GYPSY MOTH—DOWN AND OUT?

By Douglas C. Allen

Many forest owners have commented on the rarity of gypsy moth damage in 1996 and 1997 compared to previous years. Indeed, the U.S. Forest Service reported defoliation in 1996 was only approximately 200,000 acres spread over 12 northeastern states. This amounted to 15% of the 1.4 million acres recorded for 1995 and the smallest area affected since 1968! What delivered this knockout punch? Will the gypsy moth take a "ten count" or get back on its feet? Scientists have been able to shed some light on the first question, but are uncertain about future events.

The Insect

Gypsy moth probably has garnered more notice, frustration, research dollars, and environmental concerns than any other forest or urban tree pest in the United States. Because of its broad host range, large size, adaptability to a variety of habitats, and frequent excessive abundance, outbreaks of this defoliator detract from a wide range of economic and amenity values. The insect's presence and the damage it causes can significantly disrupt people's lives in many ways.

It was introduced from France around 1868, but it did not gain public notice until 1889. After this it became a household topic in an increasingly large geographic area. Today it is permanently established in 16 states from New England west to the Lake States and as far south as Virginia, and in three Canadian provinces.

Even when populations are low, the conspicuous zig zag flight of the very active, brown male moths is a common sight in late July and early August in New York. Similarly, the newly laid, buff egg masses (*Fig. 1*) are easy to spot in late summer, even when populations are low and masses are widely scattered on tree bark and other substrates.

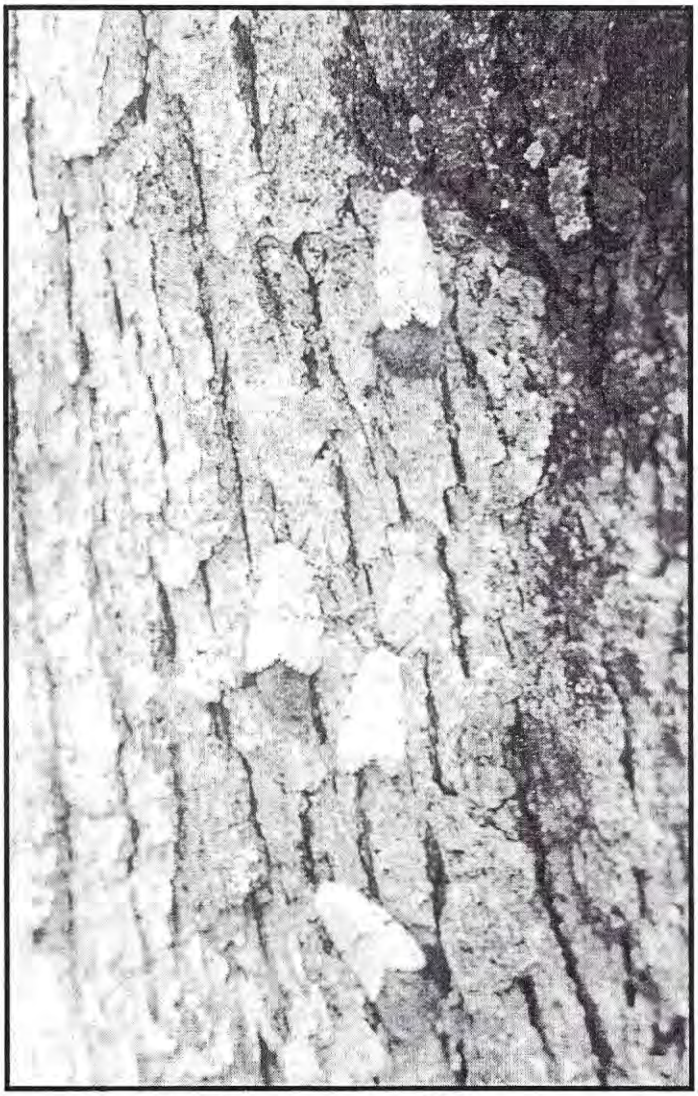


Fig. 1. Female gypsy moths and their egg masses.

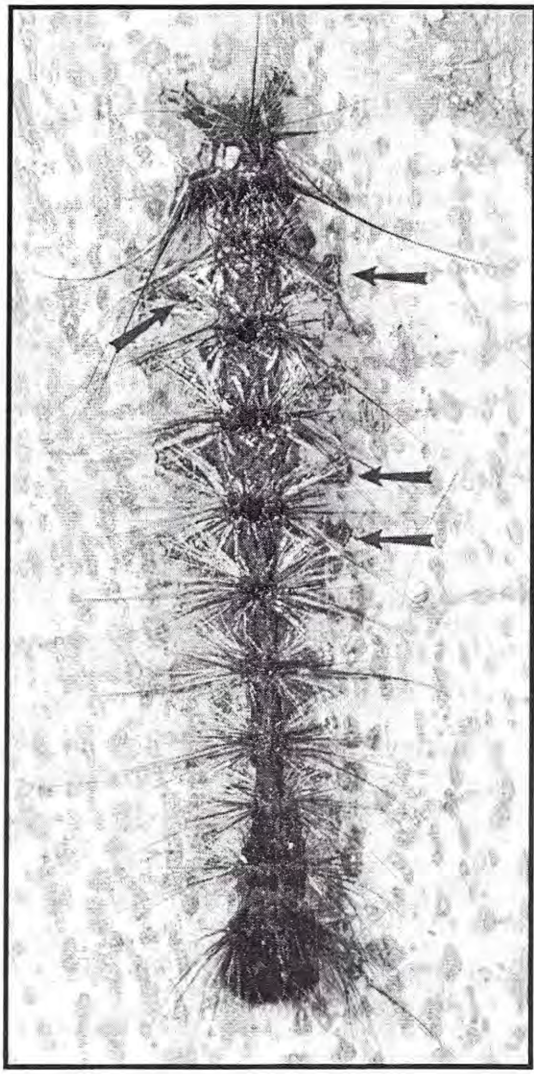
The Famous Fungus

Scientists attribute the current decline in gypsy moth to a fungus, *Entomophaga maimaiga* (ento-mow-faaga my-my-ga). The first part of its Latin name means "insect eater" and the second part is the common name given to gypsy moth in Japan. This fungus was released in the United States at several sites near Boston in 1910 and 1911 and again at two additional sites in 1985 (one of which was Allegany State Park). These attempts at biological control apparently failed, because on none of these occasions was transmission detected in resident populations of the defoliator. The first epizootics (epee-zoo-augh-ticks, a term referring to the outbreak of a disease in an insect population) were noted in seven northeastern states in 1989. One reason why the disease may have escaped detection from 1911 to 1989 is the fact that cadavers killed by the fungus closely resemble those succumbing to a common viral disease known as NPV.

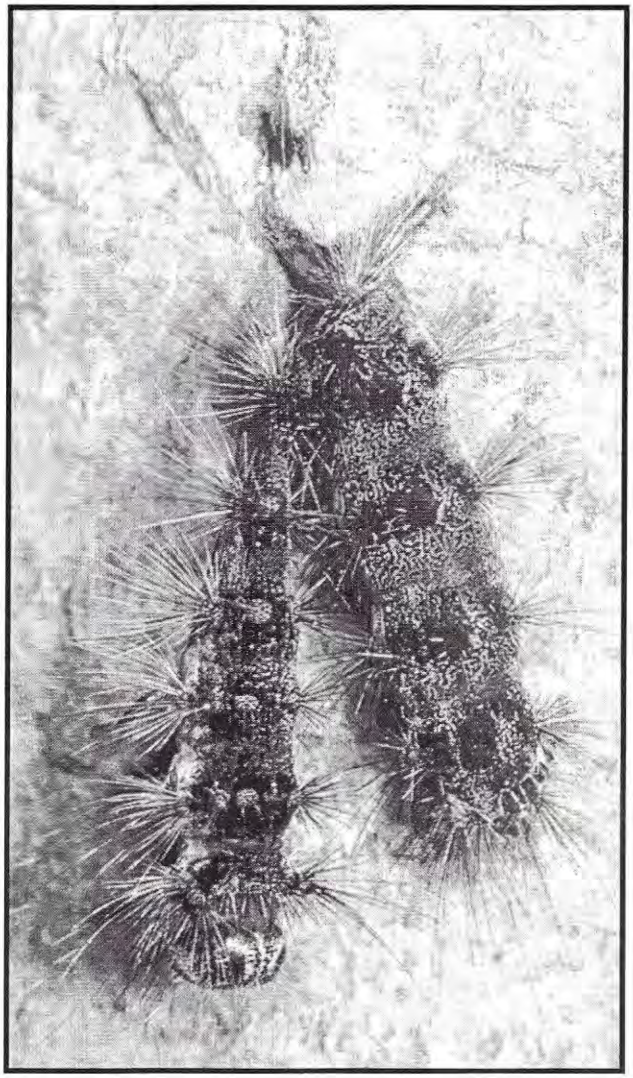
Gypsy moth NPV (a NucleoPolyhedrosis Virus; i.e., the virus replicates in the nucleus of a cell and is shaped like a polyhedron) is associated with this defoliator throughout the world. The pathogen causes a condition referred to as "wilt disease" in the U. S., "caterpillar cholera" in parts of Europe and "treetop disease" in Germany. Virus probably was imported with the original introduction, but its biology was not understood until 1947. Because it was associated frequently with the collapse of gypsy moth populations, and because of this appeared to offer potential as a biological control, research with it was greatly intensified during the 1960s and 1970s.

Determining Cause of Death

To the novice, it is difficult to establish whether the cadaver of a gypsy moth caterpillar was killed by *E. maimiaga* or NPV. The U.S. Forest Service in conjunction with **Dr. Ann Hajek**, an insect pathologist at Cornell University, published two informational leaflets in the mid-1990s (USDA Forest Service, NA-PR-02-92 and NA-PR-01-94) which provide verbal descriptions and excellent color photos that help distinguish gypsy moth caterpillars killed by these two disease-causing organisms. Recognizing if disease is present and being able to identify the causal agent may be important when a land owner who is threatened with defoliation must decide whether to initiate control activities or let nature take its course. A key element in making this decision is understanding that the fungus apparently is capable of causing disease and is transmitted readily in sparse as well as outbreak populations of gypsy moth. Epizootics of virus, on the other hand, are limited to outbreak condi



Left.
Fig. 2. Gypsy moth caterpillar killed by E. maimaiga. Arrows indicate projecting legs.



Right.
Fig. 3.Gypsy moth caterpillar killed by NPV.

tions. The most effective control agent is one that decimates the population before damage occurs; that is, prior to outbreak conditions.When the fungus is detected in a population, it is very unlikely that additional control measures will be needed.

Caterpillars killed by *E. maimaiga* are elongate and attached to a substrate (e.g., bark) vertically with head down. The body withers and dries, and legs on the back two-thirds of the cadaver project at 90 deg. to the body (*Fig. 2*).

When NPV is responsible for death, the caterpillar droops or "wilts" and takes the shape of an inverted **V** (*Fig. 3*). The body is brittle and body contents are liquified. Eventually the body shrivels and body liquids accumulate underneath on the substrate to which the caterpillar is attached.

Have We Seen The End of Gypsy Moth Outbreaks?

Not likely! Scientists concede that *E. maimiaga* has been responsible for the general decline in gypsy moth numbers and damage in recent years, but they do not know if this level of effectiveness will continue. Populations of microorganisms, like those of insects, are highly variable and unpredictable.

The dramatic appearance of the fungus during the 1990s may be associated with unusually moist conditions that prevailed during May and early June. Fungi are more sensitive to moisture conditions than most other microorganisms that cause insect diseases. According to Dr. Hajek, however, regional weather patterns can not be used to predict the likelihood of disease. Her comparison of weather records and timing of previous population declines suggests that some spread and transmission occurs even when regional conditions are relatively dry. This probably reflects the fact that even during relatively dry years or years with normal rainfall, there are always microhabitats with enough moisture to favor the fungus.

Several hypotheses have been proposed to explain the current effectiveness of this disease. The two favored by Dr. Hajek at this time are (1) there has been an increase in the aggressiveness of a strain that was introduced years ago or, (2) in recent years a new strain was accidentally introduced.

Whatever the reason, we should not become too complacent about gypsy moth. It remains important to monitor and survey for this pest. In my view it is very unlikely that we have stumbled on that infamous "silver bullet". Fungi are very sensitive to vagaries of the weather and, do not forget, insects are very adaptable. This, in general, is the main reason these animals have been so successful during the course of their evolution.

I thank Dr. Ann Hajek for providing the photographs used in *Figs. 2* and *3*. ▲

This is the 35th in the series of articles contributed by Dr. Allen, Professor of Entomology at SUNY-ESF. Reprints of this and the complete series are available from NYFOA, phone1-800-836-3566.

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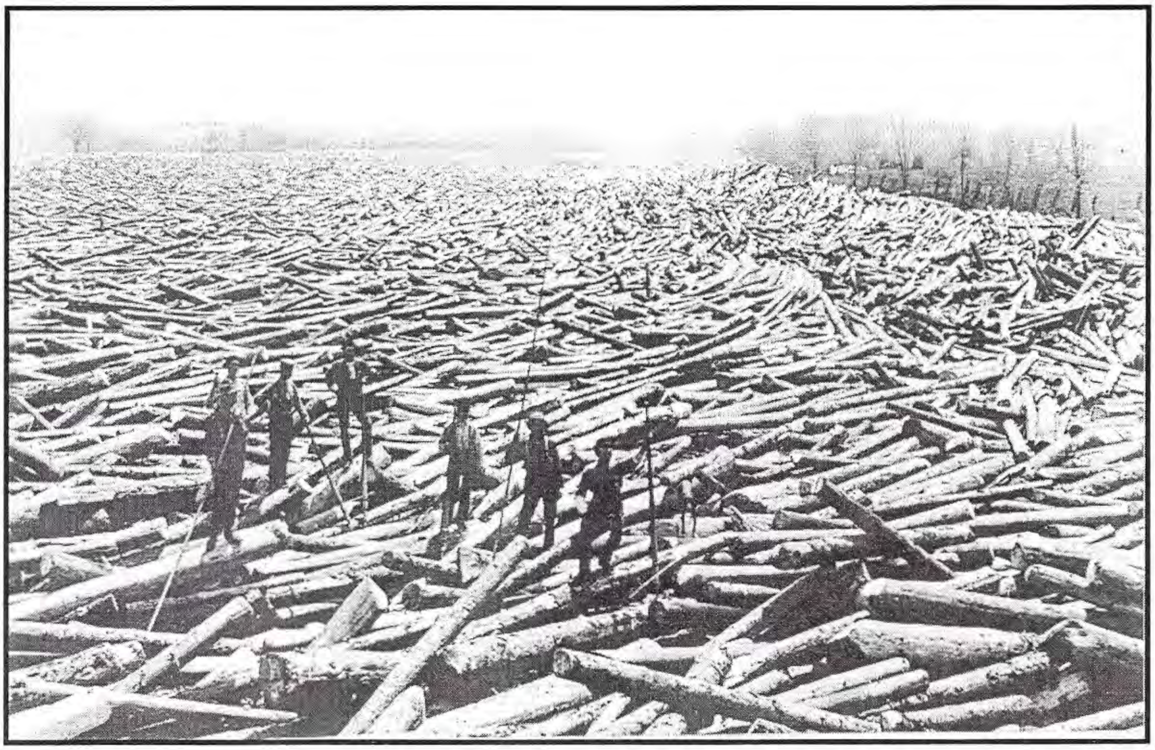

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