers. comm April 2005).
Prediction of spread: One obstacle in developing sound approaches to managing biological invasions is the lack of reliable methods for estimating and predicting the spread of an introduced species. Therefore developing effective spread estimates for invasive species is a primary concern of management programs. Tobin and colleagues (2007) used county level presence/absence quarantine records and detailed pheromone trap data from the Slow the Spread program to estimate gypsy moth spread using a number of methods. The gypsy moth is one of the most extensively monitored species in the world, thus STS data is a unique resource. STS pheromone trap data is spatially extensive and uniformly spaced due to a network of over 100,000 traps placed annually over the transition zone between infested and uninfested areas (Tobin *et al*. 2004 in Tobin *et al*. 2007). However despite the fact that the county level records were far more crude data, overall rates of spread did not differ substantially from estimates obtained by more costly pheromone traps, particularly in longer time series. These results are encouraging, as records of simple presence/absence by municipality can be used to obtain comparable estimates of spread rates if use of extensive trapping grids is not feasible (Tobin *et al*. 2007).
\r\nPeterson *et al* (2007) carried out ecological niche modeling using climate data from the native range of the Asian *Lymantria dispar*. This revealed that ecological niche data from the Asian race was able to relatively accurately predict the geographic distribution of the much better known European *L. dispar* populations, indicating that ecological characteristics of the two races are very similar. The ecological niche model predicted that the global potential distribution of both the Asian and European gypsy moths is quite broad and that “these populations appear to have the potential to colonize almost all temperate-zone areas, except for montane regions and deserts” (Peterson *et al*. 2007). However Asian gypsy moth is likely to be more difficult to control due to faster maturation and better dispersal abilities (Barnachikov 1989 in Peterson *et al*. 2007).
\r\nMonitoring of impact: Despite efforts to prevent the ongoing spread of the gypsy moth, the affected area of North American forests continues to expand. With the increased area of infestation, ecological, environmental and economic concerns about gypsy moth disturbance remain significant. As such, the pressure on current monitoring tools is greater than ever. Traditional sketch-mapping and observer based programs are likely to become less able to comprehensively quantify the areas of impact. Moderate Resolution Imaging Spectroradiometer (MODIS) is an important tool for broad-scale detection of defoliation by *L. dispar*. de Beurs and Townsend (2008) determined that daily MODIS data is optimal for monitoring insect defoliation on an annual time scale, rather than eight or 16 day data which is of less use due to the ephemeral effects of gypsy moth disturbance (de Beurs and Townsend 2008).
Please follow this link for more details on the physical, chemical and biological control options to control the spread of the gypsy moth.

Pathway

Egg masses of AGM can be transported inadvertently. AGM egg masses are tolerant of extremes in temperature and moisture and travel well on logs, lawn furniture, nursery stock, pallets, shipping containers, and on the hulls and riggings of ships (APHIS, 2003).
Caterpillars attach to travelers and their possessions. They can hitch rides and travel across the continent this way.

Principal source:

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ALIEN RANGE

[6] CANADA
[1] NEW ZEALAND
[1] SERBIA
[1] MONGOLIA
[1] RUSSIAN FEDERATION
[25] UNITED STATES

Red List assessed species 1: NT = 1;

Plethodon punctatus **NT**

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